



A Study of Antimicrobial Usage Pattern in Dogs at Aizawl, Mizoram, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author JBR conducted the study and wrote the manuscript. Author BS served as the major advisor. Author NP contributed to the overall supervision of the program. Author PK also contributed to the writing of the manuscript. Author HP provided supervision and guidance throughout the study. All authors read and approved the final manuscript.

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ABSTRACT

Antibiotics, derived from the Greek word for "opposing life," are drugs that kill or inhibit bacterial growth. Antibiotics are used therapeutically, prophylactically, and as growth promoters. Data were acquired using questionnaires focused on demographics, disease conditions, antibiotic use, and related activities. Most dogs (75.2%) were male and between the ages of 1 to 5 years (54.4%). The most common ailments were skin problems (30.4%) and digestive system disorders (32%). Antibiotic use varies by condition: the most commonly prescribed medications for respiratory

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problems were Doxycycline (45.95%) and Amoxicillin (21.62%). Cardiac problems were treated primarily with amoxicillin (44.44%). Antibiotics used for skin problems were amoxicillin (27.63%) and clindamycin (23.68%). Antibiotic for gastrointestinal problems was metronidazole (60%). In genito-urinary diseases, amoxicillin was the most used drug (42.86%). The most commonly prescribed antibiotic for musculoskeletal problems was amoxicillin (44.44%). The study focused on prevalent diseases and antibiotic usage in the region. The findings were compared to similar research, highlighting the necessity of appropriate antibiotic selection and enhanced antibiotic sensitivity testing.

Keywords: Antibiotic; antimicrobial resistance (AMR); bacteria; canine; health.

ABBREVIATIONS

AMR : Antimicrobial Resistance
FD : Fold Dermatitis
OE : Otitis Externa

1. INTRODUCTION

The term antibiotic literally means "opposing life", originated from the Greek roots ἀντι anti, "against" and βίος bios, "life". Antibiotics or antibacterial are powerful drugs that can destroy or slow down the flaring up of bacteria. Other than treatment, the antibiotics were used for preventing diseases too. The term "antibacterial" includes antiseptic drugs, antibacterial soaps, and chemical disinfectants; whereas antibiotics were an important class of antibacterial used more specifically in medicine and sometimes in livestock feed (Cudmore et al., 2004).

They were classified as bactericidal or bacteriostatic based on their effects. Based on their efficacy, they were classed as narrow or broad-spectrum antibiotics (Dalhoff et al., 2014). Bactericidal antibiotics include aminoglycosides (Tobramycin, gentamicin, and amikacin), Nitroimidazoles (Metronidazole), Glycopeptides (Vancomycin), Beta-lactams (penicillins, cephalosporins, and carbapenems), Fluoroquinolones (Ciprofloxacin, levofloxacin, moxifloxacin) and Cyclic Lipopeptides (Daptomycin). Bacteriostatic antibiotics include Chloramphenicol, Clindamycin, Ethambutol, Lincosamides, Macrolides, Nitrofurantoin, Novobiocin and Oxazolidinone (Ruiz et al., 1990).

Exorbitant use of antibiotics in the management of animal diseases may lead to the selection of resistance among microbes. The different antimicrobial resistance mechanisms were limiting uptake of a drug, modifying a drug target, inactivating a drug, and active drug efflux. Antimicrobial resistance (AMR) is the ability of

some bacteria to protect themselves against the effects of antibiotics. Clinical resistance means that a bacterium can grow in the antibiotic concentrations reached in the body during therapy resulting in treatment failure (Li et al., 2017; Bae et al., 2022).

Among north-eastern states in India, Manipur was considered as hotspot of multidrug resistance. In one of the studies, it was observed that penicillin, ampicillin, cephalosporin, cephalaxin and clavulanic acid plus amoxicillin were commonly used antibiotics for therapeutic purposes in pigs in northeast India. Oxytetracycline, amoxicillin, and streptomycin were used for dual purpose and amprolium, monensin, neomycin, bacitracin, and chlortetracycline were used for prophylaxis. Antibiotics as a growth promoter, improve growth rate, feed efficiency, reduce mortality and morbidity, and improve reproductive performance (Chattopadhyay et al., 2014). In Mizoram also Methicillin Resistant *Staphylococcus aureus* (MRSA) prevalence was reported among dogs with dermal infection (Debnath et al., 2022).

With the above background, it was proposed to conduct a study titled as "A study of antimicrobial usage pattern in dogs at Aizawl". The objective of this study was to study the pattern of usage of antibiotics in common ailments in animals.

2. MATERIALS AND METHODS

The study was conducted with the objective of studying the pattern of usage of antibiotics in common ailments in dogs. A survey was conducted about the usage of antimicrobials in animals for various ailments.

2.1 Study Area

The survey included data collection from various veterinary dispensaries and hospitals in Aizawl. The epidemiological parameters also were

recorded from the treated group. The survey recorded details about the usage of different antibiotics, how a conclusion was made for the necessity of antibiotic used, what the influential factors for the selection of antibiotics were and how a final decision was made. The study was conducted during the period from 1st January 2022 to 30th June 2022 (6 months). An observational study conducted over a period of six months involving the study area.

2.2 Selection of Sampling Area

Aizawl district has five revenue division blocks viz., Aibawk, Darlawn, Phullen, Thingsulthliah and Tlangnuam. The owners of fifty dogs each from five revenue division blocks were interviewed and data were collected and a total of 250 dog's data were recorded.

2.3 Selection of Dogs

Table 1. Revenue division block-wise dogs studied

Nos.	Revenue Division	Dogs studied
1	Aibawk	50
2	Darlawn	50
3	Phullen	50
4	Thingsulthliah	50
5	Tlangnuam	50
	Total	250

2.4 Experimental Design

Data were collected from 250 dogs under treatment with antibiotics from different veterinary hospitals of Aizawl district.

2.5 Tool of Study

The questionnaire with demographic data, the age and sex of the dog, the reason for treatment with details of system involved or conditions, practice of antibiotic sensitivity test is there or not, the practice of pre-infusion tests like allergic test, laboratory tests (diagnostic test for various conditions), practice of repeating the antibiotics, practice of changing the antibiotics, duration of treatment and prescription-based treatment were used for the study.

2.6 Preparation of Questionnaire

The questionnaire was prepared by consulting the experts in the field and referring peer

reviewed journals. Attention was given to avoid the collection of irrelevant data which was not required for the study.

2.7 Method of Data Collection

The data were collected after taking consent of the owner. The objective and aim of the study were explained to the owners and assurance was given that the collected information will be used only for the study purpose.

2.8 Selection of Variable

The study was intended to find out the antibiotic usage pattern. Hence only the relevant variables were selected after having a discussion with major guide and other experts in the field and with a thorough checking of research articles in the field.

Variables and their Measurement:

- Age of the patient:** Age completed at the time of collection of data was taken. Data were collected from dogs that completed a minimum of 1 year of age as on 1st January 2022.
- Gender of the patient:** Sex of the animal was recorded
- Respiratory system disorders, Cardiac system disorders Skin problems, Alimentary system disorders, Genito-urinary system disorders, other diseases/conditions:** Recorded as per the details in the prescription and laboratory reports.
- Antibiotic sensitivity test:** The antibiotic sensitivity test conducted before the commencement of treatment, after the commencement of treatment and before repeating the antibiotic treatment was recorded.
- Repeating the antibiotic/changing:** The repetition of antibiotic after the prescribed course of treatment as well as change of antibiotic after the first course of antibiotic was recorded. The change was based on antibiotic sensitivity test or other factors are also recorded.
- Prescription based treatment:** The treatment was based on a standard prescription from a qualified veterinary practitioner or purchase from medical shop or other people were recorded.
- Duration of treatment:** The duration of the treatment given in the prescription was recorded.

8. **Allergic test done or not:** Allergic tests done before prescribing antibiotics were recorded. The number of antibiotic tests done in a patient was recorded.
9. **Laboratory tests done or not:** The details of other tests done other than the antibiotic sensitivity tests viz., blood parameters, serum biochemistry, tests for other diseases conditions were recorded.

deworming, castration or as to do other practices like hair trimming. In this regard, it is observed that the younger age group dogs used to visit health care centres more often than the old age group. In a study by Chaudhari and Kartel, (2017), it is observed that, the majority of private dogs were male (69%, 65) and 74.2% were between the age of 1 and 6 and only 7.4% were older than 6 years.

2.9 Statistical Outline Used for Analysis of the Data

The data was collected, recorded, classified, tabulated and analysed in order to make eloquent findings. After analysis interpretations were made.

3. RESULTS AND DISCUSSION

The research study was conducted in Aizawl district of Mizoram state from the period 1st January 2022 to 30th June 2022. Study was conducted in the form of a survey involving 250 dogs who were under treatment for different health issues/disorders or diseases. The data were collected observing the objectives of the research programme and as per the proforma prepared for collecting the data. The data were analysed statistically (finding percentage with compering), interpretations were made, recorded and discussed.

3.1 Age-wise Distribution of Dogs

The data were collected from dogs that completed a minimum of 1 year of age as on 1st January 2022. The age distribution of dogs was mentioned in Table 2.

The data were collected from three age group and more dogs were from the 1-5 years age group (54.4%) and 32 dogs were belonging to 10 years and above. A total of 82 owners (32.8%) with dogs (6-10 years) were interviewed and 32 dogs were belonging to 10 years and above.

The owners are more concerned of their dogs during their younger ages, so as to give vaccine,

3.2 Gender-wise Distribution of Dogs

The data were collected from owners of dogs after interviewing and wherever possible after examination of patient and presented in Table 3.

Majority of the data were collected from male dogs (75.2%) and 24.8% of dogs were female dogs. Some of the towns in India had a preference to male dogs. In a study by Sonawane (2018) in Maharashtra, it was observed that more preference was given to male dogs as compared to female dogs and overall, 66% preference was for male dogs and 34% is for female dogs. Similarly, a study by Gebremedhin et al. (2020), involving canine population at Ethiopia it was observed that 72.1% were male dogs and male to female sex ratio was estimated at 3:1 for the dog.

3.3 Different Body Systems and Disease Distribution in Dogs

The data were collected after careful examination of prescription given to owners of the dog. As per the details given in the prescription the different systems were identified and details were recorded (Table 4).

Among the total cases surveyed, it was observed that 32% of the cases were from alimentary system disorders and 30.4% of cases were having skin problems. Genitourinary system disorders were 2.8% only. This was in agreement with the reports of other workers. Digestive problems were the highest recorded problems among dogs and the main problem for

Table 2. Age-wise distribution of dogs

No.	Age group	Number of dogs	Percent
1	1-5 years	136	54.4
2	6-10 years	82	32.8
3	10 years and above	32	12.8
	Total	250	100.0

Table 3. Gender-wise distribution of dogs

No.	Gender	Number of dogs	Percent
1	Male (M)	188	75.2
2	Female (F)	62	24.8
	Total	250	100.0

Table 4. Reflect affected body part of the dogs in question

No.	Body system	Number of dogs	Percent
1	Alimentary system disorders	80	32
2	Skin problems	76	30.4
3	Respiratory system disorder	37	14.8
4	Other diseases/conditions	32	12.8
5	Cardiac system disorders	9	3.6
6	Musculo-skeletal system disorders	9	3.6
7	Genito-urinary system disorders	7	2.8
	Total	250	100.00

the majority of gastrointestinal diseases in dogs having clinical signs which may include vomiting, diarrhoea and weight loss that may be shared by many conditions that have either primary or secondary effect on the gastrointestinal tract (Rakha et al., 2015).

Khurana et al. (2016) reported that, the most commonly reported and hardest to resolve problems encountered by veterinarians in small animal medicine were dermatological problems. In their study, to determine the prevalence of different dermatological conditions in dogs 21.34% animals had different dermatological disorders. Pyoderma, pruritis, allergic dermatitis and sarcoptic mange were the common dermatological disorders.

3.4 Antibiotic Use in Respiratory System Disorders in Dogs

The antibiotic use in dogs was recorded after careful examination of prescription collected from the owners of the dog. Veterinarians were prescribing different antibiotics for various illnesses affecting respiratory system. These antibiotics were given in Table 5.

Around, 45.95% of the cases were treated with Doxycycline and 21.62% cases were treated with Amoxicillin. It was further recorded that only one case was treated with Cefotaxime. Weese et al. (2011) recommended empirical administration of doxycycline for 7–10 days to dogs with suspected acute bacterial upper respiratory tract infections as the first-line antimicrobial option. Doxycycline was a good first choice because it was well tolerated by dogs; most *B. bronchiseptica* isolates from dogs were

susceptible to doxycycline in vitro despite resistance to other agents such as beta-lactams and sulfonamides, and doxycycline was effective in vivo for the treatment of *Mycoplasma* spp. infections. Doxycycline was also effective for the treatment of a variety of chlamydial and mycoplasma infections and other mammalian host species. Wayne et al. (2011) opined that, Doxycycline was the most frequently prescribed with no documented evidence of infection, and amoxicillin-clavulanate was the most frequently prescribed with either confirmed or suspected evidence of infection.

3.5 Antibiotic Use in Cardiac System Disorders in Dogs

Nine cases were found having problems with cardiac system in dogs. The antibiotics used were given in Table 6.

After careful recording of antibiotic usage in cardiac problems in dog, it was observed that Amoxicillin was used in 44.44% of dogs. Penicillin was used in one patient. Bea et al. (2022) reported that *Bacillus amyloliquefaciens* is a gram-positive bacterial species that was utilised as a probiotic in humans and animals. An 8-year-old, spayed, female Maltese with endocarditis and positive for *Bacillus amyloliquefaciens* was treated with amoxicillin-clavulanic acid and cefotaxime for 4 months.

3.6 Antibiotic Use in Skin Problems in Dogs

The different skin problems in dogs were treated with topical and systemic drugs. The antibiotic use was shown in Table 7.

Table 5. Antibiotic use in respiratory system disorders in dogs

No.	Antibiotic	Number of dogs	Percent
1	Doxycycline	17	45.95
2	Amoxicillin	8	21.62
3	Ceftriaxone	4	10.81
4	Others	4	10.81
5	Azithromycin	3	8.11
6	Cefotaxime	1	2.70
	Total	37	100.00

Table 6. Antibiotic use in cardiac system disorders in dogs

No.	Antibiotic	Number of dogs	Percent
1	Amoxicillin	4	44.44
2	Cefotaxime	3	33.33
3	Penicillin	1	11.11
4	Others	1	11.11
	Total	09	100.00

Table 7. Antibiotic use in skin problems in dogs

No.	Antibiotic	Number of dogs	Percent
1	Amoxicillin	21	27.63
2	Clindamycin	18	23.68
3	Cephalexin	16	21.05
4	Doxycycline	14	18.42
5	Others	7	9.21
	Total	76	100.00

It can be recorded that; 27.63% cases were treated with Amoxicillin and 23.68% cases were treated with Clindamycin. Doxycycline was used in 18.42% of cases. Oliveira et al. (2018) reported that amoxicillin-clavulanic acid was used universally for superficial bacterial folliculitis treatment especially for fold dermatitis (FD) and otitis externa (OE) in canines. Beco et al. (2013) concluded that, there was good evidence supporting the high efficacy of oral clavulanate-amoxicillin in the treatment of deep pyoderma and there was fair evidence for moderate to high efficacy of oral clavulanate-amoxicillin, clindamycin. Further they concluded that clavulanate-amoxicillin can be the first-line drugs.

3.7 Antibiotic Use in Alimentary System Disorders in Dogs

A total number of 80 (32%) cases were of alimentary tract disorders in dogs. The cases were treated with medications including antibiotics. The antibiotics used are depicted in Table 8.

The table showed that 60% of the cases were treated with Metronidazole. Enrofloxacin was used in 21.25% of cases and Sulpha drugs were used in 3.75% of cases of alimentary system disorders in dogs. Hostutler et al. (2004) recorded that, canine histiocytic ulcerative colitis conventional therapy consists of some

Table 8. Antibiotic use in Alimentary system disorders in dogs

No.	Antibiotic	Number of dogs	Percent
1	Metronidazole	48	60
2	Enrofloxacin	17	21.25
3	Ciprofloxacin	7	8.75
4	Norfloxacin	5	6.25
5	Sulpha	3	3.75
	Total	80	100.00

combination of prednisone, azathioprine, sulfasalazine, and metronidazole. Nine dogs with histologic confirmation of histiocytic ulcerative colitis were treated with antibiotic therapy (either with enrofloxacin alone or in combination with metronidazole and amoxicillin) had resolution of clinical signs within 3-12 days. Mylonakis et al. (2016) reported that, parenteral administration of wide-spectrum bactericidal antibiotics is warranted in dogs with severe Parvo viral enteritis due to the high risk of septicaemia associated with the disruption of the mucosal barrier and the concurrent profound neutropenia. Cefoxitin and ampicillin as single-agent treatments or in combination with enrofloxacin are rational empirical choices against anaerobic, Gram-positive and Gram-negative organisms.

3.8 Antibiotic Use in Genito-Urinary System Disorders in Dogs

Number of cases with genito-urinary disorders was only 7. The details of antibiotic used in these cases were given in Table 9.

Among the seven cases of genito-urinary disorders in dogs, 42.86% of cases were treated with Amoxicillin and 28.57% of cases were treated with Sulpha and Enrofloxacin. Seven cases of genito-urinary disorders in dogs were treated with Amoxicillin (42.86%) and 28.57% of cases were treated with Sulpha and Enrofloxacin. Least resistance showed to enrofloxacin in sensitivity results obtained with 6 antibiotics. More than two-thirds of isolates were resistant to tetracycline. Overall resistance to amoxicillin-clavulanic acid was 36%. The most common drug used for treatment of urinary tract infections has been amoxicillin and amoxicillin-

clavulanic acid, followed by enrofloxacin (Kar et al., 2024).

3.9 Antibiotic Use in Musculo-Skeletal System Disorders in Dogs

A total of nine cases were identified with Musculo-skeletal system disorders in dogs and the antibiotic use in these cases were recorded in Table 10.

Amoxicillin was used in 44.44% of cases and Clindamycin was used in 22.22% of cases. Cefazolin was used in 33.34% of cases. Ha et al. (2022) mentioned about a treatment with amoxicillin/clavulanic acid in combination with metronidazole for osteomyelitis in canine species. Amoxicillin/clavulanic acid is effective against aerobic organisms, including β -lactamase-producing strains of staphylococci. Metronidazole is effective in treating infections caused by β -lactamase-producing anaerobes. Clindamycin penetrates the bone with sufficient efficacy to exceed the minimal inhibitory concentration for most anaerobic bacteria even though it is a bacteriostatic drug.

3.10 Antibiotic Use in Other Diseases/Conditions in Dogs

These conditions include wounds, allergies, fever, and other similar conditions. The antibiotic usage in dogs for such conditions was given in Table 11.

The table showed that 34.38% of cases were treated with Amoxicillin. Gentamicin was used in 28.13% of cases and Cephalexin was used in 25% of cases. Doxycycline was used in one case. These conditions include wounds, allergies, fever, and other similar conditions.

Table 9. Antibiotic use in Genito-urinary system disorders in dogs

No.	Antibiotic	Number of dogs	Percent
1	Amoxicillin	3	42.86
2	Sulpha	2	28.57
3	Enrofloxacin	2	28.57
	Total	07	100.00

Table 10. Antibiotic use in Musculo-skeletal system disorders in dogs

No.	Antibiotic	Number of dogs	Percent
1	Amoxicillin	4	44.44
2	Cefazolin	3	33.33
3	Clindamycin	2	22.22
	Total	09	100.00

Table 11. Antibiotic use in other diseases/conditions in dogs

No.	Antibiotic	Number of dogs	Percent
1	Amoxicillin	11	34.38
2	Gentamicin	9	28.13
3	Cefalexin	8	25
4	Clindamycin	3	9.38
5	Doxycycline	1	3.13
	Total	32	100.00

3.11 Antibiotic Sensitivity Test in Dogs

The antibiotic sensitivity test was done two cases (0.8%). Prescott et al. (2002) opined that, antimicrobial susceptibility testing can be performed by disk diffusion susceptibility testing using standard methods and interpretation as susceptible, intermediate, or resistant, based on published criteria developed for medical pathogens.

3.12 Repeating the Antibiotic/Changing Antibiotic in Dogs

In the survey, it was observed that the antibiotics were repeated or changed in 11 dogs (2.4%). Weese et al. (2011) noted that, changes in local resistance patterns for urinary pathogens should be monitored. Consideration should be given to changing the empirical drug choice, as baseline resistance rates of the most common organisms to a first-line drug increase.

4. CONCLUSIONS

The study offers important new information about prevalent diseases and antibiotic use in canines. Different research studies shows that animals in Mizoram have bacteria that are resistant to antibiotics, which is consistent with a worldwide trend. The findings underscore the necessity of appropriate antibiotic usage in preventing the development of antibiotic resistance. In order to protect the health of both humans and animals, the study highlights the urgent necessity for cautious antibiotic management in Mizoram's animal sector. Campaigns on the wise use of antibiotics and outreach on AMR must be intensified among animal owners.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

DATA AVAILABILITY STATEMENT

The data presented in this study is contained within the article.

ETHICS STATEMENT

We hereby confirm that the study conducted in accordance with ethical guidelines that prioritize participant consent, confidentiality, and the integrity of the data.

CONSENT

The data were collected after taking consent of the owner

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Bae, H., Hwang, T. S., Lee, H. C., Jung, D. I., Kim, S. H., & Yu, D. (2022). Successful treatment of canine infective endocarditis caused by *Bacillus amyloliquefaciens*. *The Veterinary Quarterly*, 42(1), 41–47.
- Beco, L., Guaguere, E., Méndez, C. L., Noli, C., Nuttall, T., & Vroom, M. (2013). Suggested guidelines for using systemic antimicrobials in bacterial skin infections: Part 2—antimicrobial choice, treatment regimens and compliance. *Veterinary Record*, 172(6), 156–160.

- Chattopadhyay, M. K. (2014). Use of antibiotics as feed additives: A burning question. *Frontiers in Microbiology*, 5, 334.
- Chaudhari, A., & Kartel, T. (2017). *Wellbeing International WBI Studies Repository. Survey of the Private Dog Population Nainital, Uttarakhand India July*. HIS, 1. https://www.wellbeingintlstudiesrepository.org/aw_comp_dogpop/8/ (Accessed on 16/05/2025)
- Cudmore, S. L., Delgaty, K. L., Hayward-McClelland, S. F., Petrin, D. P., & Garber, G. E. (2004). Treatment of infections caused by metronidazole-resistant *Trichomonas vaginalis*. *Clinical Microbiology*, 17(4), 783–793.
- Dalhoff, A. (2014). Selective toxicity of antibacterial agents—Still a valid concept or do we miss chances and ignore risks? *Infection*, 9, 29–56.
- Debnath, A., Rajesh, J. B., Debbarma, B., Lucy, E., Sarma, K., Ralte, L., & Hmar, L. (2022). Prevalence of Methicillin Resistant *Staphylococcus aureus* in canine dermal infection in Mizoram. *Journal of Animal Research*, 12(6), 933–937.
- Gebremedhin, E. Z., Sarba, E. J., Getaneh, A. M., Tola, G. K., Endale, S. S., & Marami, L. M. (2020). Demography and determinants of dog and cat ownership in three towns of West Shoa zone, Oromia Region, Ethiopia. *BMC Veterinary Research*, 16, 1–12.
- Ha, M., Ahmed, S., Lee, D. N., Han, J., Yoon, J., & Yeon, S. C. (2022). Clinical characteristics of trauma-related chronic osteomyelitis in 3 wild raccoon dogs (*Nyctereutes procyonoides*). *Journal of Veterinary Clinics*, 39(3), 131–137.
- Hostutler, R. A., Luria, B. J., Johnson, S. E., Weisbrode, S. E., Sherding, R. G., Jaeger, J. Q., & Guilford, W. G. (2004). Antibiotic-responsive histiocytic ulcerative colitis in 9 dogs. *Journal of Veterinary Internal Medicine*, 18(4), 499–504.
- Kar, P., Rajesh, J. B., Chethan, G. E., Behera, S. K., Sarma, K., & Prasad, H. (2024). Successful management of cystitis in a male dog. *Archives of Current Research International*, 24(11), 359–365.
- Khurana, R., Kumar, T., Agnihotri, D., & Sindhu, N. S. (2016). Dermatological disorders in canines—A detailed epidemiological study. *Haryana Veterinarian*, 55, 97–99.
- Li, J., Xie, S., Ahmed, S., Wang, F., Gu, Y., Zhang, C., & Cheng, G. (2017). Antimicrobial activity and resistance: Influencing factors. *Frontiers in Pharmacology*, 8, 364.
- Mylonakis, M. E., Kalli, I., & Rallis, T. S. (2016). Canine parvoviral enteritis: An update on the clinical diagnosis, treatment, and prevention. *Journal of Veterinary Internal Medicine*, 7, 91.
- Oliveira, A., Devesa, J. S., Hill, P. B., Silva, V., & Poeta, P. (2018). Treatment of selected canine dermatological conditions in Portugal—A research survey. *Journal of Veterinary Research*, 62(4), 563.
- Prescott, J. F., Hanna, W. B., Reid-Smith, R., & Drost, K. (2002). Antimicrobial drug use and resistance in dogs. *Canadian Veterinary Journal*, 43(2), 107.
- Rakha, G. M., Abdl-Haleem, M. M., Farghali, H. A., & Abdel-Saeed, H. (2015). Prevalence of common canine digestive problems compared with other health problems in teaching veterinary hospital, Faculty of Veterinary Medicine, Cairo University, Egypt. *Veterinary World*, 8(3), 403.
- Ruiz, N. M., & Ramírez-Ronda, C. H. (1990). Tetracyclines, macrolides, lincosamides & chloramphenicol. *Boletín de la Asociación Médica de Puerto Rico*, 82(1), 8–17.
- Sonawane, S. R. (2018). Preference for gender (male/female) in dogs of Mumbai city in Maharashtra. *International Journal of Innovative Research in Science, Engineering and Technology*, 7, 4303–4307.
- Wayne, A., McCarthy, R., & Lindenmayer, J. (2011). Therapeutic antibiotic use patterns in dogs: Observations from a veterinary teaching hospital. *Journal of Small Animal Practice*, 52(6), 310–318.
- Weese, J. S., Blondeau, J. M., Boothe, D., Breitschwerdt, E. B., Guardabassi, L., Hillier, A., & Sykes, J. E. (2011). Antimicrobial use guidelines for treatment of urinary tract disease in dogs and cats: Antimicrobial guidelines working

group of the International Society for
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Veterinary Medicine International, 1,
263768.

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