

RETROSPECTIVE STUDY ON DEMOGRAPHIC AND PREVALENCE OF COMMON DISEASES OF OWNED DOG IN JUBA CITY, CENTRAL EQUATORIA STATE/SOUTH SUDAN

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ABSTRACT

The increased urbanization of Juba city and the influx of people following independence of South Sudan, enhanced the culture of dog ownership for security and safeguarding against theft and robbery. The Untoward related effects associated with dog ownership is the drive for conducting this study aiming to determine the demographic characteristics of owned dogs as well as common diseases among owned dogs in Juba city. Two government clinics were purposely chosen for retrospective collection of data from outpatients' department register for a period of five years (2017-2021). A total of **8,504 dogs** were recorded, with **local breeds (95.1%)** and **males (91.4%)** being the majority. Most dogs were **under one year old (68.0%)**, followed by those aged **1-3 years (25.6%)** and **over three years (6.4%)**. A total of **9,016 disease cases** were documented, with **tick infestations (49.0%)**, **mange (13.7%)**, and **internal parasites (10.5%)** being the most prevalent. **Age-specific trends** showed that **parvovirus (62.2%)** and **leptospirosis (41.1%)** were most common in dogs under **one year old**, whereas **babesiosis (53.4%)** and **rabies (59.0%)** were highest in dogs aged **1-3 years**. **Chronic diseases** such as **arthritis (69.6%)** and **ascites (69.5%)** were significantly more prevalent in dogs **over three years old**. Disease prevalence was also influenced by **sex and seasonality**, with **males (92.8%)** more affected and **higher infection rates during the wet season (73.5%)**. The findings emphasize the **urgent need for targeted veterinary interventions**, including **age-specific vaccination, parasites control, and public health awareness**, to reduce disease burden and improve canine health in Juba.

KEYWORDS: Canine Epidemiology, Owned Dog Demography, Diseases, South Sudan.

INTRODUCTION

Dogs are synonymous with human settlement worldwide, often being according to the nature of their relationship with the human population and their relative confinement by people (Taylor *et al.* 2017). They are the most numerous and widespread domestic carnivore globally known (Daniels and Bekoff. 1989).

In South Sudan, the recent urban sprawl of Juba City and other major towns following the independence of South Sudan from Sudan in the year 2011, have resulted in to increase population of Juba 200 times its population before independence. Influx of people from neighboring countries and diaspora introduced some variable cultures

and different levels and styles of crimes. These socio-demographic changes were followed by increased tendencies of the population to own dogs to safeguard and protect against daylight and night theft and robberies. However, the practice of keeping dogs is not without problems. In almost all parts of the world, dogs pose serious human health, socio-economic, and animal welfare problem. Dogs' populations may rapidly grow to such an extent that the health risks for humans become serious and the environment begins to suffer considerably if responsible dog ownership and management are not in place, as dog ownership practice is associated with responsibilities such as feeding, treatment, diseases prevention and movement control.

Failure of dog owner to comply with these, pushes the dog to adopt free roaming life style thus subjecting them to contract diseases, injuries and act as reservoirs of zoonotic diseases of public health importance with reported prevalence by Hyerobe *et al.* 2017; Hampson *et al.* 2015; Fielding *et al.* 2005; Rodriguez-Vivas *et al.* 2003. Besides serving as reservoirs of zoonotic infections, dogs are also playing a central role in cross-transmission and maintenance of important diseases of livestock and wildlife (Cleaveland *et al.* 2007; Fitzpatrick *et al.* 2012). Therefore, for a robust policy intervention for management and control of these diseases and quality service, requires provision of reliable data and basic information about dogs' population demography and dynamic, general health and wellbeing of dogs. Unfortunately, in South Sudan, published data is very scanty and dearth of literature on common diseases and injuries of dogs other than rabies. This study therefore, aimed at determining the prevalence of common diseases condition and demographic characteristics of owned

dogs in Juba City as a pilot to other major towns in South Sudan.

MATERIALS AND METHODS

The Study Area

The study carried out in Juba city, South Sudan. Juba city has an estimated area of 22,956-kilometer square. It has an elevation of 550 m above sea level and falls between longitude 31° 34' 16.5036" E and latitude 4° 51' 33.7068" N.

Juba is the capital city of South Sudan, as well as the most populous city in the country, founded in 1922. Located near the White Nile. It is a key tourist, cultural and economic center of the country, with many businesses, industrial and commercial facilities, representative offices, and companies. Juba is a center of financial activities and investments, and it is considered one of the most rapidly developing cities on the continent, with a blossoming economy and great perspectives for business.



Figure 1: Map showing study areas.

Study design

The study was a retrospective study to determine the prevalence of common disease conditions and demography of owned dog population reported and registered in veterinary clinics, utilizing records from the cases registered at Out Patient Department of both Clinics.

Sampling Procedures and Data Collection

Data were collected from the registered clinical cases at the Out Patient Department of two veterinary clinics. These clinics were chosen as the only government clinics supported by experience veterinary surgeons and technicians and were in position to conduct some minor surgeries in addition to vaccination. The clinics are also responsive to outside calls to attend and treat sick animals. All dogs presented for treatment from 2017 –

2021 were included in this study. The variables included were breed, sex, age, and the tentative diagnosis were performed to identify the prevalence of infectious and non-infectious diseases condition and the population of owned dogs within Juba city. However, the cases registered in both clinics were based on the clinical signs and pathological lesions of the reported condition not laboratory diagnosis. The case history was attended by veterinary officers employed by the Ministry of Animal Resources and Fisheries, Central Equatoria State, South Sudan.

Data Management and Statistical Analysis

The collected data captured in the veterinary clinics were entered into an Excel spreadsheet and cleaned off entry errors. The descriptive statistics were generated using the frequency, Chi-square was computed to generate

bivariate comparisons and associations between variables; such as the disease conditions and the breed, diseases and age and diseases with season of the year. The dog breeds categorized into local and foreign, the age distribution include: young (1m< 1year old) adult (1year-3years old) old (> than 3 years old). Statistical comparisons with P-values ≤ 0.05 were considered significant.

RESULTS

1. Demographic Characteristics of Owned Dogs

Table1: Depicts the demographic data of dogs presented at two veterinary clinics, Juba and Luri, over a five-year

period (2017–2021). A total of 8,504 dogs were recorded, with the majority (63.0%, 5,359 dogs) visiting the Juba Veterinary Clinic and the remaining 37.0% (3,145 dogs) attending the Luri Veterinary Clinic. Over these years. The number of dogs increased steadily, peaking in 2021 with 2,002 cases (23.5% of the total). The highest annual attendance at Juba Clinic was 1,326 dogs in 2021, while Luri Clinic saw its highest numbers in 2019 (751 dogs). Overall, the data indicate a consistent rise in dog presentations, with Juba Clinic handling nearly two-thirds of the cases. (Fig. 2)

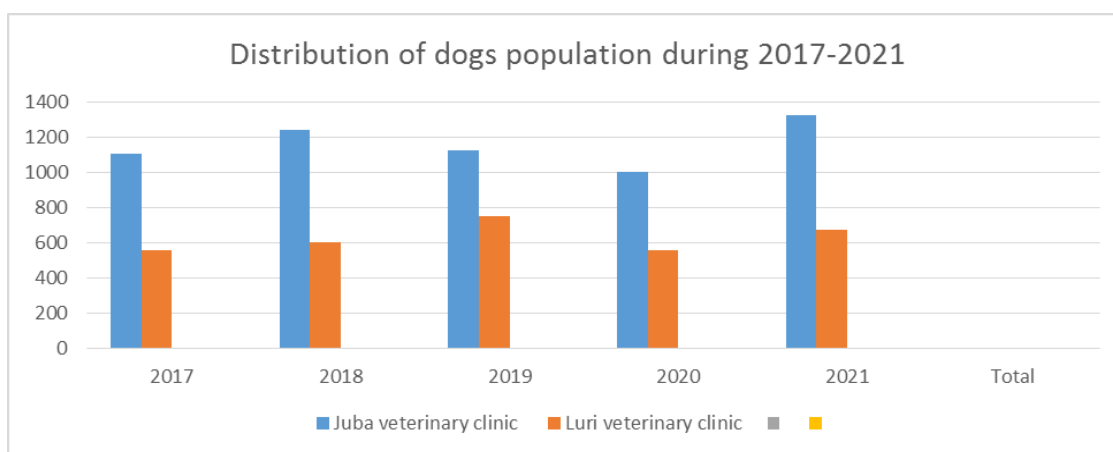
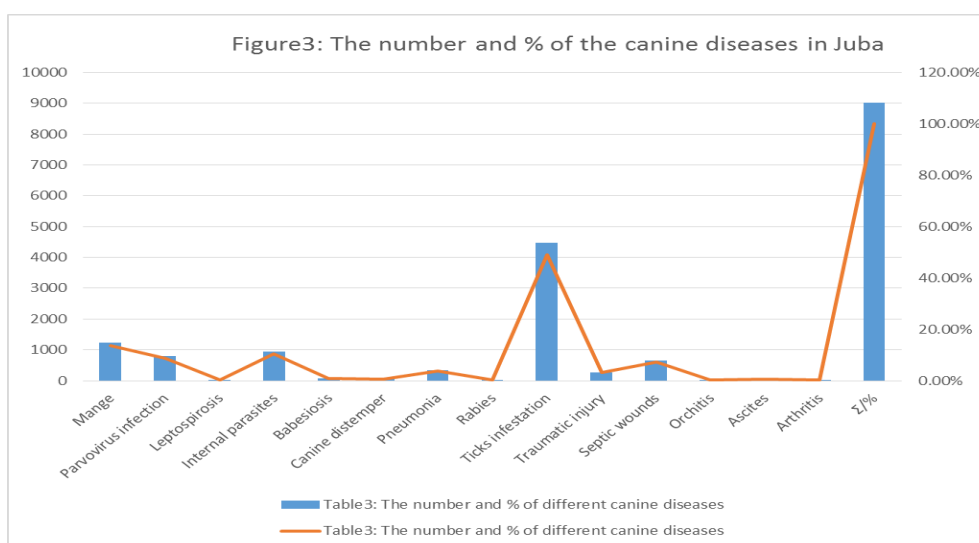


Figure 2: Demography of dog presented for the period of five years..

2. The number and proportions of various dog diseases

A total of 9016 cases of fourteen different disease conditions were collected from the record book of Juba and Luri veterinary clinics. Tick infestations being the

most prevalent 4477 (49.0%), followed by mange 1231(13.7%) and internal parasites 945(10.5%). Less common conditions include rabies 22(0.2%), leptospirosis 34 (0.4%), and 37 (0.4%) arthritis Fig. 3.



3. Association between Prevalence of Diseases, Sex and Seasonality.

The prevalence of diseases showed a significant association with both sex and seasonality. Males (92.8%) were more affected by diseases compared to females

(7.2%), with certain conditions like rabies, orchitis, and arthritis exclusively found in males. Mange, parvovirus infection, internal parasites, and septic wounds were significantly more prevalent in males than females. Seasonality also played a major role, with most cases

occurring during the wet season (73.5%) compared to the dry season (26.5%). Conditions such as mange, parvovirus infection, internal parasites, and tick infestations were more frequent in the wet season, while

diseases like rabies and orchitis had higher occurrences in the dry season. The statistical significance ($P < 0.05$) highlights a strong correlation between disease prevalence, sex, and seasonal variations. (**Table 1**)

Table 1: Association between Prevalence of Diseases and sex and seasonality.

Infectious and Non-infectious Diseases	Sex		P-Value	Season of the Year		P-Value
	Male	Female	Sig	Wet	Dry	Sig.
Mange	1139 (92.5%)	92 (7.5%)	<0.05	856 (69.5%)	375 (30.5%)	0.00
Parvo virus infection	661 (83.4%)	131 (16.5%)	<0.05.	543 (68.5%)	249 (31.4%)	< 0.05.
Leptospirosis	30 (88.2%)	4 (11.7%)	<0.05.	19 (55.8%)	15 (44.1%)	< 0.05.
Internal parasites	831 (87.9%)	114 (12.0%)	<0.05.	626 (66.2%)	319 (33.7%)	< 0.05.
Babesiosis	49 (67.1%)	24 (31.8%)	<0.05.	47 (64.3%)	26 (35.6%)	< 0.05.
Canine distemper	53 (81.5%)	12 (18.4%)	<0.05.	42 (64.6%)	23 (35.3%)	< 0.05.
Pneumonia	298 (90.0%)	33 (9.9%)	<0.05.	279 (84.2%)	52 (15.7%)	< 0.05.
Rabies	22 (100%)	0 (0.0%)	<0.05.	9(40.9%)	13 (59.0%)	< 0.05.
Ticks infestation	4346 (97.0%)	131 (2.9%)	<0.05.	3452 (77.1%)	1025 (22.8%)	< 0.05.
Trumatic injury	238 (85.6%)	40 (14.3%)	<0.05.	153 (55.0%)	125 (44.9%)	< 0.05.
Septic wounds	591 (90.6%)	61 (9.3%)	<0.05.	513 (78.6%)	139 (21.3%)	< 0.05.
Orchitis	37 (100.0%)	0 (0.0%)	<0.05.	16 (43.2%)	21 (56.7%)	< 0.05.
Ascities	44 (95.6%)	2 (4.4%)	<0.05.	37 (80.4%)	9 (19.5%)	< 0.05.
Arthritis	33 (100.0%)	0 (0.0%)	<0.05.	28 (92.4%)	5 (7.6%)	< 0.05.
Σ/%	8372 (92.8%)	644 (7.2%)	<0.05.	6628 (73.5%)	2396 (26.5%)	< 0.05.

Demographic Characteristic of dogs

Table 2, provides a breakdown of breed, sex, and age characteristics of dogs presented for treatment at two veterinary clinics, Juba and Luri. A total of 8,506 dogs were recorded, with the majority (95.1%) 8,095 dogs being local breeds. Males constituted the overwhelming majority (91.4%, 7,781 dogs). In terms of age

distribution, most dogs were under one year old (68.0%, 5,783 dogs), followed by those aged 1–3 years (25.6%, 2,180 dogs). Overall, the data highlight a strong preference for local breeds, a significant male dominance, and a higher proportion of younger dogs seeking treatment.

Table 2: Association between diseases prevalence and age.

Infectious and Non-infectious Diseases	Age			Sig.
	1m < Year old	1-3 Years old	>Than 3 year old	
Mange	312 (25.3%)	451(36.6%)	468 (38.0)	0.00
Parvo virus infection	517 (62.2%)	275 (34.7%)	0 (0.0%)	
Leptospirosis	14 (41.1%)	12(35.2%)	8 (23.5%)	
Internal parasites	374 (39.5%)	399 (42.2%)	172 (18.2%)	
Babesiosis	16 (22.0%)	39 (53.4%)	18 (24.6%)	
Canine distemper	17 (26.1%)	26(40.0%)	22 (33.8%)	
Pneumonia	58 (17.5%)	183 (55.2%)	90 (27.1%)	
Rabies	3 (13.6%)	13(59.0%)	8 (36.3%)	
Ticks infestation	1580 (35.2%)	1722 (38.4%)	1175 (26.2%)	

Trumatic injury	106 (38.1%)	74 (26.6%)	98 (35.2%)
Septic wounds	159 (24.3%)	285 (43.7%)	208 (31.9%)
Orchitis	3 (8.1%)	21(56.7%)	13 (35.1%)
Ascities	5 (10.8%)	32(69.5%)	9(19.5%)
Arthritis	4 (12.1%)	23(69.6%)	6(18.1%)
Σ/%	3168 35.1%)	3555 (39.4%)	2293 (25.5%)

DISCUSSION

Demographic Characteristics of Owned Dogs

The dominance of **local breeds (95.1%)**, suggests a preference for indigenous dogs due to their adaptability to the local environment and lower maintenance costs. This finding is consistent with studies in other African regions, such as Kenya, Gakuya *et al.* (2020) found that in Nairobi, 87.5% of dogs presented at veterinary clinics were local breeds.

The observed **male dominance (92.8%)** aligns with reports from Ghana, where male dogs are more commonly kept due to their perceived suitability for security purposes and reduced reproductive challenges (Afakye *et al.*, 2020). However, this ratio is significantly higher than reported in urban studies in developed countries, such as the United States and the United Kingdom, where the male-to-female ratio is more balanced due to widespread neutering practices (Woodroffe *et al.*, 2018). Age distribution data indicated that **63.8% of dogs were under one year old**, which may reflect high birth rates and early mortality. This is consistent with research from Ethiopia, where Mamo *et al.* (2021) found that 60.2% of dogs were under one year old, attributed to poor veterinary care and a high burden of infectious diseases.

The study identified **tick infestations (49%)** as the most common condition. This is in line with findings from Nigeria, where Nwoha *et al.* (2013) reported that **48.6% of dogs examined were infested with ticks**. Similarly, Otranto *et al.* (2017) found a **tick prevalence of 53.2% in free-roaming dogs in rural Italy**, indicating that tick-borne diseases remain a regional concern. The second most common condition was **mange (13.6%)**, which is comparable to studies in India, where Sarkar *et al.* (2020) reported a **mange prevalence of 12.8%**, largely due to poor hygiene and lack of routine treatment. **Internal parasites (10.4%)** were another major concern. This prevalence aligns with findings from Uganda, where Njenga *et al.* (2021) found an **internal parasite burden of 11.2%** among owned dogs. The high prevalence of parasites is often linked to poor deworming practices and contamination of the environment with faecal matter. Among infectious diseases, **parvovirus infection (8.7%)** was significant, especially in puppies. Studies in Ethiopia (Mekonnen *et al.*, 2019) and Ghana (Afakye *et al.*, 2020) reported parvovirus prevalence rates of 9.2% and 8.1%, respectively, consistent with our findings. The relatively high occurrence of parvovirus in young dogs highlights the need for improved vaccination programs. Zoonotic diseases such as **rabies (0.2%)** were recorded at low

prevalence, but their public health impact cannot be underestimated. Studies in Tanzania (Cleaveland *et al.*, 2017) found similar low rabies prevalence (0.3%) among owned dogs but highlighted the significant risk posed by free-roaming dogs. Conversely, higher rabies rates have been reported in parts of India (1.1%) and Nigeria (1.5%) due to insufficient vaccination coverage (Tenzin *et al.*, 2020). A **significant association ($P < 0.05$) between disease prevalence, sex, and seasonality** was observed. The study found that **males were more affected than females (92.8% vs. 7.2%)**, a trend also reported by Fielding *et al.* (2005) in South Africa, where **89% of disease cases were in male dogs**. This may be due to the fact that male dogs are more often free-roaming and exposed to environmental risks. Seasonal variation in disease prevalence was evident, with most cases occurring during the **wet season (73.5%)**. This finding is comparable to studies in Zambia (Mwacalimba *et al.*, 2021) and Thailand (Songsri *et al.*, 2018) where increased tick infestations and parvovirus outbreaks were linked to humid conditions favouring parasites survival and pathogen transmission. Conversely, rabies and orchitis were more prevalent in the **dry season**, possibly due to increased aggression and mating-related fights among male dogs, as reported by Gakuya *et al.* (2020). The findings in this research regarding the parvovirus (62.2%), align closely with studies from Africa and Asia, confirming that parvovirus primarily affects young, unvaccinated puppies consistent with reports from Nigeria (Awosanya *et al.*, 2020) and India (Sharma *et al.*, 2021). Leptospirosis was more common in younger dogs (41.1%), matching studies from South Africa (Adler *et al.*, 2021) and Sri Lanka (Rajapaksha *et al.*, 2020), confirming **higher risk for younger dogs**. Tick infestations and babesiosis peaked in the 1–3-year-old group (38.4% and 53.4%, respectively), similar to findings from Pakistan (Hussain *et al.*, 2020). These studies reinforce that **active, middle-aged dogs face the highest risk of tick infestations and babesiosis**, aligning well with our results. Rabies cases were highest in the 1–3-year-old group (59.0%), supporting data from Ethiopia (Deressa *et al.*, 2019) and India (Manoj *et al.*, 2020), confirming **higher exposure risk in middle-aged dogs which due to long outdoor activity**. Studies in Tanzania (Cleaveland *et al.*, 2017) and Ghana (Afakye *et al.*, 2020) suggest that, rabies control requires at least 70% vaccination coverage to achieve herd immunity. A similar approach should be implemented in Juba. Lastly, chronic diseases like arthritis (69.6%) and ascites (69.5%) were most prevalent in older dogs (>3 years old), consistent with studies from Nigeria (Olatunji *et al.*, 2021). These comparisons highlight global similarities in age-related disease trends, reinforcing the need for age-

specific veterinary care, including vaccination for puppies, parasite control for middle-aged dogs, and chronic disease management for older dogs.

CONCLUSION

The study revealed prevalence of canine diseases in Juba, South Sudan with the same regional and global epidemiological trends. Male dogs proved to be more susceptible to most of the encountered diseases than females, and season have an effect on the proportion of occurrence of these diseases. The study invites policy intervention for seasonal provision of drugs and vaccines for treatment and control of diseases, in addition to strengthening the diagnostic capacity and capabilities of the government clinics.

Limitations of the Study

The study was based completely on secondary retrospective data extracted from case register from the two clinics. The cases recorded were sole results of tentative clinical diagnosis deduced by the veterinary clinician through palpation, observation of lesions and clinical signs as the clinics lack confirmatory laboratory diagnostic tools and kits.

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Ethical considerations

Approval to carry out this study was given by the interim ethical committee of school of Veterinary Medicine and a go ahead letter by the Ministry of Animal Resources, Fisheries and Tourism Central Equatoria State, South Sudan.

Conflict of Interest

The authors contributed equally in this study, and agreed in all procedures in the study and publication.

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