

Investigating the Link between Sterilization-Related Changes and Recurrent Canine Illnesses in Cured Dogs

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Abstract

Canine sterilization, a widely used method for managing breed growth and promoting wellness, has been connected to specific biological variations. Although the operation is regarded as secure, there is a deficiency of information about possible long-term health consequences, particularly in dogs that have been healed. Controlling other variables, such as pre-existing healthcare issues and biological predispositions, is difficult. This study conducts a comprehensive investigation of biologically healthy street dogs in three locations in Rajasthan, India to analyze the prevalence of various illnesses. Additionally, we aimed to examine the relationship between the health of untreated dogs as well as the availability and length of animal birth control (NIO) services. The NIO administration implements sterilization and vaccination programs for unwanted canines as a means to manage their number and prevent the transmission of rabies. While it is recommended that these dogs be given to enhance their health, we provide information that similar advantages apply to unmanaged dogs in the environment. The seroprevalences of viral and microbial illness were evaluated in 250 physically healthy stray dogs from Nagpur, Thane and Nashik towns in Oct and Sep 2021. The incidence of ticks, fleas, battle wounds and physical indices were analyzed in those individuals, along with 55 more canines. Dogs residing in towns implementing an NIO system exhibited markedly ($p < 0.05$) improved generally physique circumstance evaluations, reduced incidence of open injuries probably resulting from fights, reduced prevalence of flea diseases, spreadable canine hepatitis, Ehrlichia canis (EC), Leptospira interrogans serovars (LIS) and canine distemper virus antibodies (CDVA). Nevertheless, dogs residing in towns implementing NIO strategies had a notably greater frequency of infestations caused by the Brown Dog Tick (Rhipicephalus sanguineus). The frequency of canine parvovirus and Brucella canis (BC) did not show a significant difference across the towns. This research provides the first evidence of the therapeutic advantages of NIO on patients who have not received vaccinations or medical treatment for their disorders.

Keywords: Cured Dogs, Recurrent Canine Illnesses, Sterilization, animal birth control (NIO)

INTRODUCTION

Sterilization, an essential component of proper pet keeping, induces significant biological and behavioral changes in dogs. This treatment, which includes sterilizing for females and sterilization for males, is crucial in controlling overpopulation, reducing health concerns and influencing canine behaviors (1). Sterilization involves surgical modification of the reproductive organs, resulting in a series of effects that reach beyond preventing undesired births. Sterilization causes changes in hormone stages, which affect several biological activities. Sterilization in females eradicates the estrous cycle that reduces the probability of breast cancers and uterine diseases. Male neutering reduces the probability of developing testicular cancer as well as suppresses behaviors linked to mating drives, such as wandering and aggressiveness (2). Figure (1) shows the canine disease affected in the dog's mouth.



Figure (1). Canine Disease in Dog's Mouth

(Source:

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.eastbayvetclinic.com%2Fsite%2Fblog%2F2021%2F04%2F30%2Fperiodontal-disease-in-dogs&psig=AOvVaw0dtqz9y1swBO30IZwmMAuj&ust=1702633088908000&source=images&cd=vfe&opi=89978449&ved=0CBIQjRxqFwoTCMiz-N_QjoMDFQAAAAAdAAAAABAJ)

The method leads to a more composed disposition, less hostility and lower inclinations to participate in territorial marking. Moreover, sterilized dogs can have fewer propensities for some undesired habits, promoting a more peaceful cohabitation between pets and their human counterparts (3). Gaining a thorough understanding of the wide range of sterilization-related alterations in dogs is crucial for pet shareholders, veterinarians and activists for dog protection.

Regarding the field of canine wellness, the focus is on the identification and management of common diseases (4). Nevertheless, a lesser-explored aspect of canine health pertains to the frequency of recurring diseases in dogs that have been declared healed, after effective treatment. This phenomenon reveals a complicated interaction of circumstances that question traditional ideas of healing and encourage a reassessment of long-term health care in our beloved dogs (5). The domain of recurrent canine illnesses is marked by enigmatic and ambiguous nature. Canines that have recovered from one illness can be prone to the reappearance of the same or related health issues. This recurrence raises intriguing concerns about the persistent existence of essential materials, the efficacy of therapeutic techniques and the resilience of the canine immune system.

The problematic difficulties of canines indicate evidence of illness recovery but subsequently have difficulties overcoming its recurrence (6). It is essential to understand the complex workings of the immune function and how external pressures affect to provide complete healthcare for canines and to avoid diseases. Investigating the intricate chain of causes, including genetic predisposition, environmental variables and the potential emergence of antibiotic-resistant strains, is necessary for gaining insight into the canine illnesses that remain. Even after a canine has recovered from one illness, it can face other challenges if undetected infections or secondary illnesses suddenly appear. Both veterinarians and pet owners face a problem (7, 8).

Study (9) examined the enduring negative health consequences of gonadectomy, a surgical procedure that involves the removal of the reproductive organs, in dogs as a group. The exact cause of the higher occurrence of many long-term health disorders unrelated to reproduction after sterilizing and neutered was uncertain, although it might be connected to the stimulation of “luteinizing hormone (LH)” receptors in these non-reproductive organs.

Research (10) presented that chemical sterilization employing “zinc gluconate (ZG)” was explored because of its continuous reproductive efficacy in prepubertal canines. Consequently, the administration of pH-neutralizing ZG into the testicles of adult canines contributed to the depletion of sperm-producing tissues while leaving the generation of testosterone and the total condition of adult canines unaffected.

Article (11) analyzed the implementing measures to minimize wandering in domesticated canines and animals were a crucial intervention aimed at decreasing the population of unattended creatures in public areas. Further research on other populations and investigation into other possible factors influencing roaming behavior were necessary to provide a more comprehensive understanding of the cause-and-effect connection between sterilizing and migrating.

Paper (12) presented “Canine Parvovirus (AAI 2)”, which belongs to the Parvovirus genus under the “Parvoviridae family (PF)” and “Parvovirinae super family (PS)”, was responsible for causing “hemorrhagic gastroenteritis (HG)” and myocarditis in canines. AAI 2 gene-based “oligonucleotide probes (OP)” might be used to create Genetic biosensors.

Study (13) evaluated the “Canine leishmaniasis (CanL)”, characterized by the “Leishmania infantum (LI)” genotype and communicated by bites of phlebotomine sand flies, was widespread and affects many canines in Asia, Europe, North Africa and South America. It was regarded as an emerging disease in North America. There was a requirement to generate efficient compounds for treatment and “immunoprophylaxis (IP)” to reduce the transmission of the virus among canines and as a crucial part of managing human “zoonotic leishmaniasis (ZL)”.

Research (14) analyzed the management of “canine babesiosis (cb)” would be carefully tailored to the individual responses of each Babesia species to various treatments. It was important to consider the features of strains in the species especially those were resistant to certain drugs. It was essential to perform regular follow-up and monitoring of canines that had been treated to check for any ongoing infection along with the presence of parasites. This might be done by blood sample examinations and PCR testing.

Paper (15) investigated the management of treatments had been explored individually, mostly in cases of mild illness, or combination with traditional medications for canines with more serious symptoms. Therefore, it was essential to prioritize the investigation of these immunotherapeutic medications and their possible use in the management of leishmaniasis in canines and humans.

This research provides the first evidence of the therapeutic advantages of NIO on patients who have not received vaccinations or medical treatment for their disorders.

MATERIALS AND METHODS

Investigation location

A horizontal investigation of canine illness was conducted in 3 distinct Indian towns, Nagpur, Thane and Nashik throughout the months of Sep and Oct in the year 2021. All 3 towns are located in Maharashtra, a dry and northwestern state of India. Nagpur, a populous town with a population of 3.3 million, is home to around 36,600 canines and has been supported by the Support in Distress NIO program. Thane, a populous town with a population of 1 million, is home to around 24,900 canines. These dogs have been assisted by the NIO program, an animal protection initiative run by the Marwar group. The annual percentage of sterilized female dogs in these towns

fluctuates, but around 82% of them undergo sterilization. Nashik, the third place, is a very tiny city with a population of 125,000. It is situated on the outskirts of “Ranthambore National Park (RNP)” and has not implemented any NIO or extensive rabies immunization program. There is no scientific assessment of the canine number in Nashik. Nevertheless, if we consider the dog-to-human ratios observed in Pune, a city of comparable size in Maharashtra, we can get a conservative estimate of around 4600 canines.

Research methods

The canines in Nagpur and Thane were gathered by their individual NIO services, Assistance in Distress and the Marwar animals’ preservation organization. Blood samples were obtained from the canines before their sterilization procedure while they were under anesthesia. In Nashik, canines that were sleeping were manually captured earlier in the mornings and confined for sampling as well as administering rabies vaccine. All canines were chosen exclusively based on their ability to roam freely on the streets without any restraints or enclosures. A cephalic vein was used to extract blood samples, which were preserved in EDTA blood-collecting containers.

The blood was analyzed to determine the amount of immunoglobulin G for canine distemper virus (AII) (with an adaptability of 94.2% for (IgM) and 96% for (IgG) and an accuracy of 96.7% for (IgM) and 100% for (IgG)), AAI (with adaptability of 92.6% for (IgM) and 98% for (IgG) and an accuracy of 91.9% for (IgM) and 100% for (IgG)), LIS (with adaptability of 81% for (IgG) and a accuracy of 70%), “Brucella Canis (BC)” (with a adaptability of 99% for (IgG) and a accuracy of 94%), EC (with a adaptability of 100% for (IgG) and a accuracy of 95.4%) and “infectious canine hepatitis (NAE)” (with a adaptability of 98.7% for (IgG) and a accuracy of 87%). The analysis was performed employing economically offered ELISA evaluation packages. The L interrogans test does not distinguish between the “serovars canicola (SC)”, “icterohemorrhagiae copenhageni (IC)”, “icterohemorrhagiae RGA (IRGA)”, pomona and “grippotyphosa (GP)”. In addition, IgM levels were collected for AII and AAI, which indicated the specific illness stage that each canine was undergoing at the moment of testing.

The canine had a concise physical assessment, which included evaluating their bodily health using a reduced scale and inspecting for the existence of ticks, fleas and surgical wounds. There are four weight classifications linked to the health scores are skeleton (1), underweight (2), regular fat (3) and obese (4). The scores vary from 2 to 5. Before that is released the Nashik canines received vaccinations to protect them from hepatitis.

Quantitative investigation

We used “generalized linear models (EIO)” in SPSS 21 (IBM SPSS Statistics) to ascertain the impact of NIO programs on illness occurrence. The data used a “binary logistic response (BLR)”, “binomial probability (BP)” and a “logit link function (LLF)” to analyze whether individuals were ill or not unwell. The three empirical information groups, namely physical health outcome, AII disease group and AAI infections group were analyzed using an ordinal logistic regression model with multinomial probabilities and a cumulative LLF. Due to the lack of overweight canines, the body states of 4 and 5 were merged in the investigation. A model was constructed for each illness, using location, physical condition, age and gender as fixed factors. Geography was the only substantial influencing component in the simulations, resulting in the removal of the other elements from the finalized equation. We employed Wald probability estimates to identify substantial variations across towns for all pairwise assessments of averages for each illness. Based on the p-values obtained from the initial assessments of towns for individual illnesses, we used them to assess the rectified importance of pairwise assessments. This correction takes into consideration the testing of several illnesses on individual canines. Applying an initial level of significance at ($p = 0.05$), we evaluated the statistical significance at ($p = 0.005$) after taking into consideration the presence of 11 disorders.

RESULTS

Table (1) displays the occurrence of illnesses and physical state evaluations, the importance of comparing towns in pairs and the overall impact of geography on forecasting illness occurrence. The physical health ratings, prevalence of ticks, fleas, fights and contagious canine hepatitis were influenced by the region. For each of these disorders, except for ticks, the impact of NIO on canine health was beneficial.

Table (1). Dog illness occurrence in 3 Rajasthan towns

(Source: author)

Illness	High NIO→Low NIO		
	Nashik	Nagpur	Thane
B.canis	n=59 ^A 4.55%	n=100 ^A 11.00%	n=80 ^A 6.07%
LS	n=59 ^B 40.77%	n=100 ^A 13.00%	n=78 ^A 8.89%
Ticks	n=49 ^B 35.00%	n=121 ^A 55.44%	n=84 ^A 64.95%
Fight wounds	n=103 ^B 35.59%	n=154 ^A 4.94%	n=89 ^A 7.93%
Fleas	n=65 ^B 35.66%	n=121 ^A 5.18%	n=84 ^A 2.30%
E.canis	n=61 ^C 77.77%	n=100 ^A 46.00%	n=80 ^B 59.33%
Infectious canine hepatitis	n=61 ^B 97.77%	n=100 ^A 13.00%	n=70 ^A 93.41%
AII Susceptible Diseased Unaffected	n=61 17.00%	n=100 35.00%	n=79 35.43%
	38.77%	30.00%	31.88%
	44.23%	35.00%	32.69%
AAI Susceptible Diseased Unaffected	n=61 20.43%	n=100 16.00%	n=79 25.46%
	8.77%	2.00%	4.95%
	70.8%	82.00%	69.59%
Physical health assessment minimal strength Well-being	n=105 ^B 47.64%	N=117 ^A 24.75%	N=83 ^{AB} 44.19%
	39.72%	50.11%	47.88%
	12.64%	25.14%	7.93%

The position had a substantial impact ($p = 0.0001$) on the percentage of canines harboring ticks. When comparing ticks, Nagpur and Thane showed substantial differences compared to Nashik (both $p = 0.0001$), but they did not vary from each other ($p = 0.131$).

Our findings indicate that the NIO cities had the lowest prevalence of canines with poor physical health and the greatest prevalence of canines with a healthy weight compared to the non-NIO towns. Substantial pairwise assessments indicate that as the duration of NIO climbed, the incidence of other illnesses, for which region was a relevant prediction, decreased.

Additional problems that are significant for the health of canines were noted, however, a complete evaluation was not conducted due to their infrequency. Multiple canines had symptoms indicative of “*Babesia canis/gibsoni* and *Leishmania sp*” diseases there were no accessible test to definitively establish the presence of these illnesses in the surrounding area. Although several dogs had canine-spread venereal cancers, the investigation did not document this occurrence due to the potential difficulty in diagnosing initial-phase cancer.

DISCUSSION

These findings indicate that NIO regions had a decreased occurrence of illness in canines that were not sterilized or medicated for seven out of the ten problems, including “physical health rating, fleas, battle wounds, AII, *E.Canis*, *Leptospiraserovars* (LS) and ICH”. The seroprevalence of AAI and *B.canis* did not show any significant differences between cities. The prevalence of *E.canis* in Nagpur was different from that in Thane and Nashik. The NIO system has been operational in Nagpur for 18 years, although it has been active for 8 years in Thane and has not been implemented at all in Nashik. Therefore, the prevalence of these disorders is similarly influenced by the length of NIO. The correlation between the existence of NIO programs and a reduced incidence of disease can be attributed to the decrease in the canine population number generated by NIO, together with the accompanying emotional and immunological alterations. Additionally, NIO programs seem to impact the spread of diseases across all canines, not just those that have been treated. This investigation focused on physically healthy canines that had not been sterilized or vaccinated. We contend that canines that were not treated were at a lower risk of being susceptible to infection because the surrounding canines that had NIO treatment were in better condition, had a higher ability to fight infection and they were less inclined to spread illness.

Although the majority of the illnesses examined in this investigation are not expected to be driven by climatic circumstances, leptospirosis in India is an exception that might be impacted by the presence of other main hosts and high amounts of rainfall. The annual mean precipitation for Nagpur, Thane and Nashik is 65, 35 and 80 cm, correspondingly. Although all three cities had seen a rather intense rainy season in the months before up to this investigation, the slightly more humid circumstances in Nashik could result in increased occurrences of *Leptospira* infections, which are not connected to NIO coverage. Hence, we suggest doing further examination using techniques that can distinguish between distinct LS.

The towns with NIO service saw a significant decrease in the number of chronic wounds. Considering simultaneous behavioral measurements and wound morphology, we propose that large quantities of these injuries are acquired by dog-to-dog combat. By implementing sterilization initiatives in Nagpur and Thane, the hormonal cycle in female dogs is interrupted, preventing them from entering the estrus phase. As a result, they do not engage in competition or gather together in search of breeding possibilities. Instances of combat-related mating behavior occurred regularly during the week-long investigation in Nashik but absent in the other towns were examined. These observations were conducted during the recognized breeding period. The reduction in unintentional biting can significantly reduce the risk of rabies transmission by minimizing transmission before symptoms appear which is advantageous for dogs, people and animals.

Canines originating from NIO towns had elevated rates of *R. sanguineus* tick infestation. This might be attributed to the fact that NIO centers promote tick transmission by keeping canines in intimate proximity and there could be variations in the presence of alternative hosts or environmental factors across different locations. It is advisable to

include protocols in NIO initiatives that attempt to reduce the danger of tick transmission by using “cypermethrin spray (CS)”. However, canines in NIO towns had a much-decreased occurrence of infections by the “tickborne spirochaete bacteria, *E.canis*”. This implies that there are other variables, beyond tick concentration that affect the incidence of ehrlichiosis in these canines.

The canines identified in this investigation can be a selection of the more easily captured canines, however, accurately evaluating this is challenging. Due to the differences in canine community dimension, human demography and environmental factors throughout our research cities, we need to be cautious about claiming that NIO would reduce the occurrence of non-targeted illnesses in street canine communities. Nevertheless, our results contradict the expectation that the variations across towns would lead to higher illness prevalences in NIO towns. For instance, the bigger dog populations in these cities would result in a wider group of persons vulnerable to diseases. By implementing sterilization and vaccination programs, we propose that NIO programs could achieve a better and more sustainable population of street canines, resulting in reduced disease incidence. This has substantial ramifications for developing countries such as India, where canines survive in intimate proximity with both people and endangered species.

CONCLUSION

Canine sterilization, a commonly used treatment for controlling populations and improving wellness, has not been examined for its long-term effects, in canines that had been treated. This research attempted to overcome this information deficit by conducting an assessment of physically healthy street canines in three towns in Rajasthan, India. The main purpose was to analyze the effects of NIO programs on both canines who received treatment and those received none. The results indicated those localities implementing aggressive NIO strategies showed essential physiological advantages for the whole population of canines, even those that could not acquire treatment. Canines in these towns had superior total physical health evaluations, reduced incidence of fighting-related surgical wounds, flea infestations and different illnesses such as infectious canine hepatitis, EC, LIS and CDVA. Nevertheless, communities implementing NIO programs experienced a higher incidence of Brown Dog Tick problems. This investigation demonstrates that NIO activities have a positive impact on non-vaccinated illnesses and untreated individuals in the community. Illnesses such as AAI and BC did not vary between towns. These findings contribute important perspectives to the ongoing discussion on canine individuals' regulation and well-being. Furthermore, extraneous variables such as environmental pressures and biological predispositions can affect the applicability of the achievements. Examining the impact of environmental as well as genetic variables could enhance our comprehension, leading to more precise and individualized strategies for managing canine disease.

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