A COMPARATIVE STUDY OF GASTROINTESTINAL PARASITES AMONG INTENSIVE, SEMI-INTENSIVE AND ABANDONED CATTLE IN KATHMANDU DISTRICT, NEPAL

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A thesis submitted in partial fulfillment of requirements for the award of the degree of Master of Science in Zoology with special paper parasitology

Submitted to
Central department of Zoology
Institute of Science and Technology
Tribhuvan University
Kirtipur, Kathmandu
Nepal

September, 2019

DECLARATION

I hereby declare that the work presented in this thesis has been done by myself, and has not been submitted elsewhere for the award of any degree. All sources of information have been specifically acknowledged by reference to the author(s) or institution(s).

Date: 23rd sept, 2019

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RECOMMENDATION

This is to recommend that the thesis entitled **"A COMPARATIVE STUDY OF GASTROINTESTINAL PARASITES AMONG INTENSIVE, SEMI-INTENSIVE AND ABANDONED CATTLE IN KATHMANDU DISTRICT, NEPAL"** has been carried out by Bigyan Thapa for the partial fulfillment of Master's Degree of Science in Zoology with special paper Parasitology. This is original work and has been carried out under my supervision. To the best of my knowledge, this work has not been submitted for any other degree in any institutions.

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LETTER OF APPROVAL

On the recommendation of supervisor **"Mr. Pitambar Dhakal"** this thesis submitted by Bigyan Thapa entitled **"A COMPARATIVE STUDY OF GASTROINTESTINAL PARASITES AMONG INTENSIVE, SEMI-INTENSIVE AND ABANDONED CATTLE IN KATHMANDU DISTRICT, NEPAL"** is approved for the examination in partial fulfillment of requirements for Master's Degree of Science in Zoology with special paper parasitology.

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CERTIFICATE OF ACCEPTANCE

This thesis work submitted by Bigyan Thapa entitled **"A COMPARATIVE STUDY OF GASTROINTESTINAL PARASITES AMONG INTENSIVE, SEMI-INTENSIVE AND ABANDONED CATTLE IN KATHMANDU DISTRICT, NEPAL"** has been approved as a partial fulfillment for the requirements of Master's Degree of Science in Zoology with special paper parasitology.

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BIGYAN THAPA

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LIST OF ABBREVIATIONS

et al.	-	And his associates
GI	-	Gastrointestinal
i.e.	-	That is
P value	-	Probability value
Rpm	-	Revolutions per minute
sp.	-	Species
EPG	-	Egg per gram
OPG	-	Oocyst per gram
df	-	Degree of freedom
fig	-	Figure
Nacl	-	Sodium Chloride

ABSTRACT

Animals suffer from several infectious and non-infectious diseases especially that originate from parasites. To compare the gastrointestinal parasites between intensive, semi-intensive and abandoned cattle in Kathmandu district, a total of 300 dung samples were collected (100 from each three groups) and collected samples were preserved in airtight sterile vials containing 10% formalin solution and transported to the parasitology laboratory of Central Department of Zoology, Kirtipur and processed using direct and concentration method. Prevalence of gastrointestinal parasites of Kathmandu district is 53%, 61% and 72% in intensive, semi-intensive and abandoned cattle respectively. Sex wise prevalence of this study revealed 36.36% in male and 49.44% in female of intensive cattle and there was statistically not significant association (χ^2 = 0.627, df = 1, p-value = 0.592>0.05). The overall gastro-intestinal parasitic infection in semi-intensive cattle were 70.27% in male and 55.56% in female but there was statistically not significant association (χ^2 = 0.294, df = 1, p-value = 0.587>0.05). The overall gastro-intestinal parasitic infection in abandoned cattle were 73.68% in male and 69.76% in female and there was statistically not significant association (χ^2 =0.0003, df = 1, p-value = 0.986>0.05). Out of 10 calves, 17 heifers and 73 adults in intensive cattle, gastrointestinal parasitic infection was were 30.00%, 35.29% and 60.27% in calves, heifers and adult respectively and association of parasitic infection with age was not statically significant (χ^2 = 3.781, df = 5, p-value = 0.602>0.05). Similar result revealed by semi-intensive cattle from 16 calves, 23 heifers and 61 adult, among them gastrointestinal parasitic infection was 56.25%, 56.52% and 63.93% in calves, heifers and adult respectively and association of parasitic infection with age was not statically significant (χ^2 = 2.612, df = 5, p-value = 0.809>0.05). But in case of abandoned cattle, among 14 calves, 17 heifers and 69 adult, among them gastrointestinal parasitic infection was 8.33%, 27.78% and 63.89% in calves, heifers and adult respectively and results revealed the association of parasitic infection with age was statically significant (χ^2 = 12.562, df = 5, p-value = 0.02499<0.05). There was not statically significant relationship between local breeds and cross breeds of all three categories (P>0.05). Heavy intensity was found only in case of *Fascioloa* in all three categories. This study revealed that the abandoned cattle have high prevalence (72%) of gastrointestinal parasitic infections than others. GI parasites of Cow may get transmitted to other animal as well as man.

1. INTRODUCTION

1.1 Background of study

Gastrointestinal parasitic infection is one of the problems in case of livestock management and economic impact of GI parasites results in reduces growth and production, not only that it leads into condemnation of carcasses as well as high cost of drugs and veterinary care (Rajakaruna and Warnakulasooriya, 2011). Factors like diseases, genetic makeup, poor nutritional and management practices, environmental stress etc. are responsible for the low productivity of our livestock and parasitic infections, mainly those caused by helminthes are the major constraints for poor performance of our livestock (Yadav *et al.*, 2004).

In general, younger animals and animals under stress are most likely to show signs of parasitism such as rough coat, anemia, edema, and diarrhea and the subclinical effects including decreased milk production, reduction in weight gain, and low conception rate are of major economic importance to the producer (Perry and Randolph, 1999; Sahoo *et al.*, 2002). Om *et al.* (2010) confined, not only helminthic parasites are responsible for heavy loss of money, protozoan diseases are one of the major constraints in dairy farming development all over the world, particularly in developing countries. Anthelmintic and antiprotozoal agents have been used to control gastrointestinal parasitic infections in different domestic animals and human as well from the last ten decades (Gordon, 1935). Every case succeeded in reducing intestinal parasitic infections, but none has been able to completely diminish the reinfestation of diseases (Sutherland and Scott, 2010). Uses of large amount of anthelmintic drugs have resulted in a fear of anthelmintic residues in the milk and meat of livestock animals that may be harmful for user of such animals and their product (Familton *et al.*, 2001).

1.2 Factors of helminthes infections in cattle

The most important predisposing factors of helminthes infections are grazing habits, climate, nutritional deficiency, pasture management, immunological status, vector, presence of intermediate host, and the number of infective larvae and eggs in the environment (Radostits *et al.*, 1994; Kagira *et al.*, 2010; Adedipe *et al.*, 2014).

1.3 Gastrointestinal parasitic infections in cattle

Intestinal parasites are those parasites that can infect the gastro-intestinal tract of humans and other animals (Loukopoulos *et al.*, 2007).

Gastrointestinal parasitism is a world-wide problem (Regassa *et al.*, 2006). Parasites have the potential to severely reduce host growth, reproductive success and whole health condition. Favorable environmental condition i.e. temperature, humidity etc. play an important role for the growth of GI-parasites and grasslands are one of the main sources of gastrointestinal parasitic diseases to animals (Mondal *et al.*, 2000) from where parasites get transmitted to one another by fecal-oral route. The parasites of the digestive system like small intestine and large intestine as well as those of respiratory and circulatory system infest grazing animals (Taylor *et al*., 2007). Therefore, grazing land play important role to make animal healthy. Parasites and infectious diseases have become a major concern in conservation of endangered as well as other species as they can lead to mortality, dramatic population declines, and even contribute to local extinction events (Mir*et et al*., 2016).

Gastrointestinal parasites are categorized into worms (helminthes) and oocyst-forming protozoa known as coccidia. Nematodes, trematodes and cestodes are the three major types of parasitic helminthes of economic importance (Kusiluka and Kambarage, 1996).

Protozoa

The protozoan parasites are microscopic, unicellular organism which have complex internal structure and perform various complex metabolic activities such as digestion, reproduction, respiration, excretion, etc. and some protozoan parasites commonly found in intestine of herbivorous include *Eimeria* sp., *Entamoeba* sp., *Giardia* sp. (Haque, 2007). Sajid *et al.* (2011) reported nematodes in their research such as *Entamoeba* sp. and *Eimeria* sp. But Hossain *et al.* (2016) reported *Eimeria* sp. only in their study.

Nematodes

Gastrointestinal (GI) nematodes of the order Strongylida are the most common cause of clinical helminthosis, which is due to the presence and development of nematodes in the wall or the lumen of the abomasum, the small intestine and large intestine (Radostits *et al*., 2007). In addition, Harold (1982) suggested infection with gastrointestinal nematode parasites appears to be widespread in the cattle population. Therefore, gastrointestinal nematodes are ubiquitous parasitic agents of livestock especially ruminants and are

known to limit cattle production in many areas and countries (Larsson, 2006). Sajid *et al.*, (2011) reported nematodes in cattle such as *Strongyloide spapillosus, Trichuris, Haemonchus contortus, Nematodirus spathiger, Enterobius vermicularis, Dictyocaulus viviparous, Ostertagia ostertagi, Trichostrongylus colubriformis, Oesophagastomum radiatum.*

Trematodes

Trematodes commonly called as flukes, Freshwater snail are largely infested with trematode cercaria, majority of them being amphistoms and fascolid along with four other species (Devkota *et al.*, 2011). Fluke is one of the major causes of economic losses in farm animals, commonly found flukes being liver fluke and rumen fluke, *Fasciola hepatica* and *Fasciola gigantica* are the two main species responsible for most infections (Jaja *et al.*, 2017). Fascioliasis is a zoonotic disease that infects wide varieties of mammalian hosts all around the world (Cwiklinski *et al.*, 2016). Sajid *et al.* (2011) reported trematodes in their research such as *Fasciola hepatica, Fasciola gigantica, paramhistomum cervi, Dicrocoelium dendriticum, Fasciolopsis buski, Schistosoma* sp. and Hossain *et al.* (2016) reported *Fasciola* sp., *Dicrocoelium* sp., *Paramphistomum* sp. and *Schistosoma* sp.

Cestodes

Cestodes also called tapeworms that have a flat, ribbon-like body and live in the digestive system of their hosts. The body consist a head called scolex, followed by a neckpiece linear chain of segments called proglottids (or metamers). All the segments together form the strobila. The segments are flat and altogether the strobila looks like a tape, which is why they are called "tapeworms". They lack alimentary canal they don't need them because each proglottid absorbs what it needs directly through its tegument. They have a rudimentary nervous system. The proglottids of tapeworms increase in size from head to tail, i.e. the head is not in the widest but in the narrowest end of the body (Jeffrey and Leach, 1968). Sajid *et al.* (2011) reported cestodes in their research such as *Taenia* sp., *Moniezia expansa.* Hossain *et al.* (2016) reported *Moniezia* sp. only.

1.4 Objectives

1.4.1 General Objective

- To survey the gastrointestinal parasites of intensive, semi-intensive and abandoned cattle in Kathmandu district, Nepal

1.4.2 Specific objectives

- To determine the prevalence of gastrointestinal parasites in of intensive, semi-intensive and abandoned cattle separately
- To determine the intensity of parasitic infection in cattle
- To access the risk factors of parasitic infection in cattle

1.5 Rational of study

Many researches have been carried out regarding gastrointestinal parasites of cattle in almost every country. Basically, this work compares GI parasitic infection in three different categories of cattle according to the cattle management system. Comparative study helps to acquired knowledge about the GI parasites of intensive, semi-intensive and abandoned cattle of Kathmandu district. It may be useful for the policy making to prevent the transmission of GI parasites of cattle in the Kathmandu district. The parasitic infection is one of the problems causing morbidity and even mortality of animals and they may be responsible for transmission of parasites to the human being (Rajakaruna and Warnakulasooriya, 2011). Due to feeding habit and behavioural factors, cattle are infected with different kind of GI parasites. This study provides the reference for future researchers.

2. LITERATURE REVIEW

There are many published articles regarding gastrointestinal parasites of cattle but in case of comparison of gastro-intestinal parasitic infection of cattle, few research articles have been published. Gastrointestinal parasites like coccidian, ascarid, strongyle, Setaria, and amphistomes were documented in countries with tropical and temperate climatic conditions such as Nepal, India, Bangladesh, South Africa, Sri Lanka, Italy, and Mongolia, with a prevalence rate ranging from 20 to 96% (Sharma *et al.,* 2009; Hassan *et al.,* 2011; Gebeyehu *et al.,* 2013). Prevalence in different geological condition according to their feeding habit is described:

2.1 General prevalence of gastrointestinal parasites in intensive cattle

A total of 309 (different ages, sex and breed) faecal samples were examined from two institutional farms located in the Coastal Savanna and Transitional zones of Southern Ghana, the cattle showed a very high prevalence (95.5%) of parasite infections among them 75.1% had multiple parasites while 20.4% had a single parasite infection and prevalence of *Strongyles* (63.1%) was highest followed by *Fasciola* (51.1%), *Dicrocoelium* (39.8%), *Eimeria* (29.4%), *Paramphistomum* (25.9%), *Schistosoma* (21.7%), *Ascaris* (6.1%) and then *Moniezia* (2.3%); *Strongyles, Ascaris, Moniezia* and *Eimeria* infections were significantly higher ($p<0.05$) in the calves while *Fasciola*, *Paramphistomum*, and *Schistosoma* infecitions were higher ($p<0.005$) in the adults, result revealed, low intensity (<500EPG / <10EPC) of infection and there was wide range of nematodes, cestode and protozoa egg counts (0-47200 OPG, 0-40200 EPG and 0-246000 EPG, respectively) and the range of trematodes egg count was 0-52EPC (Squire *et al.*, 2019). A total 5400 fecal samples from animals of different farms in Bangladesh were examined for gastro-intestinal nematodiasis, out of 5400 fecal samples 75.46% (n=4075), the results revealed seven groups of nematodes were prevalent during the study period including *strongyles* sp. (65.87%), *Trichuris* sp. (8.76%), *Staphanofilaria* sp. (5.70%), *Capillaria* sp. (5.25%), *Strongyloides* sp. (5.15%), *Thelazia* sp. (5.08%) and *Ascaris* sp. (4.32%) (Hossain *et al.*, 2016).

Rashid *et al.* (2015) conducted a survey on gastrointestinal parasitic infections in Brahman crossbred cattle, reared at Savar Dairy Farm (on-station) and at farmers' house (on-farm), was conducted in winter and rainy season, a total of 230 fecal samples examined; 84.8% (n=195) of them were found positive for parasitic infections, and mean

egg per gram of feces (EPG) was 426.2±23.8 and the result revealed that the higher prevalence of *Balantidium coli* (59.1%), *Paramphistomum* sp. (18.3%), *Eimeria* sp. (7.83%), *Strongyloides* sp. (7.39%), *Haemonchus* sp. (6.96%), *Trichuris* sp. (5.65%), *Fasciola gigantica* (3.91%), *Capillaria* sp. (2.17%) and *Moniezia* sp. (2.17%) and higher infection with Paramphistomum sp. While lower infection with *B. coli* and *Trichuris* sp. were found in adult cattle than in the yearlings and calves, although higher rate of infections was recorded in females (87.8%) than in the males (81.7%).

Another study on Prevalence of gastrointestinal parasitic infection and assessment of deworming program among Cattle and Buffaloes in Gumpaha District, Sri Lanka was carried out during March 2017 to December 2017, a total of 45 farms rearing cattle were selected randomly. Out of 163 faecal samples of cattle (n=147) and buffaloes (n=16), only 11.56% (n=21) Cows were positive for gastrointestinal parasitic infections and GI parasite prevalence in males was higher when compared to that of females, but the diference was non signifcant (P >0.05) (Gunathilaka *et al.,* 2018). The studies were carried out in five farms of Western Pomerania, on 84 calves and 153 Cows and in Cows, the overall prevalence was Eimeria sp. ranged from 5.5 to 23.4%, gastro-intestinal nematodes ranged from 12.7 to 42.6%. In calves, the overall prevalence Eimeria sp. was ranged from 10.0 to 36.8% oocysts and Cryptosporidium sp. 22.8% (Pilarczyk *et al*., 2009). Renwal *et al.* (2017) collected 715 faecal samples from dairy animals of eight tehsils of Bikaner district, Rajasthan that revealed overall prevalence rate of 54.12 % was recorded for gastrointestinal helminthoses with highly statistical difference among dairy animals ($p < 0.01$) and quantitative analysis revealed mild to high severity of *strongyle* sp. and *Strongyloides* sp. infections in cattle population, respectively whereas, mild severities of same infections were reported from the buffalo population of the region while on coproculture of positive samples, the nematode infections in decreasing order of prevalence were *Haemonchus* sp. (36.33 %); *Oesophagostomum* sp. (26.33 %); *Strongyloides* sp. (13.67 %); *Trichostrongylus* sp. (11.67 %); *Bunostomum* sp. (7.33 %) and *Cooperia* sp. (4.67 %).

A total of 708 faecal samples were examined with parasitological routine methods, results revealed *Fasciola hepatica*, gastrointestinal nematodes, *Eimeria* sp., *Moniezia* sp. and *Dictyocaulus viviparus* as the most frequent findings (Gillandt *et al.,* 2018). The study was conducted in four parts of Thailand, a total of 1,599 fecal samples were collected and subjected to ethyl-acetate centrifugation to identify the stages of any parasites, the result

revealed overall prevalence of parasitic infection was 46.6 % (745/ 1599), Cows aged between 1 to 5 year had the highest infection rate (51.4 %), Cows older than 5 years and younger than 1 year had rates of 41.8 and 33.8 %, respectively (Jittapalapong *et al.*, 2011). A total of 1259 rectal fecal samples were collected from Holstein dairy cattle at 94 farms in 13 counties in Taiwan, result revealed overall prevalence of gastrointestinal parasitic infection was 86.9% in which the infection rates of protozoa, nematodes, trematodes, and cestodes were 81.3%, 7.9%, 1.6%, and 0.6%, respectively. Among all parasites, *Buxtonella sulcata* (61.7%) was the most predominant one, followed with *Cryptosporidium* sp. (32.6%) and *Eimeria* sp. (11.8%) and there were significant differences in the prevalence of protozoa and nematodes between different age groups and distributional area groups (Huang *et al.*, 2014).

35 fecal samples of calves were collected from District Dairy Farm, Sylhet of Bangladesh. Fecal samples of two different genotypes were examined and the results of the fecal examination revealed that 57.14% calves were infected with some of the parasites, among them highest prevalence of parasitic infestation was by *Oesophagostomum radiatum* (25.71%) followed by *Trichuristrichuris* (20.00%), *Toxocara vitulorum* (14.29%), *Haemonchus contortus* (11.43%), *Moniezia expansa* and *Fasciola gigantica* (8.57%) and infestation with *Trichostrongylus axei, Strongyloides papillosus, Moniezia benedeni* and Bunostomum phlebotomum was the lowest (2.86%) (Kabir *et al.*, 2018). Another study in cattle at Parasitology Division of the Veterinary Research Institute, Khyber Pakhtun Khwa, Peshawar included a total of 4490 fecal samples of cattle of different breeds consisting of 3731 (83.09%) females and 759 (16.91%) males were examined and fecal examination revealed an overall prevalence of 2901 (64.61%), while the prevalence in females and males were 2411 (83.10%) and 490 (16.90%), respectively. Out of 2901 gastrointestinal parasites encountered 2209 (76.15%) were helminthes and 395 (13.62%) were protozoan parasites and 297 showed mixed infestation (Sajid *et al.*, 2011).

Out of 676 faecal samples examined, 191 (28.25%) faecal samples were found positive for gastrointestinal parasitic infections in which the eggs of *Strongyle* sp. were found predominant (65.96 %) followed by *Strongyloides* sp. (25.13%), *Eimeria* sp. (17.80%), *Trichuris* sp. (13.08%), *Moniezia* sp. (10.47%) and *Nematodirus* sp.(2.61%) and the eggs per gram of faeces in case of nematode parasites were ranged between 50 to 4000 and in case of coccidian infections the range of oocysts per gram of faeces (OPG) was between

50 to 1400 (Laha *et al.*, 2013). The pathologically important genera of worms all belong to the family Trichostrongylidae and the most pathogenic species is *Ostertagia ostertagi*, which can produce profound changes in abomasal mucosa of affected animals (Harold, 1982).

2.2 General prevalence of gastrointestinal parasites in semi-intensive cattle

A total of 3597 fecal samples of cattle (2339) and buffaloes (1258) were examined for presence of parasitic infections that revealed an overall prevalence of 58.35% and 29.80% infections in cattle and buffalo, respectively. In cattle, *Strongyle* sp. (18.76%) was predominant followed by *Eimeria* sp. (11.97%), *Amphistome* sp. (8.72%), *Strongyloides sp.* (3.76%), *Moniezia* sp. (2.65%), *Toxocara vitulorum* (1.32%), Buxtonella sulcata (0.81%), *Trichuris* sp. (0.72%), *Fasciola gigantica* (0.47%) and *Bunostomum* sp. whereas mixed infections with more than one species were recorded in 8.76% in cattle. The egg per gram (EPG) of feces in cattle was 582.44±8.13 (Das *et al.*, 2017). Shirale *et al.* (2008) reported 66.29% prevalence, among all, 62.29% had single and 6.00% had mixed infection of *Haemonchus* sp. and *Trichris* sp. and nematodes infection were higher followed by cestodes and trematodes.

Study carried out from November 2008 to May 2009, to assess the prevalence and monthly distribution of helminthes parasites of cattle in Gedebano Gutazer Wolene district, Southern Ethiopia, a total of 406 faecal samples were collected. Result revealed an overall prevalence of 39.6%, the highest prevalence was recorded for *Strongyles* 39.6% (n=161) followed by *Toxocara* sp. 922.4%), *Fasciola* sp. (16.1%), *Trichuris* sp. (13.7%) and *Paramphistomum* sp. (9.9%) and intensity of *Strongyle* infection in terms of egg per gram (EPG) showed no variations in different age group and sex, out of 61 *Strongyle* egg type positive cattle, 14 (22.95%) were massively, 29 (47.55%) moderately and 18 (29.50%) were lightly affected (Kemal and Terefe, 2013).A total 384 fecal samples of cattle from different districts of west Arsi zone (Arsi-negele, Shashemene and Kofele) were collected and examined for incidence of gastrointestinal nematodes and coccidial infestation and results 188 (49%) animals were positive for gastro-intestinal nematodes and coccidian; and out of these positive animals 109 (57.97%) were infested with single genera of gastro-intestinal nematodes and coccidian, which include: *Ostertagia* sp. 7 (1.8%), *Oesophagostomum* sp. 5 (1.3%), *strongloid* sp. 10 (2.6%), *Emeria* sp. 11 (2.9%), *Trychostrongylus* sp.14 (3.6%), *Hemonchus* sp. 45 (11.7%), *Bunostomum* sp. 17 (4.4%) and the rest 79 (42.02%) animals were infested with mixed

genera of gastro-intestinal nematodes. These include *Oesophagostomum* sp. with *Trychostrongylus* sp. 37 (9.6%), *Ostertagia* sp. with *Hemonchus* sp. 15 (3.9%), *Trychostrongylus* sp. with *Hemonchus* sp. 17 (4.4%) and *Strongloid* sp. with *Bunostomum* sp. 10 (2.6%). The prevalence of gastro-intestinal nematodes and coccidia was higher in adult and young animals as compared with calves, higher prevalence were also seen were communal grazing and watering areas are common (Bacha and Haftu, 2014).

Shrestha and Bindari (2013) conducted research in 52 fecal samples of Chauries from Gumdel VDC of Ramechhap district and result revealed 47 (90.38%) samples were found positive in which the mode of infection was either mixed (57.44%) or single (42.55%), among the gastrointestinal parasites, *Strongyle* (52%) showed the highest infection followed by *Eimeria* (23.07%), *Ascaris* (19.23%), *Trichuris* (11.53%), and *Amphistomum* (5.76%).

The study was conducted to determine the prevalence and burden of gastrointestinal (GI) parasites in cattle and buffaloes of Jabalpur, Madhya Pradesh. Out of 120 (76 cattle and 44 buffaloes) examined, 73.33% were found positive for eggs of one or more species of GI parasite. The prevalence of parasitic infection was higher in cattle (75%) as compared to that of buffaloes (70.45%), but the difference was non-significant ($p>0.05$) and Sex wise prevalence of GI parasites was higher in males as compared to that of females, but the difference was non-significant ($p>0.05$). The animals above 2 years of age were more affected by GI parasites as compared to animals of 6 months - 2 years of age, but the age wise differences were non-significant ($p>0.05$). *Strongyle* sp. (51.32%) was predominant followed by, *Eimeria* sp. (27.64%), *Moniezia* sp. (7.90%), *Amphistome* sp. (5.27%), *Fasciola gigantica* (6.58%), *Strongyloides* sp. (2.64%), *Toxocara vitulorum* (2.64%) and *Trichuris* sp. (1.32 among them single parasitic infections were more common than mixed infections. The eggs/oocysts per gram in most of the animals, was in the range of 201-300 (Markole *et al.*, 2016).

A total of 200 faecal samples comprising of 100 samples each from cattle and buffaloes from different locations of Bikaner, Rajasthan, India were analyzed to confirm the presence of gastrointestinal parasitic infection. 24 (12.00%) samples were found positive for *strongyle* eggs, only 11% cattle and 13% buffaloes were found to be positive for gastrointestinal helminthosis. The prevalence in cattle varied from 9.09 to 12.50 in different locations. The estimation of EPG count for *Strongyle* species in cattle were range between 200-1000, with an average of 504.00+245.41. This range was 200-1400

with an average of 684.61±350.82 in buffaloes (Wadhwa *et al.,* 2011). Coprological examination of 416, cattle (n = 302)and buffalo (n = 114) faecal samples revealed the about 42% (n = 127) faecal samples from cattle and 36% (n = 41) samples from buffaloes were positive for gastrointestinal (GI) parasitic infections. Non descriptive breeds of bovines showed more parasitic infections than pure breeds, the difference being statistically non-significant ($p > 0.05$) and sex wise females recorded higher infection rates than males in bovines and the difference being statistically non-significant ($p > 0.05$) (Maharana *et al.,* 2016).

A prospective study was done in western Chitwan, Bharatpur Metropolitan City in a total of 100 animals kept for dairy purpose were randomly selected from two different villages in two different seasons-summer and winter to describe the seasonal prevalence of fluke infestation in dairy cattle and buffalo and result revealed the prevalence of fluke infestation was found to be higher in the summer (26%) than in winter (22%), similarly, among cattle Jersey cross (39.5%) showed the highest infestation of flukes among the breeds followed by Jersey (12.5%), out of 38 calf, 7 heifer and 55 mother the faecal examination for fluke egg was positive 26.3% of calves, 28.6% of heifers and 21.8% of mothers respectively and out of 43 buffalo and 57 cattle the parasitic infestation was found in 18.6% and 28.1% of sample respectively (Bista *et al.,* 2018).

Adhikari *et al.* (2013) conducted research in which fecal samples were collected arbitrarily from 45 water buffaloes and 66 cows at four villages in Chitwan Valley and *Buxtonella sulcata* cysts were detected in 12 of the 45 samples (27%) from water buffaloes and 14 of the 66 samples (21 %) from Cows, simultaneously, Eimerian oocysts, nematode eggs of strongylids, *Trichuris* and Capillariinae, and trematode eggs of *Fasciola* and Amphistomes were found; however, their prevalences were relatively low (0-ll %) except for Eimerian oocysts (47% and 33% for buffaloes and Cows, respectively).

Study assessed the prevalence of gastrointestinal parasites in cattle presented for slaughter in abattoirs and compared with that of Teaching and Research farm of Federal University of Agriculture in which faeces were randomly collected from 205 cattle, result revealed that prevalence of gastrointestinal parasites was 95.12%, helminthes had lower prevalence of 44.39% (91) compared to coccidial oocysts, 95.12% (195) and study shows prevalence of 32.68%, 11.22% and 0.49% for nematode, trematode and cestodes, respectively. Analysis revealed significant ($p<0.05$) difference between the prevalence of nematodes

and trematode as well as the mean faecal egg count of the cattle sampled in the abattoir and the University farm and they concluded, gastrointestinal parasites are prevalent in cattle in the study area with *Eimeria* sp. being most prevalent (Takeet *et al.*, 2016). A total of 310 fecal samples of yellow cattle were collected in Taiwan and its offshore islands Penghu and Kinmen for gastrointestinal parasite examination using coprological techniques, the result revealed that the overall prevalence was 73.2% and the infection rates of protozoa, nematodes, trematodes, and cestodes were 57.7%, 37.7%, 17.1%, and 0.6%, respectively, in which *Cryptosporidium* sp. (41.6%) were the most predominant, followed by strongyles (36.1%) and *Eimeria* sp. (11.9%) and the results indicate that superior management systems and regular anthelmintic treatments should be performed for the control of parasitic infections on yellow-cattle farms (Tung *et al.*, 2012).

Akanda *et al.*, (2014) conducted a survey to determine the prevalence of gastrointestinal parasitism in crossbred and local cattle, Sylhet division, Bangladesh; fecal samples were collected randomly from 288 local and 144 crossbred cattle of four representative areas in three seasons and the result revealed incident of gastrointestinal parasitic infections was more frequent in rainy season followed by summer and winter in which higher prevalence of *Paramphistomum* sp. (20.53%) was found in rainy season whereas *Haemonchus* sp. (5.46%) and *Moniezia* sp. (4.18%) were higher in summer ($P<0.05$); *Paramphistomum* sp. infections were more recurrent in adult while *Toxocara* sp. were largest in calf ($P<0.05$) and prevalence of *Haemonchus* sp. (4.56%) infections was significantly higher in local adult cattle whereas *Trichostrongylus* sp. (4.41%) infections were largest in local young cattle ($P<0.05$). A total of 1,508 faecal samples from various breed of domestic animals viz: cattle, sheep, dogs, pigs, horses, rabbits and goats were carefully examined using formal ether concentration technique; out of the 556 cattle faeces examined, 480(31.8%) were infected and positive for multiple helminthic infection, Strongyle-like eggs (43.2%) and *Eimeria* bovis (13.3%) *Moniezia* worms (0.5%) and they concluded gastrointestinal parasites and their eggs are still endemic in the study area which is indicative of a neglect of simple management practices which has a negative impact on Livestock production in Nigeria (Dogo *et al.*, 2017).A comparative study in cattle and sheep from three municipalities in the Colombian Northeastern Mountain was conducted by taking 200 fecal samples directly from the rectum in cattle and sheep and the result revealed the global prevalence of GI parasites was 56.3% while the prevalence by municipalities, there was no statistical association ($p>0.05$), the prevalence of parasitic infection was higher in

sheep (63%) as compared to that of cattle (50.5%), but the difference was non-significant ($p>0.05$) (Pinilla *et al.*, 2019).

In grazing ruminants (277 cattle, 104 sheep and 94 goats) of Jakiri, Bui Division, North West Region of Cameroon, the least prevalence among all was observed in cattle (56.7%) and concerning the various management techniques, prevalence of GIT parasites were higher in tethered animals (88.1%) followed by free range grazing animals (60.9%) in which *Eimeria* sp. recorded the highest prevalence (20.9%) among the various species of parasites encountered during the study in cattle, Mixed infections of *Trichostrongylus* sp., *Eimeria* sp. and *Haemonhus* sp. were most prevalent in all the animal species (Ntonifor *et al.*, 2013).

A total of 143 fecal samples were collected from different cattle herds randomly without treatment anthelmintic drugs, results revealed 63% of the cattle examined were found positive with one or more parasite species in which *Eimeria* sp. are predominant (43.87%) followed by *Strongylus* sp. (30.32%), *Fasciola hepatica* (12.25%), *Toxocara vitulorum* (6.45%), *Moniezia benedeni* (1.93%), *Paramphistomum daubneyi* (1.93%) and *Strongyloides papillosus* (1.29%) and as for the body condition score, there is a statically significant ($P< 0.01$) difference between the prevalence rate of GI parasite and the nutritional status of cattle (Moussouni *et al.*, 2018).A total of 1413 faecal samples of cattle and buffaloes were examined of which 68.93% were found positive for various gastrointestinal parasites and the prevalence was found higher in buffaloes (73%) as compared to cattle (65%), result revealed in cattle; strongyle infection (43%) was most prevalent followed by coccidia (24.25%), *Amphistomes* (17.59%), *Trichuris* sp. (5.96%), *Fasciola* sp. (0.99%), *Toxocara* sp. (0.43%), *Strongyloides* sp. (0.28%) and *Moniezia* sp. (0.28%) (Gupta *et al.*, 2012).

2.3 General prevalence of gastrointestinal parasites in abandoned cattle

Very few research articles have been published regarding gastrointestinal parasites of abandoned cattle. Prevalence of gastrointestinal parasites is ranging from 20 to 96% (Sharma *et al.*, 2009).

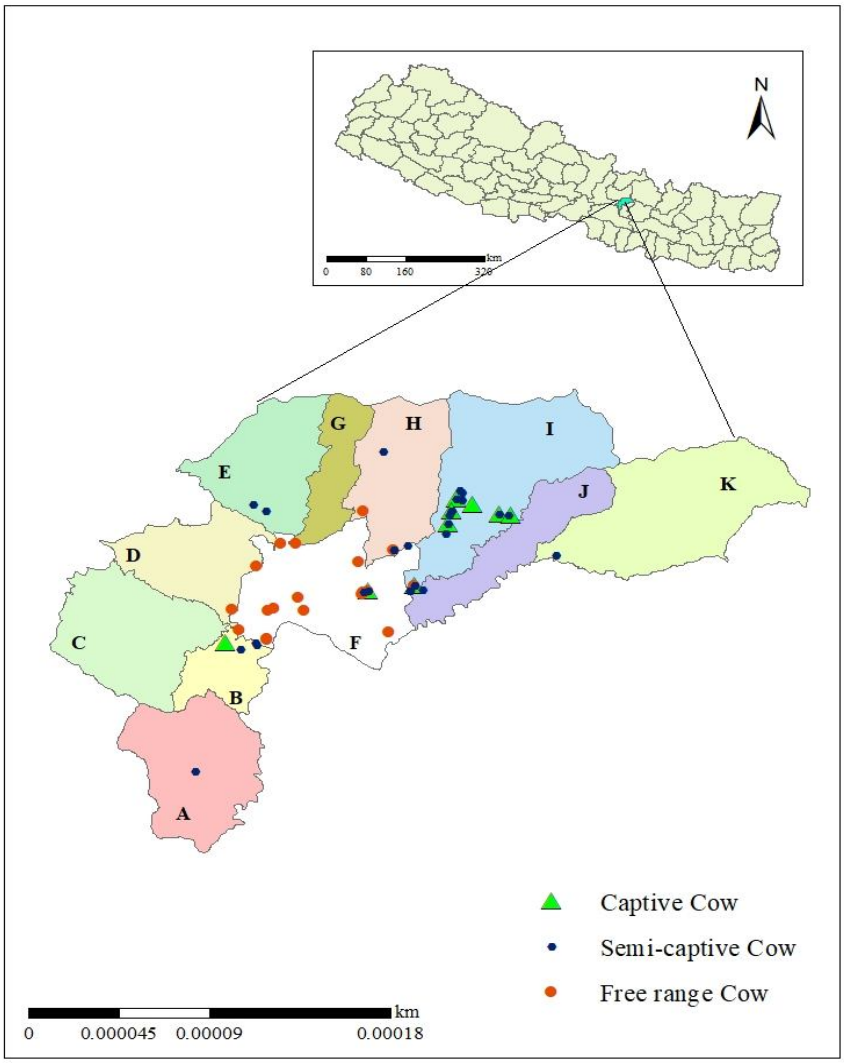
Fecal samples from 500 dogs and 300 cats from an animal refuge in Nakhon Nayok Province, Thailand to test for gastrointestinal protozoa and helminths using a formalin-ether concentration technique. The overall prevalence of parasites in stool from dogs was 36.2% (181/500), 35.7% (177/500) had helminths and 2.8% (14/500) had protozoa. The

helminths were: hookworm (30.6%), *Trichuris vulpis* (16.0%), *Toxocara canis* (6.6%), *Hymenolepis diminuta* (1.2%), *Spirometra mansoni* (0.6%), and *Dipylidium caninum* (0.2%). *Giardia duodenalis* (2.8%) was found in the stool of dogs. The overall prevalence of parasites in stool from cats was 44.3% (133/300), 43.3% (130/300) were helminths and 6.0% (18/300) were protozoa. The helminths were hookworm (34.7%), *T. cati* (9.7%), *S. mansoni* (4.0%), *Platynosomum fastosum* (2.7%), *Strongyloides* sp. (0.7%), and *Echinostoma* sp. (0.3%). Two species of protozoa, *Isospora* sp. (5.7%) and *G. duodenalis* (0.3%) were found in the stool of cats. Two percent of dogs and 5.0% of cats had mixed protozoan and helminthic infections (Rojekittikhun *et al*., 2014).

3. MATERIALS AND METHODS

3.1 Study area

Kathmndu district is located in Kathmandu valley, Province number 3 of Nepal. Among 77 district of Nepal, it is one of the district covers an area of 395 km^2 (Total area of Nepal is 147,181 km^2). According to National population and housing census, 2011, it is most densely populated district with 1,744,240 inhabitants. The district is located from 27°27′E to F 27°49′E longitude and 85°10′N to 85°32′N latitude.



A= Dakshinkali Na.Pa., B= Kirtipur Na.Pa., C= Chandragiri Na.Pa., D= Nagarjun Na.Pa., E= Tarakeshwor Na.Pa., F= Kathmandu Ma.Na.Pa., G= Tokha Na.Pa., H= Budhanilkantha Na.Pa., I= Gokarneshwor Na.Pa., J= Kageswori Na.Pa, K= Shankharapur

Fig. 1: Map of Kathmandu district with indication of sample collection

3.2 Study design

This study was designated to assess the gastrointestinal parasitic infection in Cow of Kathmandu district. The study comprises:

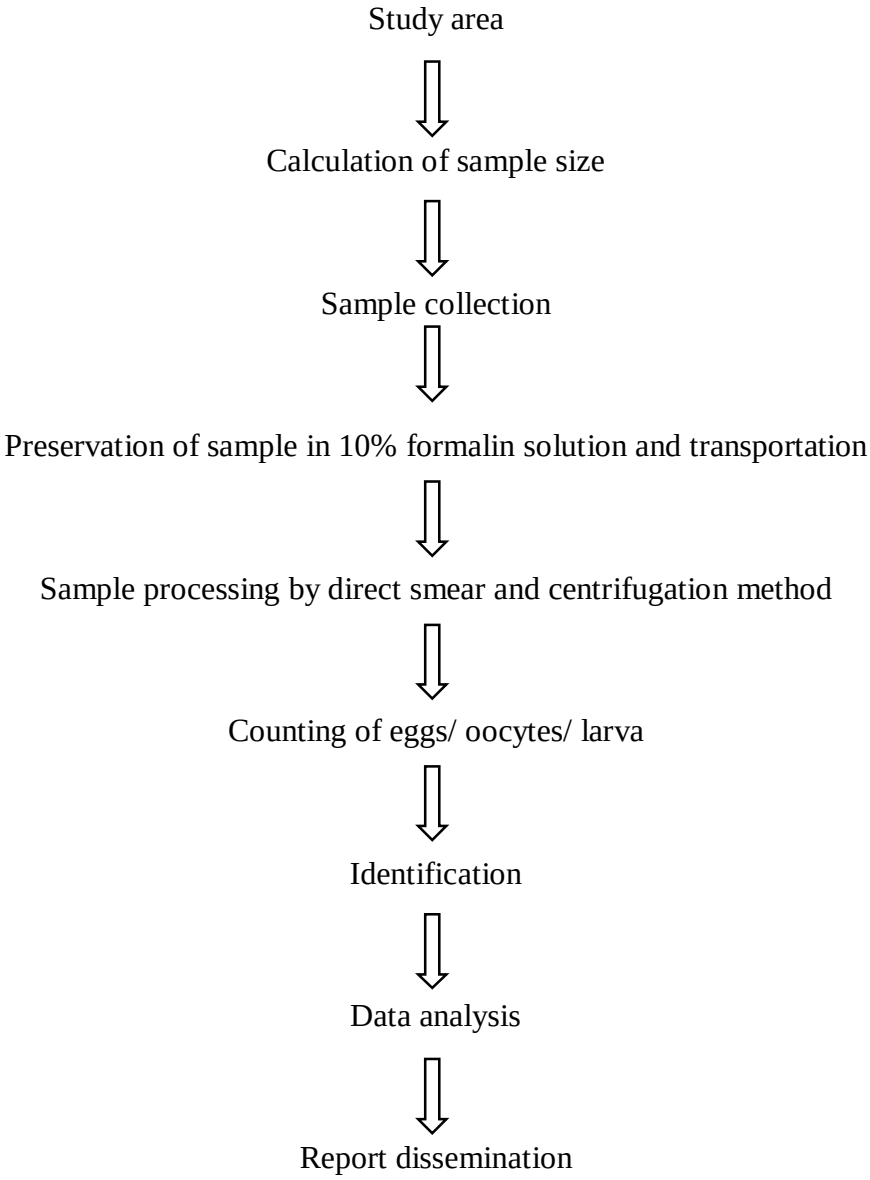


Fig. 2: Flowchart showing study design

3.3 Materials used

3.3.1 Equipments

I. Compound microscope

II. Ocular micrometer

III. Centrifuge machine

IV. Centrifuge tubes

V. Volumetric flask

VI. Beaker

VII. Gloves

VIII. Slides

IX. Cover slips

X. Glass rod

XI. Cotton

XII. Tea Strainer

XIII. Watch glass

XIV. Dropper

XV. Tooth picks

XVI. Test tube holder

XVII. Mask

XVIII. Vials

XIX. Pistle

XX. Weighing machine

XXI. Camera

3.3.2 Chemicals

I. 10% Formalin solution

II. Logule's Iodine solution

III. Methylene blue

IV. Nacl Solution

V. Distilled water

3.4 Duration of study

Preliminary survey was conducted in 19th January, 2019 to compare the gastrointestinal parasitic infection among intensive, semi-intensive and abandoned cattle in Kathmandu district. 300 dung samples were collected during 15th March, 2019 to 20th April, 2019 for laboratory investigation.

3.5 Sample size

The minimum sample size for this study was determined by using Thrusfield formula for sample determination.

$$n = \frac{Z^2(Pexp)(1 - Pexp)}{d^2}$$

Where,

n= required sample size

Z= Confidence level, its value is 1.96 at 95% level of confidence

Pexp= expected prevalence of GI parasites (50%)

d= desired absolute precision level at 95% confidence level

According to Thrusfield formula, a minimum sample for this study was 96.04. So 100 samples for each of three categories (n= 300) were collected.

3.6 Sampling and sampling techniques

Cross section study was done for the purpose. A total of 300 samples were collected from different part of Kathmandu district randomly. The Animals were grouped as

Calf: 0-1 years old

Heifer: 1-3 years old

Adult: >3 years old

3.7 Sample collection

Dung samples of cattle were collected directly from rectum by randomly selected animals, by using new unused glove and kept in a sterile vial and coded by ID number of animals from which the sample was taken. About 10gm of sample was collected from each cattle. Although sample collection from abandoned cattle were done with the help of sterile spatula, only upper surface of dung was taken avoiding to touch with soil surface so that it prevents contamination of cattle dung with soil. Abandoned cattle were marked by the permanent marker after the collection of sample.

3.8 Preservation of dung sample

After collection, the samples were preserved in 10% formalin solution immediately, so that it helps in maintaining morphology of protozoan parasites and preventing further development of helminthes egg and larva.

3.9 Questionnaire survey

Questioners were taken with the owner of intensive cattle and semi-intensive cattle at the time of sample collection. One questionnaire survey represented one farm or one shed. But in case of abandoned cattle, questionnaire survey was done with people of that area where cattle were frequently found with regular follow up. Regular observation was done with the interval of three days up to 15 days for abandoned cattle to confirm their feeding habit, sources of water and area they visit. 67 questionnaires have been done (7 from intensive cattle, 40 from semi-intensive cattle and 20 from abandoned cattle).

3.10 Laboratory examination

The collected samples were brought to the Central Department of Zoology, Kirtipur, Kathmandu for laboratory test. The samples were examined by iodine wet mount method and concentration technique (flotation and sedimentation).

3.10.1 Iodine wet mount

One tooth pick of dung samples were added in a drop of Logule's iodine solution on clean glass slide then covered by cover slip. The smear was examined under compound microscope at 10X and 40X (Soulsby, 1968).

3.10.2 Concentration techniques

Eggs, Cysts and trophozoites are difficult to be detected in direct smears or mount. So floatation and sedimentation techniques (Soulsby, 1982; Zajac and Conboy, 2012) have been carried out.

3.10.2.1 Flotation technique

This technique ensures the nematode and cestode eggs float in liquid as well as protozoan cyst present in Cow dung. Two gram of samples was put in beaker and 10 ml of distilled water was added. The sample was grinded lightly with help of pistle and the solution was filtered by tea strainer. The filtrate solution was poured into the centrifuge tube of 15 ml and centrifuged at 2000 rpm for five minutes. The tube's water was replaced by saturated Nacl solution and again centrifuged.

After centrifuged, more saturated Nacl solution was added to develop convex meniscus at the top of the tube and one drop of methylene blue was also added to stain. A cover slip was placed for five minutes then removed from tube, placed on glass slide and examined under electric microscope at 10X and 40X. The photographs of eggs and cysts of parasites were taken and identified on the basis of shape, shell and size (Soulsby, 1982; Zajac and Conboy, 2012).

3.10.2.2 Sedimentation technique

This technique is used for detection of trematode eggs. It provides a better result because the eggs of trematode are heavier than other. About 1gm of dung was taken in glass pestle and a little quantity of distilled water was added and mixed properly. Suspension was strained to remove the debris and poured into a centrifuge tube up to 2cm below the brim. Then centrifuge tubes were kept in centrifuge machine and centrifuged at 2000

revolutions per minute (rpm) for 5 minutes. The supernatant was discarded and Iodine wet mount was prepared for each sample by mixing 1-2 drops of the sediments with Lugule's iodine solution in a glass slide and examined under microscope by covering with cover slip. The presence of eggs was identified by their morphological characteristics (Bowman, 1999).

3.10.3 Eggs and cysts size measurement

Eggs and cysts size were measured by using micrometry. The calibration factor was found to be 2.588 in this study.

3.10.4 Egg and cysts identification

Prepared slides were examined under microscope under 10X and 40X respectively. Size of eggs/oocysts/cysts was measured using ocular micrometer. The eggs, cysts and larva were identified by comparing the structure, color and size of eggs, cysts and larva of published articles, journals and books (Soulsby, 1982; Taylor *et al.*, 2007; Hussam, 2015).

3.11 Intensity calculation of GI parasites

Intensity of gastro-intestinal parasites was calculated depending on the number of eggs/oocysts and larvae found per gram.

Light infection= <2 eggs/oocysts/larvae per gram

Mild infection= 2-4 eggs/oocysts/larvae per gram

Moderate infection= 4-6 eggs/oocysts/larvae per gram

Heavy infection= > 6 eggs/oocysts/larvae per gram

3.12 Data analysis

The data were analyzed by using MS-Excel 2010 and statistical analysis was performed using "R", version 3.5.2 software package with chi-squared test. In all cases 95% confidence interval (CI) and $P<0.05$ was considered for statistically significant association.

4. RESULT

4.1 General prevalence of GI parasites of intensive, semi-intensive and abandoned cattle

Altogether 300 dung samples were examined in which each of three categories include 100 samples. There was not statically significant relationship between intensive and semi-intensive cattle (χ^2 =0.561, df = 1, P-value = 0.454>0.05). Similarly, there was not statically significant relationship between semi-intensive and abandoned cattle (χ^2 =0.091, df = 1, P-value = 0.340>0.05). But there was slight statically significant relationship between intensive cattle and abandoned cattle (χ^2 =2.888, df = 1, P-value = 0.089>0.05) (fig. 3).

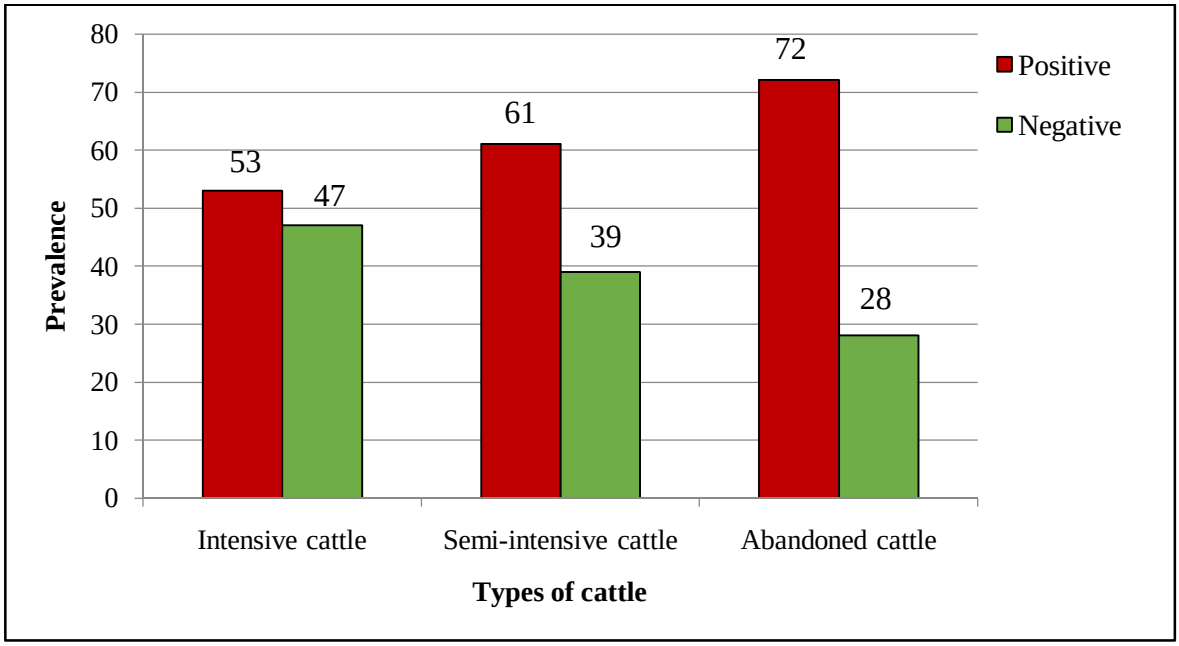


Fig. 3: General prevalence of GI parasites of intensive, semi-intensive and abandoned cattle

4.2 Prevalence according to sex of intensive, semi-intensive and abandoned cattle

4.2.1 Sex-wise prevalence in intensive cattle

Out of 100 samples, The overall gastro-intestinal parasitic infection was 4 (36.36%) in male and 44 (49.44%) in female. The result revealed that the parasitic infection was higher in female than male (Fig. 4). There was statistically not significant association between male and female GI parasitic infection (χ^2 = 0.627, df = 1, p-value = 0.592>0.05).

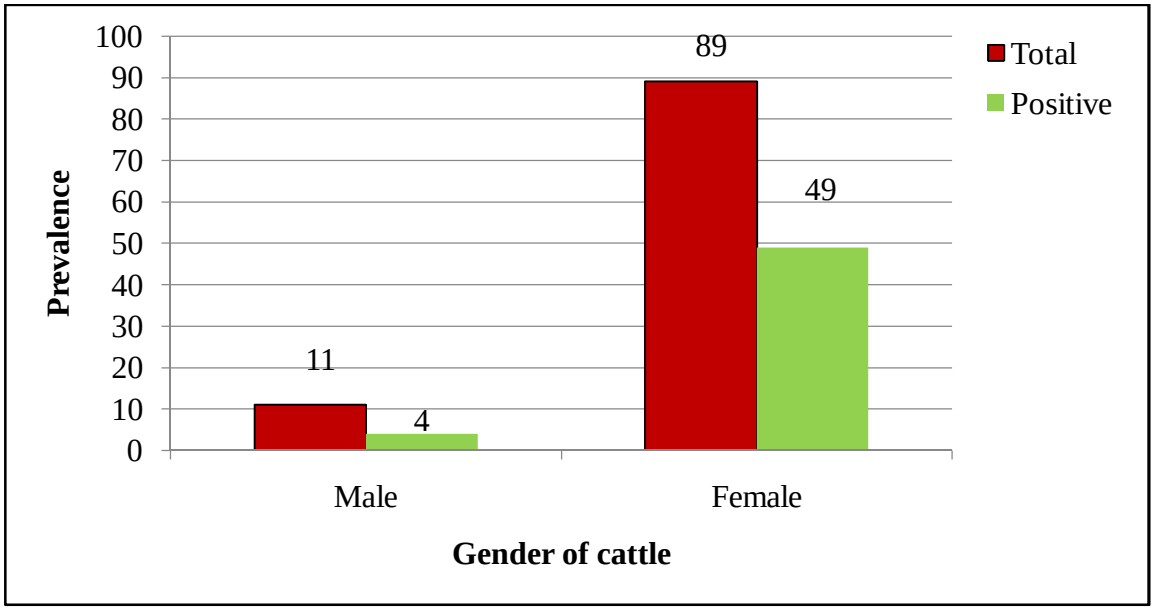


Fig. 4: Prevalence of GI parasites according to sex of intensive cattle

4.2.2 Sex-wise prevalence in semi-intensive cattle

The overall gastro-intestinal parasitic infection was 26 (70.27%) in male and 35 (55.56%) in female. The result revealed that the parasitic infection was higher in male than female (Fig.5) but there was statistically not significant association between male and female GI parasitic infection ($\chi^2 = 0.294$, df = 1, p-value = 0.587>0.05).

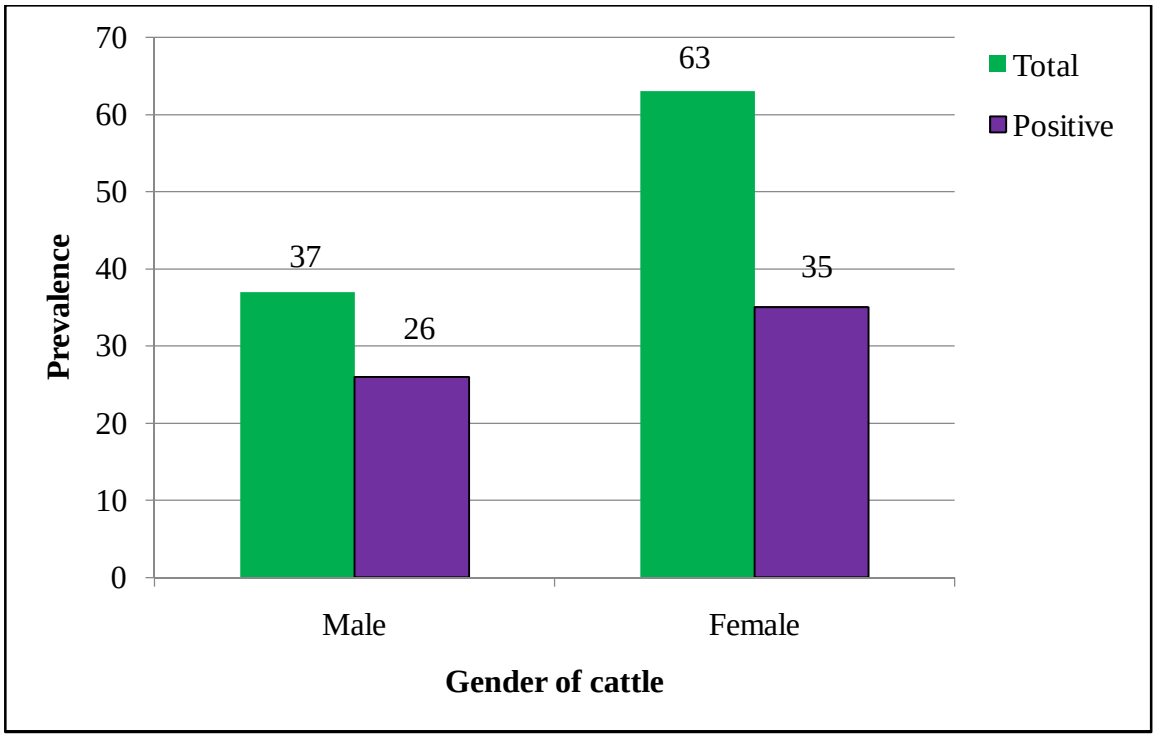


Fig. 5: Prevalence of GI parasites according to sex of semi-intensive cattle

4.2.3 Sex-wise prevalence in abandoned cattle

The overall gastro-intestinal parasitic infection was 42 (73.68%) in male and 30 (69.76%) in female. The result revealed that the parasitic infection was higher in female than male (Fig. 6) but there was statistically not significant association between male and female GI parasitic infection (χ^2 =0.0003, df = 1, p-value = 0.986>0.05).

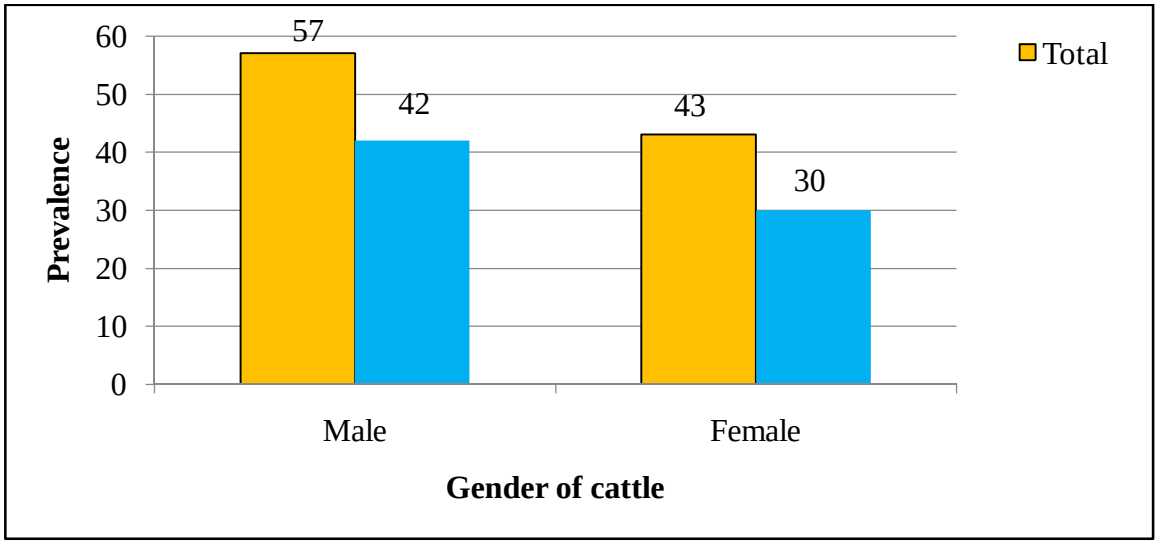


Fig. 6: Prevalence of GI parasites according to sex of abandoned cattle

4.3 Prevalence within different age group of intensive, semi-intensive and abandoned cattle

4.3.1 Age wise prevalence in intensive cattle

Dung samples were collected from 10 calves, 17 heifers and 73 adult, among them gastrointestinal parasitic infection were 30.00%, 35.29% and 60.27% in calves, heifers and adult respectively (Table 1). Although, results revealed the association of parasitic infection with age of intensive cattle was not statically significant (χ^2 = 3.781, df = 5, p-value = 0.602>0.05).

Table 1: Prevalence of GI parasites within different age group of intensive cattle

Cattle type	Total	Female	Positive (%)	Male	Positive (%)	Total Positive (%)
Calf	10	5	2 (50.00%)	5	1 (20.00%)	3 (30.00%)
Heifer	17	11	3 (27.27%)	6	3 (50%)	6 (35.29%)
Adult	73	73	44 (60.27%)	0	0	44 (60.27%)
Total	100	89	49 (55.06%)	11	4 (36.36%)	53 (53.00%)

4.3.2 Age wise prevalence in semi-intensive cattle

Dung samples were collected from 16 calves, 23 heifers and 61 adult, among them gastrointestinal parasitic infection was 56.25%, 56.52% and 63.93% in calves, heifers and adult respectively (Table 2). Association of parasitic infection with age of semi-intensive cattle was not statically significant ($\chi^2 = 2.612$, df = 5, p-value = 0.809>0.05).

Table 2: Prevalence of GI parasites within different age group of semi-intensive cattle

Cattle type	Total	Female	Positive (%)	Male	Positive (%)	Total Positive (%)
Calf	16	11	7 (63.64%)	7	2 (28.57%)	9 (56.25%)
Heifer	23	17	8 (47.06%)	6	5 (83.33%)	13 (56.52%)
Adult	61	35	20 (57.14%)	24	19 (79.17%)	39 (63.93%)
Total	100	63	35 (55.55%)	37	26 (70.27%)	61 (61.00%)

4.3.3 Age wise prevalence in abandoned cattle

Dung samples were collected from 14 calves, 17 heifers and 69 adult, among them gastrointestinal parasitic infection was 8.33%, 27.78% and 63.89% in calves, heifers and adult respectively (Table 3) and results revealed the association of parasitic infection with age of abandoned cattle was statically significant ($\chi^2 = 12.562$, df = 5, p-value = 0.02499<0.05).

Table 3: Prevalence of GI parasites within different age group in abandoned cattle

Cattle type	Total	Female	Positive (%)	Male	Positive (%)	Total Positive (%)
Calf	14	2	1 (50.00%)	12	5 (41.67%)	6 (42.86%)
Heifer	17	0	0	17	13 (76.47%)	13 (76.47%)
Adult	69	41	29 (70.73%)	28	24 (85.71%)	53 (76.81%)
Total	100	43	30 (69.77%)	57	42 (73.68%)	72 (72.00%)

4.4 Prevalence of GI parasites among breeds of intensive, semi-intensive and abandoned cattle

4.4.1 Prevalence of GI parasites among breeds of intensive cattle

24 local breeds and 76 cross breeds were selected from 7 different farms among them 58.33% (n=14) local breeds and 51.32% (n=39) cross breeds revealed positive result for parasitic infection (fig. 7). There was not statistically significant association between

local breeds and cross breeds of intensive cattle (χ^2 = 0.0175, df = 1, P-value = 0.895>0.05).

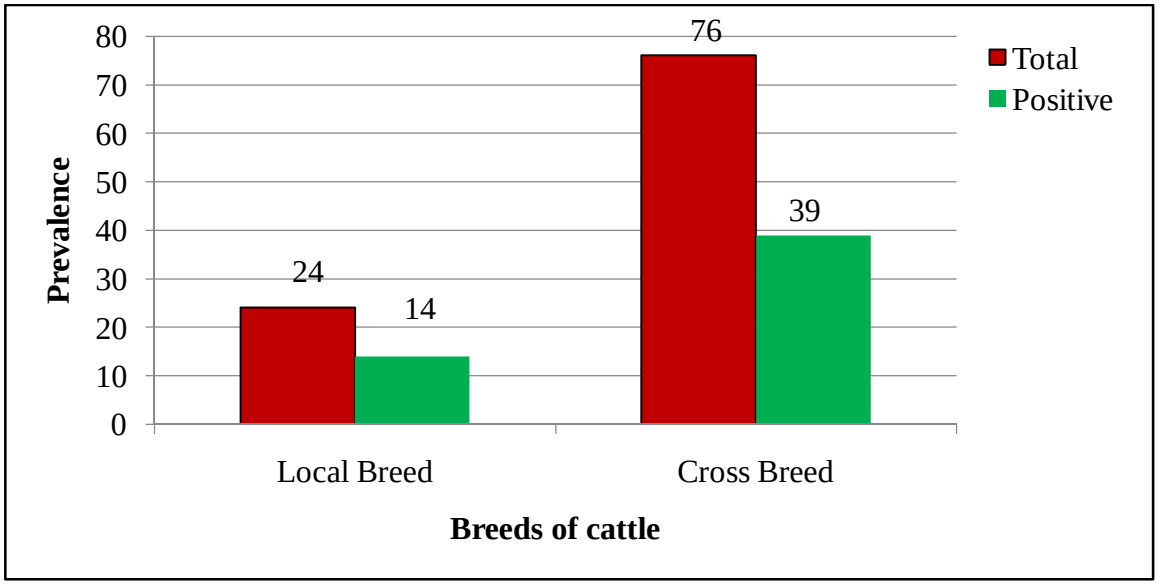


Fig. 7: Prevalence of GI parasites among breeds of intensive cattle

4.4.2 Prevalence of GI parasites among breeds of semi-intensive cattle

54 local breeds and 46 cross breeds were selected, among them 75.93% (n=41) local breeds and 47.83% (n=22) cross breeds revealed positive result for parasitic infection (fig. 8). There was not statistically significant association between local breeds and cross breeds of semi-intensive cattle (χ^2 =1.522, df = 1, P-value 0.1299>0.05).

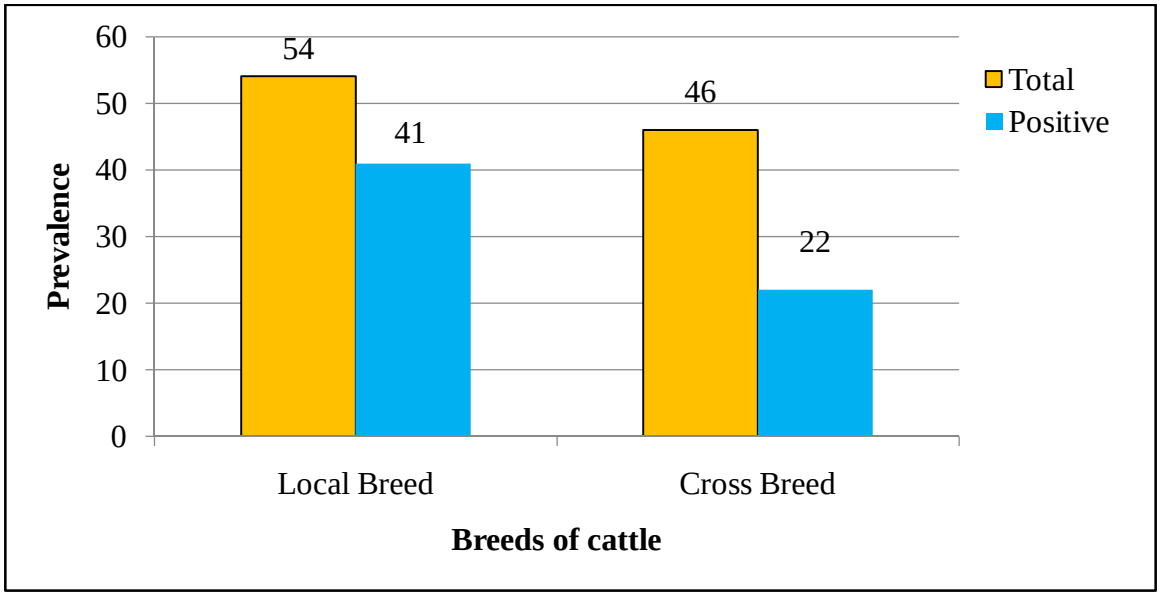


Fig. 8: Prevalence of GI parasites among breeds of semi-intensive cattle

4.4.3 Prevalence of GI parasites among breeds of abandoned cattle

24 local breeds and 76 cross breeds were selected, among them 64.86% (n=24) local breeds and 76.19% (n=48) cross breeds revealed positive result for parasitic infection (fig. 9). There was not statistically significant association between local breeds and cross breeds of abandoned cattle (χ^2 =0.1112, df = 1, P-value = 0.738>0.05).

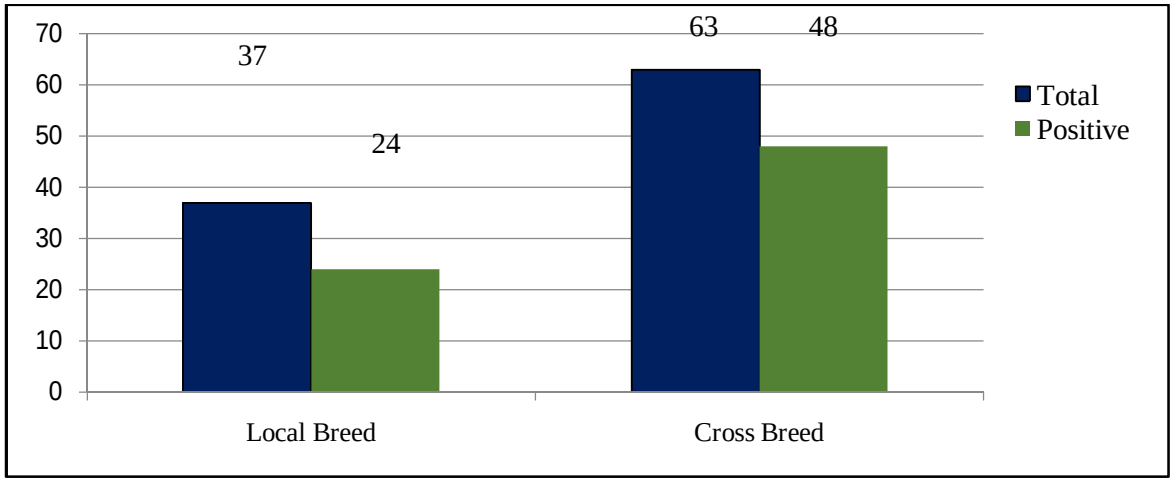


Fig. 9: Prevalence of GI parasites among breeds of abandoned cattle

4.5 Rate of GI parasites and coccidian infection identified in intensive, semi-intensive and abandoned cattle

4.5.1 Rate of single GI parasites and coccidian infection of intensive cattle

Out of 53 infested cattle 33 cattle were infected with single parasites with total prevalence 62.26%. Among single parasitic infestations observed in current study *Eimeria* sp. are most dominant and less number of parasitic infestation was observed in Strongyles (Table 4)

Table 4: Rate of single GI parasites and coccidian infection of intensive cattle

Parasites	**Number of infection**	**Percentage**
Eimeria sp.	13	39.39%
Fasciola sp.	6	18.18%
Paramphistomum sp.	4	12.12%
Haemonchus sp.	3	9.09%
Ostertagia sp.	2	6.06%
Toxocara sp.	2	6.06%
Trichostrongyloides sp.	2	6.06%
Strongyles	1	3.03%
Total	33	62.26%

4.5.2 Rate of mixed GI parasites and coccidian infection of intensive cattle

Out of 53 infected cattle total prevalence of mixed infection was 37.74%. Among mixed parasitic infestations observed in current study *Eimeria* sp. with *Ostertagia* sp. are dominant. There were no mixed infection seen more than two parasites (Table 5)

Table 5: Rate of mixed GI parasites and coccidian infection of intensive cattle

Parasites	**Number of infection**	**Percentage**
Eimeria sp. with *Ostertagia* sp.	6	30.00%
Eimeria sp. with *Fasciola* sp.	4	20.00%
Fasciola sp. with Strongyles	4	20.00%
Ostertagia sp. with *Haemonchus* sp.	3	15.00%
Trichostrongyloides sp. with *Haemonchus* sp.	3	15.00%
Total	20	37.74%

4.5.3 Rate of single GI parasites and coccidian infection of semi-intensive cattle

Out of 61 infested cattle, 24 cattle were infected with single parasites with total prevalence 39.34%. Among single parasitic infestations observed in current study *Eimeria* sp. are most dominant and less number of parasitic infestation were observed in *Toxocara* sp., *Ostertagia* sp., *Capillaria* sp. and Strongyles (Table 6).

Table 6: Rate of single GI parasites and coccidian infection of semi-intensive cattle

Parasites	**Number of infection**	**Percentage**
Eimeria sp.	8	33.33%
Fasciola sp.	5	20.83%
Paramphistomum sp.	3	12.50%
Haemonchus sp.	2	8.33%
Trichostrongyloides sp.	2	8.33%
Toxocara sp.	1	4.17%
Ostertagia sp.	1	4.17%
Capillaria sp.	1	4.17%
Strongyles	1	4.17%
Total	24	39.34%

4.5.4 Rate of mixed GI parasites and coccidian infection of intensive cattle

Out of 53 infected cattle total prevalence of mixed infection was 60.66%. *Eimeria* sp. with *Fasciola* sp. is more dominant than other mixed infection (Table 7).

Table 7: Rate of mixed GI parasites and coccidian infection of semi-intensive cattle

Parasites	**Number of infection**	**Percentage**
Eimeria sp. with *Fasciola* sp.	9	24.32%
Eimeria sp. with *Paramphistomum* sp.	7	18.92%
Eimeria sp. with *Ostertagia* sp.	5	13.51%
Eimeria sp. with *Trichostrongyloides* sp.	3	8.11%
Trichostrongyloides sp. with *Haemonchus* sp.	3	8.11%
Fasciola sp. with *Haemonchus* sp.	3	8.11%
Ostertagia sp. with Strongyles	4	10.81%
Eimeria sp. with *Fasciola* sp. and *Trichostrongyloides* sp.	2	5.45%
Trichostrongyloides sp. with *Haemonchus* sp. and *Capillaria* sp.	1	2.70%
Total	37	37.74%

4.5.5 Rate of single GI parasites and coccidian infection of Abandoned cattle

Out of 72 infested cattle, 26 cattle were infected with single parasites with total prevalence 36.11%. Among single parasitic infestations observed in current study *Fasciola* sp. are most dominant (Table 8).

Table 8: Rate of single GI parasites and coccidian infection of abandoned cattle

Parasites	**Number of infection**	**Percentage**
Fasciola sp.	7	26.92%
Paramphistomum sp.	4	15.38%
Eimeria sp.	3	11.54%
Haemonchus sp.	2	7.69%
Trichostrongyloides sp.	2	7.69%
Toxocara sp.	1	3.85%
Ostertagia sp.	2	7.69%
Capillaria sp.	2	7.69%
Trichuris sp.	1	3.85%
Strongyles	2	7.69%
Total	26	36.11%

4.5.6 Rate of mixed GI parasites and coccidian infection of abandoned cattle

Out of 72 infected cattle, total prevalence of mixed infection was 63.89%. *Eimeria* sp. with *Fasciola* sp. is more dominant than other (Table 9).

Table 9: Rate of mixed GI parasites and coccidian infection of abandoned cattle

Parasites	Number of infection	Percentage
Eimeria sp. with *Fasciola* sp.	11	23.91%
Eimeria sp. with *Paramphistomum* sp.	6	13.04%
Eimeria sp. with *Ostertagia* sp.	9	19.57%
Eimeria sp. with *Trichostrongyloides* sp.	4	8.70%
Eimeria sp. with *Haemonchus* sp.	2	4.35%
Fasciola sp. with *Haemonchus* sp.	3	6.52%
Fasciola sp. with *Ostertagia* sp.	2	4.35%
Fasciola sp. with Strongyles	2	4.35%
Paramphistomum sp. with *Haemonchus* sp.	1	2.17%
Eimeria sp. with *Fasciola* sp. and *Ostertagia* sp.	2	4.35%
Fasciola sp. with *Haemonchus* sp. and *Trichostrongyloides* sp.	1	2.17%
Trichostrongyloides sp. with *Haemonchus* sp. and *Capillaria* sp.	2	4.35%
Trichostrongyloides sp. with *Trichuris* sp. and *Ostertagia* sp.	1	2.17%
Total	46	63.89%

4.6 Intensity of intensive, semi-intensive and abandoned cattle

4.6.1 Intensity of GI parasites of intensive cattle

In this study, *Fasciola* sp. was found to be highly infective in cattle followed by *Ostertagia* sp., *Paramphistomum* sp., *Trichostrongyloides* sp. and *Eimeria* sp. Other parasites such as *Toxocara* sp. and Strongyles were found comparatively less infective (Table 10).

Table 10: Intensity of GI parasites of intensive cattle

Class	Parasites	Light (+)	Mild (++)	Moderate (+++)	Heavy (++++)
Sporozoa	*Eimeria* sp.	15	3	1	-
Nematode	*Toxocara* sp.	5	4	-	-
	Ostertagia sp.	4	2	1	2
	Trichostrongyloides sp.	5	1	1	-
	Strongyles	3	1	-	-
	Haemonchus sp.	3	2	-	-
Trematode	*Fasciola* sp.	6	4	2	1
	Paramphistomum sp.	5	4	1	-

4.6.2 Intensity of GI Parasites of semi-intensive cattle

In this study, *Fasciola* sp. was found to be highly infective in cattle followed by *Paramphistomum* sp., *Ostertagia sp.*, *Trichostrongyloides* sp., *Eimeria* sp. and *Haemonchus* sp. Other parasites such as *Toxocara* sp., *Capillaria* sp. and Strongyles were found comparatively less infective (Table 11).

Table 11: Intensity of GI parasites in semi-intensive cattle

Class	Parasites	Light (+)	Mild (++)	Moderate (+++)	Heavy (++++)
Sporozoa	*Eimeria* sp.	19	8	3	-
Nematode	*Toxocara* sp.	7	5	-	-
	Ostertagia sp.	5	1	1	1
	Trichostrongyloides sp.	4	1	1	1
	Strongyles	3	1	1	-
	Haemonchus sp.	4	3	2	-
	Capillariab sp.	2	1	-	-
Trematode	*Fasciola* sp.	10	5	2	4
	Paramphistomum sp.	7	4	3	1

4.6.3 Intensity of GI Parasites of abandoned cattle

In this study, *Fasciola* sp. was found to be highly infective in abandoned cattle followed by *Ostertagia sp.*, *Eimeria* sp., and *Paramphistomum* sp. and Other parasites such as *Trichostrongyloides* sp., *Toxocara* sp., *Trichuris* sp., *Capillaria* sp. and Strongyles were found comparatively less infective (Table 12).

Table 12: Intensity of GI parasites of abandoned cattle

Class	Parasites	Light (+)	Mild (++)	Moderate (+++)	Heavy (++++)
Sporozoa	*Eimeria* sp.	19	7	3	1
Nematode	*Toxocara* sp.	5	3	-	-
	Ostertagia sp.	8	5	4	3
	Strongyloides sp.	7	4	1	-
	Trichostrongyloides sp.	8	4	1	-
	Strongyles	4	1	1	-
	Haemonchus sp.	5	2	2	-
	Trichuris sp.	5	2	1	
	Capillaria sp.	4	1	1	
Trematode	*Fasciola* sp.	17	8	3	3
	Paramphistomum sp.	13	2	4	1

4.7 Questionnaire survey

4.7.1 Assessment of knowledge, attitude and practices among cattle farmers regarding parasitic infection for intensive and semi-intensive cattle

About 47 questioners were carried out by direct interview with farmers and cattle related people. Among them 60% were female and 40% were male. About 90% of respondents were literate and 10% were illiterate. About 10% cattle were kept in Damp and shady area and remaining 90% were kept in sunny area. 70% cattle were treated with different kind of anthelminthic drugs. About 70% cattle owner has no idea about transmission of parasites. 90% source of water was normally suitable to drink.

Table 13: Questionnaire survey for cattle farmers regarding parasitic infection to intensive and semi-intensive cattle

S.N.	Questionnaires (n=47)	Probable Answer	Percentage of Respondents
1	All age group of cattle kept together	Yes	70%
		No	30%
2	Location of shed	Sunny area	90%
		Damp area	7%
		Others	3%
3	Types of breed	Local breed	40%
		Cross breed	60%
4	Fodder collection sites	Jungle	30%
		Crop land	60%
		Market	4%
		Others	6%
5	Treatment history	Yes	70%
		No	30%
6	Mode of medicine treatment with grain	Yes	5%
		No idea	95%
7	Any idea about parasites	Yes	30%
		No	70%
8	higher risk of infection among age group	Juvenile	30%
		Young	20%
		Adult	10%
		Old/ Diseased	40%
9	Information about infection	Through veterinary agent	90%
		Self	10%
		Yes	50%
10	any idea about of mode of infection	No	50%
		No	79%

11	Association of other domestic animals	Goats	10%
		Hens	10%
		Pig	-
		Others	10%
12	Water sources	Pond, river while only grazing	5%
		Water collected from well	40%
		Nearby pond and stored at home	5%
		Tap water	50%
13	Grain taking	In soil	-
		Thatched	40%
		Bamboo fencing	10%
		Others	60%
14	Attending of any training about Cow farm	Yes	70%
		No	30%
15	Perception of people towards safety role of farm in transmission of parasites	Yes	70%
		No	30%

4.7.2 Questionnaire survey for abandoned cattle

20 questionnaire surveys have been done for street cattle in different locations. Respondent for the abandoned cattle are local people in which cattle usually reside. Most of the cattle were associated with dogs (Table 14).

Table 14: Questionnaire survey for abandoned cattle

S.N.	Questionnaires (n=20)	Probable Answer	Percentage of Respondents
1.	Source of grass	Grassland	20%
		Street side	60%
		Other	20%
2.	Water sources	Pond, river while only grazing	10%
		Water from well	60%
		Nearby pond and stored at home	10%
		Tap water	20%
	Association with other animals	Goats	10%
		Hens	-
		Dogs	80%
		Others	10%
3.	higher risk of infection among age group	Juvenile	
		Young	10%
		Adult	5%
		Old/ Diseased	85%
4.	Location to stay in night time	Under Bridge	40%
		Street	20%
		Open space	10%
		Other	30%

4.8 Photographs of Eggs/ Oocysts of parasites

Some photographs of identified eggs and oocysts of parasites are given below;

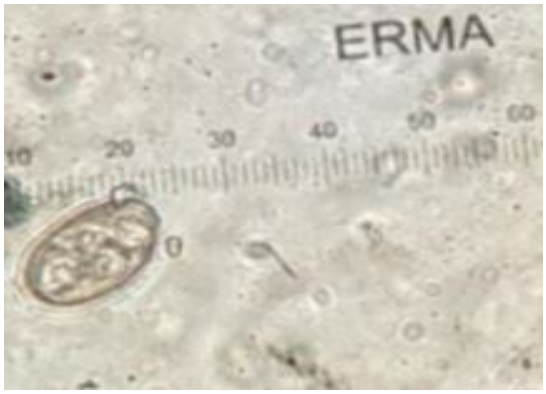


Plate 1: *Eimeria* sp. without micropyle (10x X 40x)

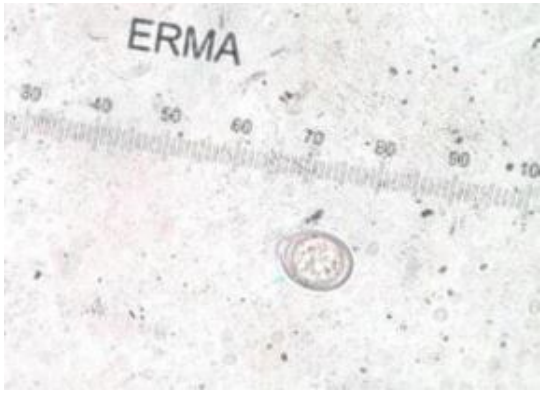


Plate 2: *Eimeria* sp. with micropyle (10x X 40x)

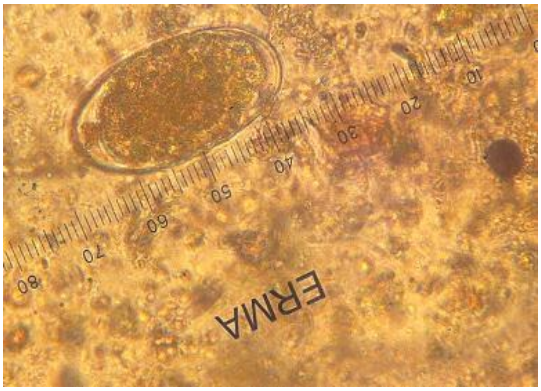


Plate 3: *Oestertagia* sp. (10x X 40x)

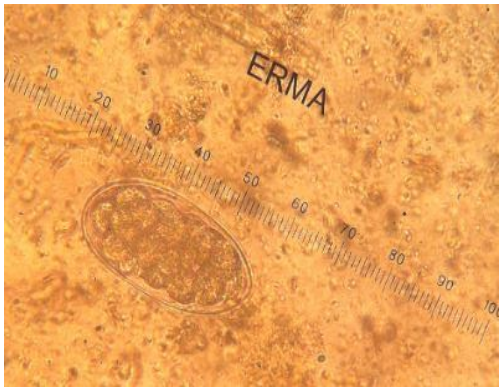


Plate 4: *Trichostrongyloides* sp. (10x X 40x)

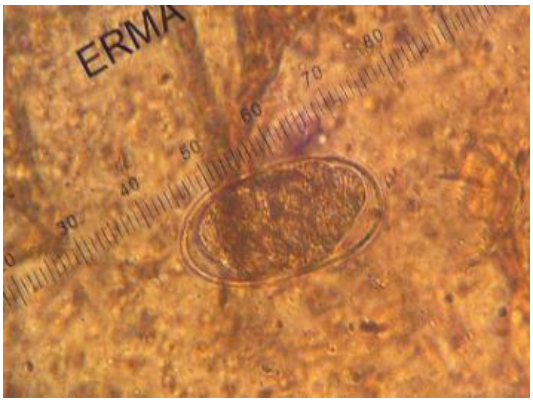


Plate 5: *Haemonchus* sp. (10x X 40x)

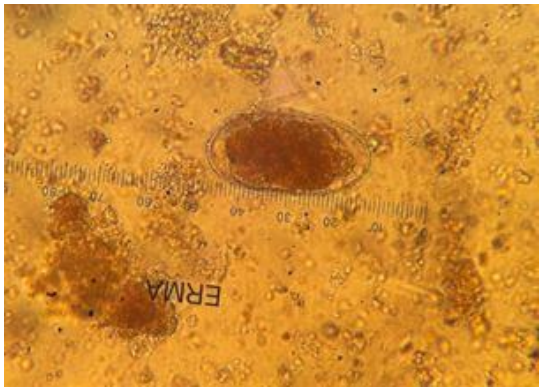


Plate 6: Strongyle (10x X 40x)

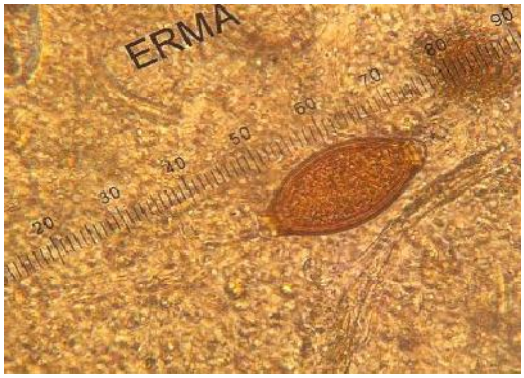


Plate 7: *Capillaria* sp. (10x X 40x)

Plate 8: *Trichuris* sp. (10x X 40x)

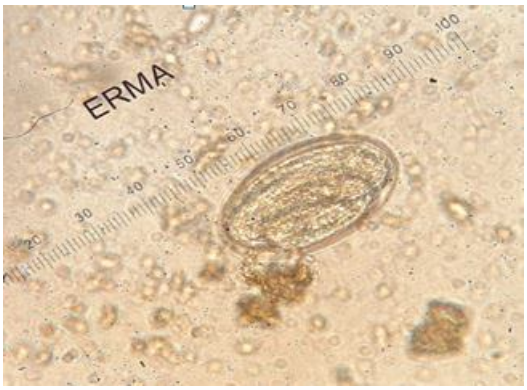


Plate 9: *Strongyloides* sp. (10x X 40x)

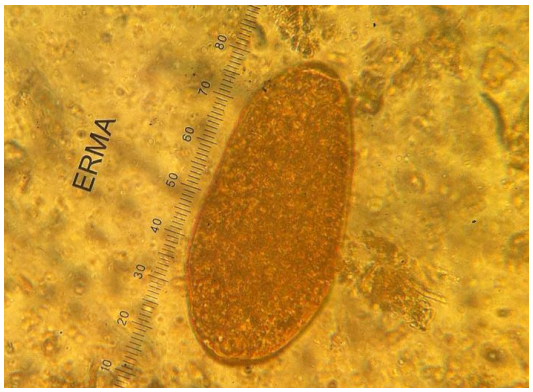


Plate 10: *Paramphistomum* sp. (10x X 40x)

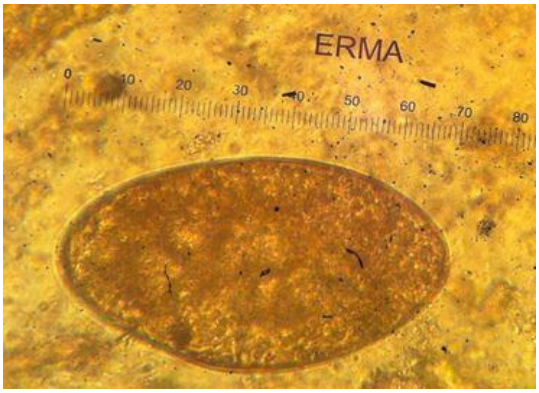


Plate 11: *Fasciola* sp. (10x X 40x)

5. DISCUSSION

Animals suffer from several infectious and non-infectious diseases especially that originate from parasites (Akhter and Arshad, 2006). This work on gastrointestinal parasites in cattle of Kathmandu district revealed that cattle were infected with several gastrointestinal parasites.

In the present study, a total of 300 dung samples were collected (100 from each three groups) from the different parts of the Kathmandu district. Then these samples were processed for laboratory examination by direct smear method and concentration method. After, laboratory examination, prevalence were found to be 53% in intensive cattle, 61% in semi-intensive cattle and 72% in abandoned cattle for one or more than one GI parasites.. Some of the prevalence reported by previous researchers in totally intensive cattle were 95.5% by Squire *et al.* (2019) from 309 faecal samples examined from two institutional farms located in the Coastal Savanna and Transitional zones of Southern Ghana, 84.8% by Rashid *et al.* (2015) from 230 fecal samples examined in Brahman crossbred cattle, reared at Savar Dairy Farm (on-station), 75.46% by Hossain *et al.* (2016) from 5400 fecal samples in animals of different farms in Bangladesh. In other hand Gunathilaka *et al. (*2018), Harold (1982) and Jittapalapong *et al.* (2011) have reported prevalence in intensive cattle were 11.56% from 147 faecal samples in the assessment of deworming program among cattle and buffaloes in Gumpaha District, Sri Lanka was carried out during March 2017 to December 2017, 28.25% from 676 faecal samples and 46.6 % from 1,599 fecal samples were in four different parts of Thailand. This variation in finding might be due to the difference in the number of fecal sample examined, climatic condition, dewormed history in Cows, farm management system or density of parasites in that habitat. But present prevalence of intensive cattle (53%) is in agreement with Renwal *et al.* (2017), from 715 faecal samples in dairy cattle of eight tehsils of Bikaner district, Rajasthan. This similarity may due to similarity in geographical conditions, farm management system and study design.

Similarly, semi-intensive cattle indicated slightly greater (61%) prevalence than intensive cattle. This result is in agreement with Das *et al.* (2017) with the overall prevalence of 58.35% from 3597 fecal samples of cattle. This similarity may due to similar climatic conditions and cattle rearing practices of farmers. There was also variation of prevalence in semi-intensive range. Dogo *et al.*, (2017), Shirale *et al.* (2008), Markole *et al. (*2016) and Takeet *et al.* (2016) reported 31.8%, 66.29%, 73.33% and 95.12% prevalence

respectively. The prevalence may vary according to anthelminthic treatment history, body conditions of cattle and management system (Bacha and Haftu, 2014).

The result of this study revealed the parasitic infection in semi-intensive cattle (61%) are slightly higher than intensive cattle (53%), although there was not statically significant relationship (χ^2 =0.561, df = 1, P-value = 0.454>0.05). Prevalence may be influenced by several factors. So there is variation in prevalence of gastrointestinal parasites in cattle. The prevalence in abandoned cattle (72%) is higher in comparison with intensive and semi-intensive but there was not statically significant relationship between all three groups of cattle (χ^2 =2.933, df = 2, P-value = 0.230>0.05). But there was slightly significant relationship between intensive cattle and abandoned cattle (χ^2 =2.888, df = 1, P-value = 0.089>0.05). This may be due to completely different management system of cattle. Intensive cattle were under the intensive care of owner whereas abandoned cattle were grazing freely and staying in those places where risk of transmission of parasites is high.

Sex wise prevalence of this study revealed 36.36% in male and 49.44% in female of intensive cattle and there was statistically not significant association between male and female GI parasitic infection (χ^2 = 0.627, df = 1, p-value = 0.592>0.05). The overall gastro-intestinal parasitic infection in semi-intensive cattle were 70.27% in male and 55.56% in female but there was statistically not significant association between male and female GI parasitic infection (χ^2 = 0.294, df = 1, p-value = 0.587>0.05). The overall gastro-intestinal parasitic infection in abandoned cattle were 73.68% in male and 69.76% in female and there was statistically not significant association between male and female GI parasitic infection (χ^2 =0.0003, df = 1, p-value = 0.986>0.05). This result is similar with Markole *et al.* (2016) and Maharana *et al.* (2016). This similarity may due to under the same environmental conditions of two sexes. Male and female grazing on the same grass land or forest has equal chance of transmission of parasites. And male and female staying on the same shed and providing with same grains and grass has equal chance of transmission of any parasitic diseases although body condition may influence them (Bacha and Haftu, 2014). Hence, result of this study revealed there is no any significant relation within the sex of cattle.

From the intensive cattle, dung samples were collected from 10 calves, 17 heifers and 73 adults; among them gastrointestinal parasitic infection was were 30.00%, 35.29% and 60.27% in calves, heifers and adult respectively. Although, results revealed the

association of parasitic infection with age of intensive cattle was not statically significant (χ^2 = 3.781, df = 5, p-value = 0.602>0.05). Similar result showed by semi-intensive cattle from which dung samples were collected from 16 calves, 23 heifers and 61 adult, among them gastrointestinal parasitic infection was 56.25%, 56.52% and 63.93% in calves, heifers and adult respectively and association of parasitic infection with age of semi-intensive cattle was not statically significant (χ^2 = 2.612, df = 5, p-value = 0.809>0.05). This result is in agreement with the result of Markole *et al.* (2016), they concluded The animals above 2 years of age were more affected by GI parasites as compared to animals of 6 months - 2 years of age, but the age wise differences were non-significant (p>0.05). That may be due the high exposer rate of abandoned cattle with parasites than that of intensive cattle. This may due to the common place to live for calf, heifer and adult that has equal chances of transmission of parasites in all three groups.

But in case of abandoned cattle, dung samples were collected from 14 calves, 17 heifers and 69 adult, among them gastrointestinal parasitic infection was 8.33%, 27.78% and 63.89% in calves, heifers and adult respectively and results revealed the association of parasitic infection with age of abandoned cattle was statically significant (χ^2 = 12.562, df = 5, p-value = 0.02499<0.05). This fact is also supported by the previous researcher Bacha and Haftu (2014). This may due to the similar study design of both works.

Out of 53 dung samples of intensive cattle, Sporozoa such as *Emeria* sp. has higher prevalence of parasitic infection followed by trematode, *Fasciola* sp. and *Paramphistomum* sp. while in case of nematode, *Ostertagia* sp. has higher followed by *Toxocara* sp. *Trichostrongyloides* sp. *Haemonchus* sp. and Strongyles. Findings of this result are supported by Gillandt *et al.* (2018), Das *et al.* (2017) and Moussouni *et al.* (2018). They have reported *Eimeria* sp. is predominant in their research followed by trematodes and nematodes with more or less rate of infections.

Out of 61 positive dung samples of semi-intensive cattle, Sporozoa such as *Emeria* sp. has higher prevalence of parasitic infection followed by trematode, *Fasciola* sp. and *Paramphistomum* sp. while in case of nematode such as *Toxocara* sp. has higher followed by *Haemonchus* sp., *Ostertagia* sp., *Trichostrongyloides* sp., and Strongyles and Capillaria. Similar result shown by abandoned cattle, out of 72 dung samples of intensive cattle, *Fasciola* sp. has higher prevalence of parasitic infection followed by *Emeria* sp., *Paramphistomum* sp., *Ostertagia* sp., *Trichostrongyloides* sp., and *Strongyloides* sp. Other parasites shows comparatively less infections such as such as *Haemonchus* sp.,

Trichuris sp., *Toxocara* sp. (n=8), *Capillaria* (n=6) and Strongyles (n=6). In agreement with this result Huang *et al.* (2014), Takeet *et al.* (2016) and Gupta *et al.* (2012) has also reported same pattern of parasitic infections with slightly more or less number parasitic infections.

In intensive cattle, 24 local breeds and 76 cross breeds were selected from 7 different farms among them 58.33% (n=14) local breeds and 51.32% (n=39) cross breeds revealed positive result for parasitic infection. There was not statistically significant association between local breeds and cross breeds of intensive cattle (χ^2 = 0.0175, df = 1, P-value = 0.895>0.05). Similarly from semi-intensive cattle, 54 local breeds and 46 cross breeds were selected, among them 75.93% (n=41) local breeds and 47.83% (n=22) cross breeds revealed positive result for parasitic infection. There was not statistically significant association between local breeds and cross breeds of semi-intensive cattle (χ^2 =1.522, df = 1, P-value 0.1299>0.05). In abandoned cattle, 24 local breeds and 76 cross breeds were selected, among them 64.86% (n=24) local breeds and 76.19% (n=48) cross breeds revealed positive result for parasitic infection. There was not statistically significant association between local breeds and cross breeds of abandoned cattle (χ^2 =0.1112, df = 1, P-value = 0.738>0.05). Maharana *et al.* (2016) have analysed their data in Non descriptive breeds of bovines and pure breeds, the difference being statistically not significant ($p > 0.05$). This might be due to the same geological conditions, management system and study design.

In the intensive cattle, *Fasciola* sp. was found to be highly infective in cattle followed by *Ostertagia sp.*, *Paramphistomum* sp., *Trichostrongyloides* sp. and *Eimeria* sp. Other parasites such as *Ascaris* sp. and Strongyles were found comparatively less infective. Similar result has been carried out in semi-intensive and abandoned cattle being a *Fasciola* sp. highly infective. In overall, result of Kathmandu district revealed high intensity of trematodes followed by sporozoa and nematodes. In Nematode *Ostertagia sp.* and *Trichostrongyloides* sp. have high rate of infection. It is in agreement with Gillandt *et al. (*2018), they have also reported that the trematode has higher rate of infection than nematode. This may due to same geological condition and management system.

Questionnaire survey:

About 47 questioners were carried out by direct interview with farmers and cattle related people. 7 questioners representing the 7 farms of this study area and 40 questioners were

taken from semi-intensive cattle of different part of the Kathmandu district. Among them 60% respondent were female and 40% respondent were male. About 90% of respondents were literate and 10% were illiterate. About 10% cattle were kept in Damp and shady area and remaining 90% were kept in sunny area. 70% cattle were treated with different kind of anthelminthic drugs. About 70% cattle owner has no idea about transmission of parasites. 90% source of water was normally suitable to drink. Knowledge and practices of farmers directly influence the infection of parasitic diseases. So, it is necessary to properly manage shed.

Questionnaire survey revealed that 70% of respondent who directly taking care of cattle were not participated in any training provided by Veterinary Services in local level. That may be the region that farmer has no basic idea about drug resistivity, transmission of parasitic diseases and general parasitic diseases of cattle.

20 questionnaire surveys have been done for abandoned cattle from different locations. Respondent for the abandoned cattle are local people in which cattle usually reside. Most of the cattle were associated with dogs. Hence there may be chances of sharing gastrointestinal parasites between cattle and dogs. Further study required to investigate the transmission of parasites from cattle to other animals and vice-versa.

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The present study disclosed that gastrointestinal parasites such as sporozoa, nematodes and trematodes infections in the cattle are prevalent throughout the study area with the prevalence of 53%, 61% and 72% in intensive, semi-intensive and abandoned cattle respectively. Sex wise prevalence of this study revealed 36.36% in male and 49.44% in female of intensive cattle. The overall gastro-intestinal parasitic infection in semi-intensive cattle were 70.27% in male and 55.56% in female. Similarly, the overall gastro-intestinal parasitic infection in abandoned cattle were 73.68% in male and 69.76% in female.

Heavy intensity was found only in case of *Fascioloa* sp. in all three categories. This study revealed that the abandoned cattle have high prevalence (72%) of gastrointestinal parasitic infections than others. GI parasites of cattle may get transmitted to other animal as well as man. So it is necessary to properly managed abandoned cattle.

6.2 Recommendation

Based on the finding of the present study, following recommendations have been drawn to reduce the risk of gastro-intestinal parasitic infection to cattle in Kathmandu district;

- Awareness programme should be conducted by all cattle owner about the effect of drug resistance, way to use anthelminthic drugs.
- Periodic deworming of cattle against helminthes should be practiced strategically for intensive, semi-intensive and abandoned cattle as to overcome further spread of the parasites.
- Veterinary services should be expanded.

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APPENDIX - I

Questionnaire Survey for Intensive and semi-intensive cattle

A COMPARATIVE STUDY OF GASTOINTESTINAL PARASITES AMONG INTENSIVE, SEMI-INTENSIVE AND ABANDONED CATTLE IN KATHMANDU DISTRICT, NEPAL

Cattle type Intensive cattle ☐ Semi-intensive ☐ Date:

Name of cow farm: Code number:

Cow owner: Location:

1. How many cattle do you have in your farm? (age wise)

i) Calves =

ii) Heifer =

iii) Adult =

2. Are all kept together in a single shed?

i) Yes

ii) No……...

3. What is the location of cattle shed?

i) Sunny area

ii) Damp area

iii) Others…….

4. How many types of cattle do you have? Can you name please.

…….....

5. How many types of cow do you have? Can you name please?

…….

6. From where you manage grass for cattle?

i) Jungle ii) Crop land

iii) Market iv) Other ……..

7. Have you provided any medicines to your cattle? How long before?

i) Yes, before ……

ii) No

8. Have you notice any kind of parasites in cattle dung?

i) Yes ……

ii) No

9. How do you know that your cattle have parasites inside the stomach/ Intestine?

i) Through veterinary agent

ii) Self

iii) Other …….

10. Have you any idea about transmission of GI parasites in cattle?

i) Yes ……

ii) No

11. Are there any domestic animals nearby the shed?

i) Goat ii) Hens

iii) Pig iv) Others……...

12. What is the source of water for cattle?

i) Pond, rivers while grazing ii) Water collected from well

iii) Nearby pond and stored at home iv) Other…….

13. Have you participated in any training to manage cow farm properly?

i) Yes

…….

ii) No

14. Do you think your farm is safe to prevent transmission of parasites?

i) Yes

ii) No

15. What should be done to control GI parasites?

……

Thank You

APPENDIX - II

Questionnaire Survey for abandoned cattle

A COMPARATIVE STUDY OF GASTOINTESTINAL PARASITES AMONG INTENSIVE, SEMI-INTENSIVE AND ABANDONED CATTLE IN KATHMANDU DISTRICT, NEPAL

Code Number: **Date:**

Location:

1. Sources of grass:
a. Grassland
b. Street
c. Others…….....
2. Sources of water:
a. Pond, river while only grazing
b. Water from well
c. Nearby pond and stored at home
d. Tap water
3. Association of abandoned cattle with other animals:
a. Goats
b. Hens
c. Dogs
d. Others
4. In which group of abandoned cattle has higher risk of infection?
a. Calves
b. Heifers
c. Adults
5. Abandoned cattle spend their night:
a. Under Bridge
b. Street
c. Open space
d. Others……

Thank You

APPENDIX - III

Identified Eggs/ Oocysts/ Larvae of GI Parasites of cattle

In a comparative study of gastro-intestinal parasites of Cow, a total of 300 dung sampleswerecollectedfor microscopic examination. The identified gastro-intestinal parasites of cattle are give in the table.

Table: Morphological characters of egg, oocyst and larva of GI parasites of cattle

SN	Name of Parasites	Morphological Characters	Size	Reference Size (Soulsby, 1982)
1.	*Eimeria* sp. ➢ Oocyst	Ovoid or ellipsoidal shaped, contained polar cap (micropyle) or Ovoid and spherical shaped, without polar cap (micropyle).	38.4µm ± 24µm 28µm ± 19µm	23-38µm ± 16-24µm 20-29µm ± 14-22µm.
1.	*Fasciola* sp. ➢ Egg	Oval, non-embryonated, thin egg shell, operculated and immature.	128 µm ± 45µm	125-130µm ± 40-65µm.
2.	*Paramphistomum* sp. ➢ Egg	Barrel-shaped, clear shell and operculum at one end.	166.4 µm ±78µm	125-130µm ± 40-65µm
3.	*Strongyloides* sp. ➢ Egg	Oval, clear thin shelled similar to hookworm but are smaller and contain fully developed embryo when passed in the faeces of the host.	71.8 µm ± 23 µm	40-75 ± 20-25 µm.
	➢ Larva	Grayish green short and thick, first stage larva passed in feces.	0.45 mm	0. 4-0.8mm
4.	*Ostertagia* sp. ➢ Egg	Morphologically typical of *Trichostrongylid* eggs, oval in shape.	79.36 µm ± 42 µm	80-85µm ± 40-45 µm.
5.	*Trichostrongyloides* sp. ➢ Egg	Oval, bilaterally symmetrical, embryo mass multi-segmented, thin, transparent outer layer		79-92µm ± 32-49 µm.
6.	Strongyles ➢ Egg	Oval, thin-shelled, segmenting when laid.	79.36 µm ± 45 µm	70-85µm ± 40-47µm

7.	*Haemonchus* sp. ➢ Egg	Oval, passed in the feces of host contain an embryo divided 16-32 cells.	74.24 µm ± 40 µm	70-85µm ± 40-45.
8.	*Toxocara* sp.	unsegmented small atrophied ovum with a mass of disorganized highly refractile granules	52µm ± 65 µm	45 -75 µm ± 60-90 µm
9.	*Trichuris* sp. ➢ Egg	Brown colour, contain unsegmented embryo, barrel shaped with transparent plug at either pole.	77µm ± 40 µm	70-80µm ± 30-42 µm
10.	*Capillaria* sp. ➢ Egg	Contain unsegmented embryo, barrel shaped with plug at either pole.	75µm ± 40 µm	70-80µm ± 30-40 µm