Prevalence of parasitic infestation in domestic animals of hot humid region

N.N. Brahmbhatt[1], B. Kumar[2], B.J. Thakre[1], A.S. Patel[3*], V.D. Dodia[4], V.L. Parmar[4]

[1]Department of Veterinary Parasitology, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Junagadh-362001, Gujarat; [2]Department of Veterinary Parasitology, College of Veterinary and Animal Sciences, Bihar Animal Sciences University, Kishanganj-855107, Bihar; [3]Department of Livestock Product Technology, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Junagadh-362001, Gujarat; [4]Department of Veterinary Clinical Complex, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Junagadh-362001, Gujarat, India.
*Corresponding Author: ajay.patel@kamdhenuuni.edu.in

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Abstract

A comprehensive study conducted from January to December 2022. The study includes blood smear examination of 1629 animals, coprological analysis of 467 animals, and skin scrapping assessments of 55 animals. The microscopic examination revealed that the overall prevalence of parasitic infections in domestic animals was 10.41%. Specifically, 10.65% (173/1629) of the animals were diagnosed with haemoparasitic infections, 9.85% (46/467) with gastro-intestinal parasitic infections, and 9.09% (5 /55) with mite infestations. The highest incidence of haemoparasitic infection was recorded in cattle (15.45%) while sheep and goats have highest incidence of GI parasitic infections (37.5%). In terms of gender-wise analysis, the study found a significantly ($p<0.05$) higher prevalence in female animals (12.08%, 191/1580) compared to male animals (5.77%, 33/571). Season wise analysis found that higher prevalence in monsoon season followed by summer & winter in case of haemoparasitic and GI infections while in case of mite infection higher prevalence found in summer followed by monsoon and winter but statistically non-significant ($p>0.05$). Similarly, age-wise prevalence revealed significant differences ($p<0.05$), with a higher prevalence in adult animals (12.17%, 203/1668) compared to young animals (4.34%, 21/483). Present study would help in development of the control strategy against the parasitic diseases in animals.

Key Words: Parasitic Diseases; haemoparasites; gastro-intestinal parasites; ectoparasites

Introduction

In tropical and sub-tropical countries across the world, including India, parasitic illness poses a severe threat to the well-being, production, and efficiency of numerous household animals. The parasitic infection is seriously viewed as main health hazard (Farhang et al 2017) and economic loss (Besana et al 2020) in livestock industry especially in hot humid regions across the world. Haemoprotozoal illness, gastrointestinal parasite infection, and mite infestation are frequent parasitic disorders in a variety of species. Furthermore, the epidemiological survey of gastrointestinal parasites and hemoparasite diseases in domestic animals varies according to the local management techniques and prevalent climatic circumstances. Consequently, accurate mapping of the parasite infection of each species in the various agro-climatic zones provides essential information that may be used to guide the implementation of additional control measures.

The climate in and around the Junagadh district is humid and arid, which is ideal for the growth of parasites. Environmental factors may also promote the growth of various parasite larval stages as well as tick survival and proliferation, which could seriously harm animal owners' finances. Ticks infect animals and spread a variety of illnesses that harm both infected and non-infected hosts. Maintaining animal productivity and reproductive health in tropical and/or sub-tropical regions-which are highly conducive to the growth, development, and survival of parasites, notably ticks and tick-borne illnesses-is the biggest challenge in these types of settings.

Regarding the prevalence of parasite illnesses in different household animals in Junagadh (Gujarat), India, not much information is available (Kumar et al., 2016; Maharana et al., 2016). Since this district is home to numerous kinds of dog, sheep, and goat in addition to Gir cattle and Jaffrabadi buffaloes, it is a rich in livestock. Undertaking a comprehensive investigation of the prevalence of different parasite illnesses and their correlation with meteorological factors is crucial. Moreover, Preventing and managing parasitic infections in animals often involves regular veterinary care, proper hygiene, and the use of preventive measures such as vaccinations, deworming medications, and parasite control products. Early detection and treatment are crucial to minimizing the impact of these infections on the health of animals.Thus, in order to ascertain the prevalence of parasitic infections and develop strategic and tactical control methods, the current study was carried out to look into the incidence of parasitic infections in various animal species that were brought to the Veterinary Clinical Complex (VCC) with various ailments.

Materials & Methods

Study Location and Duration

The present study was conducted at Department of Veterinary Clinical Complex (VCC), College of Veterinary Science and Animal Husbandry, Kamdhenu University, Junagadh-362001, Gujarat from January to December 2022

Agro Climate Condition of Junagadh, Gujarat

South Saurashtra	Dry Sub-humid Climate	Junagadh, Gir-Somnath, Jamnagar, Amreli, Bhavnagar, Porbandar

Junagadh district in Gujarat, India, is situated at approximately 21.5250° N latitude and 70.4671° E longitude. The region experiences a tropical wet and dry climate, characterized by distinct seasonal variations. The average annual temperature hovers around 25.7°C (78.2°F), while the district receives an average annual precipitation of approximately 657 mm (25.9 inches). Junagadh city, the district's headquarters, is located at an elevation of about 107 meters (351 feet) above sea level.

During the summer months, from March to June, temperatures range from 28°C to 40.16°C, with May often being the hottest month. In contrast, the winter season, spanning from October to February, sees temperatures ranging from 10°C to 25°C, with January being the coolest month, averaging around 24.1°C. The monsoon season, from June to September, brings the majority of the district's rainfall, averaging between 800 to 1200 mm. August is typically the wettest month, with an average precipitation of 134.44 mm.

Humidity levels in Junagadh vary throughout the year, with an average of 52.56%. The monsoon months experience higher humidity, while the dry season sees lower levels. Wind speeds in the district average around 8.81 km/h annually, with some variation across different months. This climate pattern reflects Junagadh's tropical nature, characterized by hot summers, cooler winters, and significant rainfall during the monsoon period (Sindhi et al., 2022)

Sample Collection & Processing

The veterinarian at VCC assessed the clinical status of the animals before collecting the clinical samples of cattle, buffaloes, sheep, goats, horses, dogs and cats. Samples such as faeces, blood, and skin scraping were collected from animals based on their symptoms to diagnose endoparasite, hemoprotozoal and mite infections.

Where faeces were taken straight from the rectum of animals experiencing digestive disturbances, blood was taken from the jugular vein, ear vein, and/or saphanous vein of various animal species experiencing general health issues such as fever, anemia, prolonged anorexia, etc., and skin scraping were taken from animals experiencing dermatitis issues.

A total of 2151 samples were collected between January and December 2022. These included 758 cattle (602 blood, 153 faecal, and 03 skin scrapping), 722 buffaloes (564 blood, 157 faecal, and 01 skin scrapping), 68 sheep and goats (33 blood, 32 faecal, and 03 skin scrapping), 129 horses (113 blood, 13 faecal, and 03 skin scrapping), and 474 dogs and cats (317 blood, 112 faecal, and 45 skin scrapping). Samples of skin, blood, and feces were processed according to standard protocol. The blood samples were screened using the thin-smeared Giemsa-stain method, skin samples were treated with 10% KOH, and faecal samples were treated with flotation and sedimentation procedures. The prevalence of each age and gender was also examined throughout the year.

Statistical analysis

In order to derive interpretations, the resulting data were collated, formed for frequency, and then converted to percentage. The $\chi 2$ test was used to do statistical analysis on the data using SPSS 13.0 software, with statistical differences being deemed significant when $p<0.05$.

Results

The overall incidence of parasitic infections in domestic animals were 10.41%, (224/2151). Specifically, 10.65% (173/1629) of the animals were diagnosed with haemoparasitic infections, 9.85% (46/467) with gastro-intestinal parasites infections, and 9.09% (5 /55) with mite infections (Table 1). In terms of gender-wise analysis, the study found a significantly higher ($p<0.05$) prevalence in female animals (12.08%, 191/1580) compared to male animals (5.77%, 33/571). Age-wise prevalence analysis also revealed significant differences ($p<0.05$), with a higher prevalence in adult animals (12.17%, 203/1668) compared to young animals (4.34%, 21/483) (Table 2). Seasonally, highest incidence of both haemo-parasitic and GI parasitic infection was recorded in monsoon while mites infection in summer (Table 4).

Animal species wise incidence of parasitic infections

The significantly highest ($p<0.05$) incidence of haemoparasitic infection was recorded in cattle (15.45%) followed by buffaloes (9.75%), sheep and goats (9.1 %), horses (5.3%) and lowest in dogs (5.50%). While, the highest incidence of gestro-intestinal infection was recorded in sheep and goats (37.5%) followed by horses (30.77%), cattle, 8.5%), buffaloes (7%) and lowest in dogs (5.36%). No incidence of mites was recorded in horse and sheep and goats, while 100 % incidence was recorded in buffaloes, 66.67 % in cattle and 4.44 % in dogs because of very less number of skin scraping samples were collected. The data on animal wise incidence of different parasitic infections (species of parasite) are presented in Table 3.

Prevalence of haemoparasitic infections

Examination of giemsa-stained peripheral blood smears of 602 cattle, 564 buffaloes, 317 dogs, 113 horses, and 33 sheep and goats revealed following incidences of haemoparasites: *Trypanosoma evansi* (0.61%, 10/1629), *Babesia* spp. (0.30%, 05/1629), *Theileria* spp. (8.59%, 140/1629), *Anaplasma* spp.(0.49%, 08/1629), *Ehrlichia canis* (0.30%, 05/1629), and *Hepatozoan* spp. (0.30%, 05/1629) (Table-3).

Prevalence of GI parasitic infections

Coprological examination of fecal samples from 153 cattle, 157 buffaloes, 112 dogs, 13 horses, and 32 sheep and goats revealed the presence of various gastro-intestinal parasites, including *Fasciola* spp. (1.28%, 6/467), Amphistomes (1.07%, 5/467), *Schistosoma* spp. (0.42%, 2/467), *Diphylobothrium* spp. (0.21%, 1/467), *Trichuris* spp. (0.64%, 3/467), Strongyls (1.07%, 5/467), *Strongyloides* spp. (0.64%, 3/467), *Toxocara* spp. (0.85%, 4/467), *Ancylostoma* spp. (0.64%, 3/467), Oocysts of coccidia (1.71%, 8/467), & *Balantidium coli* (1.28%, 6/467) (Table 3).

Prevalence of mite infections

Skin scrapping of 3 cattle, 1 buffalo, 45 dogs, 3 horses, and 3 sheep and goats were processed and the presence of *Demodex* spp. (1.81%, 1/55), *Sarcoptes* spp. (3.63%, 2/55), *Psoroptes* spp. (1.81%, 1/55), and *Notoderes* spp. (1.81%, 1/55) recorded (Table 3).

Table 1. Overall incidence of parasitic infection in domestic animals of Junagadh district

Parasites	Total sample	Positive	Incidence (%)
Haemoparasites	1629	173	10.65
GI parasites	467	46	9.85
Mites	55	05	9.09
Overall	2151	224	10.41

The chi-square statistic is 0.3365. The *p*-value is 0.845151. The result is not significant ($p>0.05$)

Table 2. Sex and age wise prevalence of parasitic infection in domestic animals of Junagadh district

Sex wise incidence		
Sex	**Total sample**	**Positive**
Male	571	33 (5.77%)
Female	1580	191 (12.08%)*
	2151	224 (10.41%)
Age wise incidence		
Young (< 1 Year)	483	21 (4.34%)
Adult (> 1 year)	1668	203 (12.17%) **
	2151	224 (10.41%)

*The *p*-value is 0.000023 Significant at $p<0.05$. **The *p*-value is <0.00001 Significant at $p<0.05$.

Table 3. Incidence of parasitic infection in domestic animals of Junagadh district

Parasites	**Cattle (602)**	**Buffalo (564)**	**Dog & Cat (317)**	**Horse (113)**	**Sheep & Goat (33)**	**Incidence**
Trypanosoma evansi	02	03	03	02	00	10/1629 (0.61%)
Babesia spp.	02	00	02	01	00	05/1629 (0.30%)
Theileria spp.	85	51	00	03	01	140/1629 (8.59%)
Anaplasma spp.	04	01	01	00	02	08 /1629 (0.49%)
Ehrlichia spp.	00	00	05	00	00	05 /1629 (0.30%)
Hepatozoon spp.	00	00	05	00	00	05 /1629 (0.30%)
Fasciola spp.	03	02	00	00	01	06/467 (1.28%)
Amphistomes	02	02	00	00	01	05/467 (1.07%)
Schistosoma spp.	01	01	00	00	00	02 /467 (0.42%)
iphylobothrium spp.	00	00	01	00	00	01/467 (0.21%)
Trichuris spp.	00	00	00	00	03	03/467 (0.64%)
Strongylus spp.	01	01	00	01	02	05 /467 (1.07%)
*Strongyloides*spp.	01	00	00	00	02	03 /467 (0.64%)
*Toxocara*spp.	01	02	01	00	00	04/467 (0.85%)
*Ancylostoma*spp.	00	00	03	00	00	03/467 (0.64%)
Coccidia	03	01	01	01	02	08/467 (1.71%)
Balantidium coli	01	02	00	02	01	06/467 (1.28%)
*Demodex*spp.	00	00	01	00	00	01/55 (1.81%)
*Sarcoptes*spp.	01	01	00	00	00	02/55 (3.63%)
*Psoroptes*spp.	01	00	00	00	00	01/55 (1.81%)
*Notoderes*spp.	00	00	01	00	00	01/55 (1.81%)

Table 4. Season wise prevalence of parasitic infection in domestic animals of Junagadh district

Season	**Haemoparasitic**	**GI parasite**	**Mite**
Monsoon (July to September)	18.32% (79 /431)	17.69% (20 /113)	8.33% (02/24)
Summer (March to June)	10.95% (66 /602)	10.11% (17 /168)	11.76% (02/17)
Winter (October to February)	4.69% (28 /596)	4.82% (09 /186)	7.14% (01/14)
Overall	10.62% (173/1629)	9.85% (46/467)	9.09% (05/55)

The chi-square statistic is 0.3598, The *p*-value is 0.985636, Non Significant at $p > 0.05$.

Discussion

Parasitic infections are ubiquitous in animals especially in tropical and sub-tropical region of the worlds. Similarly, the overall prevalence of parasitic infections in domestic animals was 10.41% recorded in western part of India where, the haemo-protozoan parasites were shown to be more prevalent than endo-parasites and mite infections in domestic animals. *Theileria* infection was observed most common hemoprotozoan parasite in cattle, buffalo, horses, sheep, and goats. The primary cause of this may be the increased population of *Hyalomma* ticks

(unpublished), which thrive in the hot and humid climate of the Junagadh district (Brahmbhatt et al., 2019). The prevalence of theileriosis in animals varies across India. For example, in Tamil Nadu, 11% of sheep and 3% of goats had a hemoprotozoan parasitic infection (Velusamy et al., 2015); in Punjab state, 14.65% of cattle had a higher prevalence of the disease (Singh et al., 2012)and 15.38 % (Haque et al., 2011); in Junagadh district, Gujarat, 3.4% and 1.2% of cattle and buffalo showed a prevalence rate of the disease (Kumar et al., 2016).There has been relatively little evidence of *Babesia* spp., *Ehrlichia* spp., and *Hepatozooan* spp., in mammals. The low prevalence of the vector, *Rhipicephalus microplus*, and *Rhipicephalus sanguineus* in Junagadh, Gujarat, or the low density of exotic breeds or cross-bred animals in this area of the country, could be the cause of the low incidence of *Babesia* spp. in cattle, buffalo, sheep, and goats.

A coprological analysis showed a 9.85% incidence of gastro-intestinal parasite infections. Faecal samples contained a variety of GI parasites, including trematode, nematode, cestode, and protozoa. The coccidian oocyst was the most common GI parasite detected, with 1.71% of cases. Other common parasites included *Balantidium coli* and *Fasciola* spp. (1.28%), Amphistomes and Strongyle (1.07%), *Toxocara* spp. (0.85%), *Trichuris* spp., *Strongyloides* spp. and *Ancylostoma* spp. (0.64%), and *Diphylobothrium* spp. (0.21%).The almost similar observation was recorded from different parts of country (Jyoti et al., 2011; Singh et al., 2012; Thakre et al., 2019).The findings showed that protozoan parasites find out more in number than helminth diseases. Oocysts of coccidian and *B. coli* were the most common of all, as shown by previous research (Kumar et al., 2016) and the current investigation.These results unequivocally demonstrated that the incidence rate of gastrointestinal parasite infection in domestic animals varies significantly between species and geographical regions. This variance could result from changes in the local environment and the agro-climatic conditions. For their survival and proliferation, animal parasites likewise favor humid environments. Due to the presence of numerous intermediate snail host species in various perennial freshwater bodies, the incidence of *Fasciola* (1.28 %) and *Amphistome* (1.07 %) shows higher prevalence rate, which is a digenetic trematode parasite in the current study (Choubisa, 2010). The rainy season offers the ideal conditions for these digenetic trematode parasites to complete their life cycle (Choubisa, 2010). Therefore, it is conceivable that the monsoon season would see a high incidence of *Fasciola* and *Amphistome* parasites. During the rainy season, animal feed and drinking water are contaminated. Thus, a high prevalence of helminthic and protozoan infections is possible during the rainy season. A number of researchers have also noted and documented a somewhat high frequency of gastrointestinal parasite infections during the monsoon season (Khajuria et al., 2012; Sutar et al., 2010; Tambe et al., 2011). Conversely, a small number of researchers have also noted and documented a significant frequency of these parasite infections throughout the summer and winter (Padwal et al., 2011). In addition, 45 dogs, 3 horses, 3 sheep & goats, 3 cattle, 1 buffalo, skin scraping examination were performed in order to diagnose mites. The highest incidence of mites infection was observed in buffaloes (100%) and lowest in dogs (4.44%), while no infection in sheep and goats and horses. This is because very low number of sample of skin scrap was collected and analyzed for cattle, buffaloes, sheep & goats and horses. *Demodex* spp. (1.81%), *Sarcoptes* spp. (3.63%), *Psoroptes* spp. (1.81%), and *Notoderes* spp. (1.81%) were found to be present. The most common mite was *Sarcoptes*, which was followed by *Notoderes, Pasoroptes*, and *Demodex* species. Mange or mite infestations have a negative impact on the health of the animals and lower the output of milk and meat, also they cause major issue in livestock husbandry. The incidence of mange mites in the livestock in Gujarat's Junagadh area was unknown. Moreover, Canine scabies, canine demodicosis, tick, flea, and lice infestations, atopic dermatitis, and cutaneous traumas are among the dermatological conditions that affect dogs. In addition to skin-to-skin contact between healthy and diseased individuals, scabies can also occasionally be transmitted by contaminated clothing, towels, or bed linens. Dry, scaly, hyperkeratotic, and crusted skin, especially on the extremities, is a pathognomonic symptom of scabies (Tidman & Tidman, 2013). The current study shows the agreement with the previous reports (Ali et al., 2021; Muhammad et al., 2021).Basically clinical symptoms are used to diagnose mange infection, however they can be mistaken by other infestations, such as ringworm, flea allergies, and ticks. Therefore, confirmation requires laboratory diagnosis using microscopic identification of eggs, nymphs, and adults from skin scrapings. Due to the lack of a commercially available, highly sensitive serological and molecular diagnostic assay, the classical microscopic detection of mites with questionable sensitivity is the only method used globally.

When analyzing the data by gender, it was discovered that the prevalence was substantially higher in female animals (12.08%, 191/1580) than in male animals (5.77%, 33/571). The prevalence was higher in adult animals (12.17%, 203/1668) than in young animals (4.34%, 21/483), according to age-wise prevalence analysis, which likewise showed significant differences ($p<0.05$). Our study's results indicate that age and gender have a substantial impact on the prevalence of the illness under investigation. The hormonal profiles of males and females may differ, which may impact immunological responses and vulnerability to specific diseases. For instance, it has been demonstrated that estrogen alters immune function, which may increase a female animal vulnerability to

certain illnesses. Exposure risks may be influenced by gender-specific activities, such as social interactions or reproductive patterns. Female animals may interact with infections more frequently due to differences in their habitat or feeding habits. Sex-specific differences in anatomy or physiology may affect the chance of a disease developing or worsening. For instance, variations in the distribution of body fat may impact the way in which specific infections spread or the way in which illnesses present.

In terms of age distribution, young animals are more susceptible to illnesses since their immune systems are still developing. Adult animals, on the other hand, typically have stronger immune responses because of their immunological memory and prior exposures. Furthermore, because they live longer lives and engage in more social interactions or considerable mobility, adult animals may be more exposed to infections. A higher incidence rate in adults may result from this increased exposure.

Seasonal analysis revealed that haemoparasitic and gastrointestinal parasitic infections were most prevalent during the monsoon (18.32%, 17.69%), followed by summer (10.95%, 10.11%) and winter (4.69%, 4.82%) whereas mite infections were more common in summer (11.76%), followed by the monsoon (8.33%) and winter (7.14%). However, these results were not statistically significant. The observed seasonal trends in infection prevalence are primarily driven by temperature, humidity, vector activity, host immunity, and environmental contamination, all of which fluctuate with the seasons. Increased humidity and rainfall in monsoon create ideal conditions for the survival and proliferation of parasites and their vectors (e.g., ticks, mosquitoes, and flies for haemoparasites; contaminated water and food for GI parasites). Moreover, Water stagnation during monsoon facilitates the spread of vector-borne infections and waterborne gastrointestinal parasites. Higher host susceptibility due to nutritional stress, reduced immunity, and increased exposure to contaminated food and water during monsoon and summer may leads higher prevalence of haemoparastes and GI infections. Summer follows monsoon in prevalence as warm temperatures still support vector activity and parasite survival, though dryness may limit their spread. Winter sees the lowest prevalence as low temperatures reduce vector activity, parasite multiplication, and environmental contamination.

Conclusion

A study at the Veterinary Clinical Complex, Kamdhenu University, Junagadh found that parasitic infections in domestic animals were prevalent at 10.41%. The study identified 10.65% of cases with haemoparasites, 9.85% with gastrointestinal parasites, and 9.09% with mite infestations. The highest incidence haemoparasitic infection was recorded in cattle while sheep and goats have highest incidence of GI parasitic infections. Key findings include the presence of parasites such as *Trypanosoma evansi*, *Babesia spp.*, *Theileria spp.*, *Fasciola spp.*, and *Demodex spp.* among others. These findings are essential for creating efficient methods of controlling parasite infections in animals.

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Conflict of interest

The authors declare no conflict of interest.

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