1. INTRODUCTION

Livestock is an essential component of the farming systems of our country. Buffaloes and cattle are the most important domestic animals which produce higher percentages fat containing milk, manure and draught power. Parasitic diseases and parasitic infections are one of the major constraints for profitable dairy industry in tropical and subtropical countries including India. The hot and humid climatic conditions in India are highly conducive for the development and multiplication of parasites. Therefore parasite and parasitic diseases are very common in India. The sub-clinical and latent forms of infections are particularly dangerous as they disseminate the causative organisms without clinical manifestation of symptoms (Martinez-Gonzalez et al., 1998). The most important predisposing factors of gastrointestinal parasitic infections are grazing habits, climates, nutritional deficiency, pasture management, immunological status, presence of intermediate host, vector and the number of infective larvae and eggs in the environment (Kumar et al., 2013).

Gastrointestinal parasitism is one of the major health problems and cause considerable global economic losses as a consequence of reduced weight gain, digestive disturbance, lowered production, impaired reproductive performance, condemnation of affected organs and mortality in infected animals (Raza et al., 2007).

Majority of helminths parasites discharge their eggs in the feces. Immature stages, tapeworm segments or even adult nematodes may be voided in feces. Hence a critical macroscopic inspection and microscopic examination of feces passed by the animal would indicate the causative agent and gives much useful information about the state of alimentary canal. The disease becomes overt only when the worm burden (or intensity of infection) exceeds a certain threshold (Kumar et al., 2013). Host responses that induce pathologies are key determinants for disease manifestations. Since gastrointestinal parasitism result in initial acute phase to a chronic phase, inflammatory responses, severity of pathology depends on the number/types of parasites, host immune responses/genetics and duration of infection.
Parasites, their eggs and excretion-secretion products can directly induce host pathology in many infections. The mature worms produce toxins that destroy red blood cells, leading to unthrifty anaemic condition. Immature worms migrating through the body tissues open the way for bacteria and fungi to enter, causing some other serious diseases (Lebbie et al., 1994).

Therefore, it is important to recognize, control and prevent parasitic infections with better management. The diagnosis of parasitism in animals cannot usually be arrived at from the clinical appearance of the animal. Thus parasitism, in most instances must be confirmed by a laboratory diagnosis. Records of parasitological and pathological changes are useful for the evaluation of diseases at farm level and verify the efficacy of prophylactic and therapeutic interventions.

Keeping in view of the above facts, the present study was designed with the following objectives:

**Objectives**

1. To study the prevalence of gastrointestinal parasitic infections in young bovine.

2. To study the pathological lesions associated with gastrointestinal parasitic infections in young bovine.
2. REVIEW OF LITERATURE

There is abundance of literature available on helminthes of livestock. The relevant concerned with gastrointestinal parasites of cattle and buffaloes and pathology associated with parasitic infection is being reviewed.

Prevalence of gastrointestinal parasites

Anwar et al. (2000) examined 5000 cattle of either sex of different age groups for the presence of hydatid cysts and reported 35 percent prevalence of hydatidosis. The incidence was recorded in male and female as 29.93 percent and 41.77 percent, respectively.

Bhattacharyya and Ahmed (2005) collected 546 fecal samples from cattle and buffaloes of different ages, breeds and either sex. The incidence of infection was slightly higher in buffaloes (71 %) compared to cattle (68.6 %). The highest prevalence of infection was in the monsoon (82.3 %), followed by winter (76.9 %). The most dominant species were reported \textit{i.e. Strongyloides} (32, 5.9 %), \textit{Trichuris} spp (15, 2.8 %).

Molina et al. (2005) observed the highest prevalence of liver fluke in cattle and buffaloes more than 6 years of age, followed by those aged more than 3-6 years. The lowest prevalence was in animals aged 3 months to 3 years. Animals aged more than 6 years also had a higher number of mature and immature parasites compared to younger ones.

Hirani et al. (2006) collected 1503 fecal samples from adult cattle in Gujarat and revealed the overall infection of gastrointestinal parasites up to 44.2 percent. Three major parasitic infections were detected such as Amphistomes (16.2 %), Strongyles (12.1 %) and \textit{Eimeria} spp (9.1 %). Prevalence of gastrointestinal parasitism was highest during summer (51.83 %) followed by monsoon (45.2 %) and the lowest in winter (36 %). The highest prevalence was observed during September and the least in December.

Gadre et al. (2007) screened 2288 animals for helminthes infection revealed that 1441(62.96 %) animals harboured the different
parasites. 41.63 percent, 11.11 percent, 0.98 percent and 46.28 percent were found positive for Nematodes, Trematodes, Cestodes and mixed type of helminths infections respectively. The most common helminths observed were *Paramphistomum* spp (12.28 %), followed by *Toxocara* spp (10.97 %), *Moniezia* spp (8.96 %), *Strongylus* spp (6.99 %), *Fasciola* spp (3.81 %) and *Trichuris* spp (1.87%). The infection rate was highest during post-monsoon (78.80 %), followed by winter (63.44 %), monsoon (62.34 %) and summer (46.66 %).

Sheikh *et al.* (2007) reported the seasonal prevalence of bovine fascioliosis. They reported overall prevalence rates of fascioliosis was 51 percent and during spring, summer; autumn and winter seasons were 37 percent, 31 percent, 20 percent and 73 percent, respectively.

Yadav *et al.* (2007) studied an epidemiological investigation of *Fasciola* spp infection and revealed 11.77 percent and 18.68 percent infection rates in cattle and buffaloes, respectively. The prevalence of *Fasciola* spp infection was highest in May (18.06 %) and September (17.84 %) and lowest in April (0.8 %) and November (1.18 %).

Yadav *et al.* (2008) recorded the seasonal prevalence of *Fasciola gigantica* infections in slaughtered buffaloes and revealed 4.03 percent infection in summer, followed by 3.24 percent in winter and 1.01 percent infection in rainy season. Year-wise prevalence of infection was recorded at 3.67 percent, 2.75 percent and 1.61 percent during 2004, 2003 and 2002, respectively.

Singh *et al.* (2009) reported 35.8 percent, 19.3 percent and 4.4 percent incidence of Amphistomes, *Fascila gigantica* and *Schistosomoes* respectively in cattle. Trematode incidence was highest during the rainy season (74.38 %), followed by winter (57.2 %) and summer (24.4 %).

Alam (2010) studied the incidence of Trematode infections in cattle and recorded 18.10 percent and 32.86 percent infections of *Fasciola gigantica* and Amphistomoses, respectively.
Hailu et al. (2011) examined 210 fecal samples by modified Mc-Master slide techniques and 163 (77.6 %) of them were found to contain at least one gastrointestinal helminth parasite eggs. The most prevalent gastrointestinal helminth parasite eggs detected were *Paramphistome* (48.6 %), *Strongylidae* (32.4 %), *Fasciola* (23.3 %), *Moniezia* (5.2 %), *Strongyloides* (3.3 %), *Toxocara vitulorum* (2.4 %) and *Trichuris* spp (1.9 %), in decreasing order. The overall infection rates for Nematode, Cestode, Trematode and mixed infections were 42.3 percent, 5.2 percent, 71.9 percent and 19.7 percent, respectively. The overall prevalence of gastrointestinal helminthes infection was high in October (81.3 %) and low in February (52.4 %).

Haque et al. (2011) reported 37.97 percent prevalence of gastrointestinal parasitic infections in adult animals. Strongyle (18.99 %) was the most prevalent gastrointestinal parasite followed by *Eimeria* spp (13.42 %), *Moniezia expansa* (5.57 %), Amphistomes (3.80 %), *Trichuris* spp (0.76 %) and *Fasciola* spp (0.51 %).

Hossain et al. (2011) collected 100 fecal samples from slaughtered buffaloes, of them 69 percent were positive for different individual parasitic infestation. Trematodes, Nematodes, Cestodes and Protozoan infestations were 48 percent, 16 percent, 2 percent and 3 percent, respectively. Among the incidence of Trematode infestations were *Paramphistomum* spp (15 %) and *Fasciola* spp (10 %), Nematode *Toxocara* spp (4 %) and 1 percent for both *Trihostrongylus* spp and *Strongyloides* spp and 7 percent mixed infection were observed.

Kakar et al. (2011) examined liver of cows (288) and buffaloes (201) for the presence or absence of *Fasciola* spp. Over all prevalence of fascioliosis was 24.6 percent and 27.3 percent in cows and buffaloes, respectively.

Fecal samples of 4490 cattle of different breeds consisting of 3731 (83.09 %) females and 759 (16.91 %) males were examined for parasitic ova Rafiullah et al. (2011) and 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 (10.23 %) showed mixed infestation. The helminthes observed were Nematodes (*Trichuris*), Trematodes (*Fasciola hepatica, Fasciola gigantica*) and Cestodes (*Taenia, Moniezia expansa* spp), while *Eimeria* were the protozoa encountered.

Wadhwa *et al.* (2011) examined fecal samples from cattle (100) and buffaloes (100) from different locations of Bikaner, Rajasthan for the presence of gastrointestinal parasitic infection. 11 percent cattle and 13 percent buffaloes were found to be positive for gastrointestinal helminthosis. Twenty four (12.00 %) samples were found positive for Strongyle eggs. The estimation of EPG count for Strongyle in cattle and buffaloes were in range between 200-1000, with an average of 504.00 ± 245.41 and 200-1400 with an average of 684.61 ± 350.82, respectively.

Asrafuzzaman (2012) reported 6.91 percent and 39.27 percent *Fasciola gigantica* and Amphistomes infections in cattle, respectively.

Bhutto *et al.* (2012) collected 1800 fecal samples from buffaloes of different sex and age groups. The overall prevalence of fascioliosis was 42.06 percent, and all positive samples were infected with *Fasciola gigantica*. Month-wise prevalence reflected that the higher rate in colder months viz. December (58.67 %) and January (61.33 %), while the lowest in the warm months *i.e.* May (31.33 %), June (24.67 %) and July (26.00 %).

Total 1413 fecal samples of cattle and buffaloes were examined of which 68.93 percent were found positive for various gastrointestinal parasites Gupta *et al.* (2012). The prevalence was found higher in buffaloes (73 %) as compared to cattle (65 %). In cattle, Strongyle infection (43 %) was most prevalent followed by Coccidia (24.25 %), Amphistomes (17.59 %), *Trichuris* spp (5.96 %), *Fasciola gigantica* (0.99 %), *Toxocara* spp (0.43 %), *Strongyloides* spp (0.28 %) and *Moniezia* spp (0.28 %). Prevalence of Amphistomes (45 %) was found highest in buffaloes followed by Strongyles (39 %), Coccidia (22 %), *Fasciola gigantica* (6.77 %), *Strongyloides* spp (2.97 %), *Trichuris* spp (2.26 %) and *Moniezia* spp (0.71 %). Season wise prevalence rates of different parasitic diseases revealed that the incidence was highest in the rainy season.
Huq (2012) revealed the incidence of gastrointestinal helminth parasites of cattle as 7.21 percent, 44.79 percent and 19.27 percent with *Fasciola gigantica*, Amphistomes and *Schistosoma spp*, respectively.

Laha *et al.* (2012) examined 676 fecal samples of them 191 (28.25 %) were found positive for gastrointestinal parasitic infections. The eggs of Strongyle were found predominant (65.96 %) followed by *Strongyloides* spp (25.13 %), *Eimeria* spp (17.80 %), *Trichuris* spp (13.08 %), *Moniezia* spp (10.47 %) and *Nematodirus* spp (2.61 %). They found the eggs per gram of feces in case of nematode parasites ranged between 50 to 4000.

Rafiqul (2012) recorded 78.24 percent prevalence of parasitic infections and 403.01±31.82 mean egg per gram of feces (EPG) in cattle. The parasites identified on fecal examinations were trematodes *Fasciola gigantica* (4.11 %), Amphistomes (40 %) and Schistosoma spp (5 %), nematodes *Haemonchus* spp (3.52 %), Strongyles (1.17 %), *Strongyloides* (1.17 %), *Trichuris* spp (1.76 %) and cestodes *Moniezia* spp (3.52 %). Lower infection with *Moniezia* spp (3.33 %) was found in young cattle than in the adults (4.08 %). Higher rate of infections was also recorded in females (78.83 %) than in the males (75.76 %) which were statistically insignificant.

Singh *et al.* (2012) detected 3.77 percent, 1.88 percent, 3.77 percent, 10.69 percent and 1.26 percent Amphistomes, *Fasciola* spp, *Eimeria* spp, Strongyles and *Trichuris* spp, respectively from feces of cattle.

Yasin (2012) studied the incidence of gastrointestinal helminths parasites of cattle at Shahjadpur Upazila in Sirajgonj district, Bangladesh and recorded *Fasciola gigantica* (4.25 %), Amphistomes (31.32 %) and *Schistosoma* spp (4.25 %) infections in cattle.

Aktaruzzaman *et al.* (2013) determined the extent of concurrent infection and seasonal distribution of gastrointestinal parasites in cross-breed cattle. They examined 4248 fecal samples of them 3268 (76.93 %) samples harboured one or more parasitic ova or cyst and the rest 980 (23.07 %) samples were found free of parasitic ova or cyst. Among the positive cases,
single infection of fascioliosis (29.05 %), Paramphistomiasis (8.3 %), Toxocariasis (11.32 %), Monieziasis (0.7 %), Trichuriasis (1.1 %), Trichostrongylosis (1.4 %) and Strongyloidosis (1.6 %) were found positive. Mixed infection with at least two (dual infection) and/or any three of above mentioned parasitic species (triple infection) were also recorded. Cattle harbouring eggs of one parasite were more common than those harbouring eggs of two or three parasites concurrently. Significantly (p<0.001) higher proportion of Fascioliosis cases were observed in rainy season compared to those which were recorded in winter and summer seasons, similar trends were also noticed in case of Paramphistomiasis, Toxocariasis and Balantidiasis. An increasing trend of occurrence from summer through rainy and winter season was observed in case of Haemonchosis, Monieziasis, Trichuriasis and Strongyloidosis but not statistically significant (p>0.05). A non-significant (p>0.005) decreasing trend of occurrence from winter through summer and rainy season was also observed in case of Trichostrongylosis.

Ardo et al. (2013) examined total of 3,015 livers of slaughtered cattle of them 657 (21.8 %) livers were infected with liver flukes. Sex-specific prevalence was significantly higher (P<0.05) in females (23.6 %) than in males (18.2 %) and age specific prevalence was higher (23.3 %) in 49-72 months cattle.

Gupta et al. (2013) reported higher prevalence rate of gastrointestinal parasites in buffaloes (73 %) as compared to cattle (65 %). In cattle, Strongyle infection (43 %) was most prevalent followed by Coccidia (24.25 %), Amphistomes (17.59 %), Trichuris spp (5.96 %), Fasciola gigantica (0.99 %), Toxocara spp (0.43 %), Strongyloides spp (0.28 %) and Moniezia spp (0.28 %). Prevalence of Amphistomes (45 %) was found highest in buffaloes followed by Strongyles (39 %), Coccidia (22 %), Fasciola gigantica (6.77 %), Strongyloides spp (2.97 %), Trichuris spp (2.26 %) and Moniezia spp (0.71 %).

Khan et al. (2013) examined 2,09,615 slaughtered buffaloes and revealed 50.96 percent overall prevalence of hydatidosis and 3.52 percent, 5.58 percent and 54 percent prevalence was recorded in calves, heifers and adult buffaloes, respectively.
Kumar et al. (2013) recorded prevalence of gastrointestinal nematodes as Strongyle (21.04 %), Toxocara spp (1.01 %), Trichuris spp (73 %) and Fasciola spp (3.13 %) in buffaloes.

Mebrahtu and Beka (2013) reported 24.44 percent total prevalence of fascioliosis. The percentage of prevalence as 16.89 percent Fasciola hepatica, 5.56 percent Fasciola gigantica, 1.11 percent immature fluke and 0.89 percent mixed infections were also noted.

Telila et al. (2013) identified the helminthes eggs in fecal sample of cattle were Strongyle type eggs (41 %), Fasciola (36.5 %), Paraphostomum (18.4 %), Toxocara (7.7 %), Trichuris (5.2 %), and Moniezia (2.8 %). This result indicated the highest prevalence of Strongyle type eggs than other helminths eggs and the lowest prevalence of Moniezia eggs.

Hussien et al. (2015) examined 1120 livers of male cattle of them 24.29 percent (272) were infected by liver fluke, 35.89 percent (402) by hydatid cyst and 3.93 percent by mixed infection.

**Pathology associated with gastrointestinal parasites**

Smith and Stevenson (1970) describe the clinical and postmortem findings of an outbreak of trichuriasis in cattle calves. History revealed marked diarrhoea, accompanied by tenesmus during the week prior to the death of animals. The feces were foamy and contained large amounts of mucus. Examination of fecal samples revealed Trichuris eggs with counts up to 1200 per gram (EPG) and other GI helminths egg counts up to 200 EPG in several animals. Gross postmortem examination revealed very thickened and oedematous large intestine. The mucosa was haemorrhagic with areas of ulceration. Histologically, they were found many cystic spaces lined by a single layer of cells within the lamina propria and submucosa. The cysts contained necrotic debris, mucus, eosinophils, neutrophils, lymphocytes and double-operculated Trichuris like worm eggs. Inflammatory cells surrounding the cysts also extended into the muscularis mucosa and submucosa. Examination of the gastrointestinal contents revealed the presence of Trichuris worms grossly and they were identified as Trichuris discolor.
Ahmedullah *et al.* (2007) examined livers of slaughtered adult buffaloes for pathological changes during the period from July 2006 to March 2007 in two slaughterhouses of Barisal district. Grossly, 31.25 percent, 22.5 percent, 2.5 percent, 3.75 percent and 2.5 percent of *Gigantocotyle explanatum* (amphistomiasis), *Fasciola gigantica*, hydatidosis, abscesses, and haemorrhages respectively were found in livers. Histopathologically, 31.25 percent, 7.5 percent, 5 percent and 15 percent of cirrhosis, nodular hepatitis, granulomatous hepatitis and parasitic cholecystitis were recorded, respectively.

Verma and Swamy (2009) recorded the 23.53 percent incidence of hydatid cyst in the liver of Indian buffaloes. Grossly, variable size, fertile or sterile, intact or collapsed, unilocular or multilocular, deeply or superficially located hydatid cysts were observed. Microscopically, the lesions were found in the liver depending upon the stage of development and variability of the cysts. Scolex was found in the hepatic parenchyma showing slight hemorrhage, leucocyte infiltration and mild hepatocellular degeneration. Cysts content thick capsule and from inside out a highly cellular zone rich in mononuclear cells with abundant fibroblasts with an outer thick fibrous zone of concentrically arranged collagen bundles.

Ghoneim *et al.* (2011) examined a total of 360 cattle and 360 buffaloes carcass of different ages and sexes at Kalyobia abattoirs from January to December, 2011. Prevalence of *Fasciola* species in the slaughtered cattle (3.67 %) was lower than that in slaughtered buffalo (5.56 %). Generally, females (6.67 % & 11.67 %) were more susceptible to infection with fascioliosis than males (2.08 % & 2.5 %) among slaughtered cattle and buffalo, respectively. Microscopically, newly formed bile ductules with inflammatory cells infiltration and fibrosis associated with hyperplasia in the lining epithelium with polyp’s formation as well as the portal area fibrosis with inflammatory cells infiltration were observed.

Mebrahtu and Beka (2013) conducted post mortem examination of 450 animals of them 110 (24.44 %) revealed liver flukes. Pathological lesion of liver due to fascioliosis was observed as abscess (1.33 %), hemorrhage (5.3 %), hepatic fibrosis (7.1 %) and calcification of bile ducts (10.66 %).
Mohamed et al. (2013) examined livers of slaughtered cattle (825) and buffaloes (1740) of different ages and sexes during the period from January 2011 to March 2013. The incidences of the parasitic affections were recorded as 5.20 percent and 3.27 percent in cattle and buffaloes, respectively. 2.67 percent and 2.11 percent Fascioliosis and 0.61 percent and 0.20 percent hydatidosis were recorded in the cattle and buffaloes respectively. Lesions in acute fascioliosis were severe congestion, haemorrhagic migrating tracts formed from degenerated hepatocytes, erythrocytes and eosinophils beside old parasitic tracts represented by central necrosis surrounded with eosinophils, macrophages and lymphocytes together with connective tissue capsule. Chronic fascioliosis showed presence of liver flukes within the lumen of the bile ducts in addition to dystrophic calcification. Typical fertile, sterile, degenerated or calcified hydatid cysts were also observed.

Abraham and Jude (2014) examined slaughtered cattle and found that 179 (44.8 %) of 400 cattle had fascioliosis. Parasite intensity ranged between 8-10 flukes per liver of infected cattle. Infected liver of the hepatic parenchyma revealed severe haemorrhage, thickening and gross fibrosis of bile duct. Microscopically, necrosis and dislodgement of hepatic cells were found. The central vein of cattle infected by Fasciola hepatica and Fasciola gigantica was enlarged and laden with debris.

Pandya et al. (2014) examined total 1444 liver samples collected from slaughtered buffaloes and revealed enlarged liver, covered with rust colored patches, showing haemorrhagic tracts because of migration of flukes, perforation and presence of large number of immature flukes in the parenchyma and at the opening of the bile duct. Hundreds of immature and mature flukes were recovered after squeezing and tearing of liver. Microscopic changes revealed focal necrosis with heavy infiltration of inflammatory cells. Portal triad area revealed proliferation of fibrous tissue. Hepatic cells showed degenerative changes and mild fatty changes. There were large numbers of multiple haemorrhagic tracts made up of erythrocytes and degenerating hepatic cells with polymorphs, eosinophils and mononuclear cells. Bile ducts showed hyperplasia, desquamation and degeneration of epithelium.
Salmo et al. (2014) studied pathological damage caused by chronic bovine liver fascioliosis and revealed hepatocytes swelling, fatty changes, and accumulation of bile pigment in bile canaliculi, congestion, neutrophils and eosinophils infiltration, abscess, telangiectasis, pericellular fibrosis and cirrhosis. The lesions recorded in the bile duct were ranged from infiltration of mononuclear inflammatory cells, portal fibrosis, bile duct hyperplasia, papillomatous projection, adenomatous hyperplasia and bile duct metaplasia.
3. MATERIAL AND METHODS

3.1 Location of work

The work was conducted in the Department of Veterinary Pathology, College of Veterinary Science and Animal Husbandry, Nanaji Deshmukh Veterinary Science University, Jabalpur (Madhya Pradesh).

3.2 Meteorological data and features of place

Jabalpur is situated at 23.17 degree latitude and 79.57 degree E longitudes at 410.87 MSL (mean sea level) in the southern part of second agro-climatic zone, including Satpura Plateau and Kymore hills. It has tropical climate having average rainfall of 1241mm.

3.3 Study period

The study was conducted for a period of eight months from August 2014 to March 2015.

3.4 Materials

3.4.1 Animals

The animals (buffaloes and cattle) above 6 month of age till 2\textsuperscript{nd} lactation were selected randomly irrespective of sex and breed from the organized dairy farm \textit{i.e.} from Livestock Farm, Adhartal and different dairies in and around Jabalpur were included in the study.

3.4.2 Equipments

- Mc Master slide- Chalex Corporation
- Microscope- Leica, DM 750

3.4.3 Chemicals

- Saturated salt solution
- Saturated sugar solution
- Harris hematoxylin (SO34, Himedia)
- Eosin 2 \%W/ V (Qualigens)
3.5 Methods

3.5.1 Collection of samples

3.5.1.1 Antemortem collection

For parasitological study total 120 rectal or fecal samples were collected randomly from buffaloes (44) and cattle (76).

Fecal content were collected per rectal using sterilized hand gloves and about 2-5 grams of fecal samples were placed in sterile plastic container which were labeled and sealed properly for identification of animals and brought to the laboratory for examination.

3.5.1.2 Postmortem collection

During the study period total 21 animals (9 buffaloes and 12 cattle) were brought for postmortem examination. Of these total 13 animals (7 buffaloes and 6 cattle) from Livestock farm (LSF), Adhartal and total 8 animals (2 buffaloes and 6 cattle) from different dairies in and around Jabalpur were subjected for post mortem examination in the Department of Veterinary Pathology, College of Veterinary Science & A.H., Jabalpur.

During the detailed postmortem examination of these animals rectal contents were collected aseptically in sterile containers for parasitological examination.

Tissue samples from liver, stomach, affected parts of intestine, mesenteric and hepatic lymph node were collected at the time of necropsy in 10 percent buffered formalin for histopathological examination.

3.6 Sample processing

3.6.1 Parasitological examination

3.6.1.1 Physical examination

Description of collected fecal samples was recorded and kept in clean, dry petridish for gross examination. With the help of a spatula sample was spread properly and examined for its colour, consistency, odour, stages of parasites and abnormal constituents of the feces (as presence of blood or blood clots, mucus, shreds of intestinal mucosa and/or particles of undigested food) and findings were recorded.
3.6.1.2 Microscopic examination

3.6.1.2.1 Direct smear

Fecal smear/intestinal smear were prepared by placing a small quantity of feces on a clean microscope slide and mixing with a few drops of physiological saline. A cover slip was placed over the smear. The smear was scanned under the microscope by starting at one corner and then moving the slide to the opposite corner.

3.6.1.2.2 Qualitative concentration methods

3.6.1.2.2.1 Floatation method

The floatation technique was used for demonstrating nematode and cestode egg as well as oocyst of coccidia in fecal samples. Saturated solution of sodium chloride of specific gravity 1.28 and Sheather’s sugar solution of specific gravity 1.27 (for cestode and nematode eggs) was used as a floatation fluid. Floatation methods are based on the differences in specific gravity of parasite eggs, cysts and larvae and that of fecal debris. Use an emulsifying fluid of a greater specific gravity than that of the contained eggs.

In the pastel mortar approximately 3 gram of feces mixed thoroughly with 50 ml of floatation fluid then suspension sieved through a fine sieve of 0.25 mm mesh and filtrate was transferred to a centrifuge tube and a cover slip was placed on the top. The suspension was centrifuged at 1000 rpm for 10 min. The cover slip from the centrifuge tube were gently removed and placed over the microscope slide. The slide was examined under low (100 X) magnification (Chauhan, 2006).

3.6.1.2.2.2 Sedimentation method

The sedimentation technique is a qualitative method for detecting trematode eggs in feces. The majority of trematode eggs too large and heavy to float reliably and they sink rapidly to the bottom of a faecal/water suspension.
Approximately 3g of feces were mixed with 40-50 ml of tap water. The suspension was filtered through a tea strainer into a test tube. After 5 minutes the supernatant was removed carefully with a pipette. The sediment was resuspended in water for 5 minutes. The supernatant was discarded and a small drop of sediment was transferred to microscope slide. After placing a coverslip the slide was examined under low (10x) magnification (Chauhan, 2006).

3.6.1.2.3 Quantitative concentration method

3.6.1.2.3.1 Strongyle egg and coccidia oocyst count

Severity of infection in the positive animal can be judge with reasonable degree of accuracy by counting the number of eggs or oocysts present in the 1 gram of feces. This is commonly known as egg count. Nematode eggs per gram of feces (EPG) and coccidia oocysts per gram of feces (OPG) were counted for each positive sample by modified McMaster Technique (Soulsby, 1982).

One gram of feces was mixed with 14 ml of salt solution and strained through an ordinary single mesh nylon strainer to remove the coarser particles. The suspension was thoroughly mixed and immediately charged into McMaster egg counting chamber with the help of a pipette, filling it’s all spaces and avoiding air bubbles. The charged counting chamber was then placed undisturbed on the stage of a compound microscope for 10-15 minutes and thereafter, the eggs in both the ruled areas of 1 square centimeter were counted in S shaped manner by starting at end of square in both chambers. Counted eggs of both chambers were multiplied by 50 to obtain eggs present in per gram of feces.

3.6.2 Pathological examination

3.6.2.1 Macroscopic examination

During the detailed postmortem examination of animals (buffaloes and cattle) gross pathological changes observed in liver, stomach, different parts of intestine, mesenteric and hepatic lymph node were noted.
3.6.2.2 Microscopic examination

The collected tissue samples (liver, stomach, affected parts of intestine, mesenteric and hepatic lymph node) were processed by conventional paraffin embedding technique. Five micron sections were taken and stained by standards Hematoxylin and Eosin (H&E) staining procedure for detailed histopathological studies (Gridley, 1960).

3.6.2.3 Special staining technique

3.6.2.3.1 Demonstration of connective tissue

Masson’s Trichrome staining was done for the demonstration of collagen fibers. The tissues were kept in bouin’s fluid for overnight. They were cooled and washed in running water until yellow colour disappeared. The sections were stained in Weigert’s hematoxylin solution for 10 minutes and in Biebrich scarlet acid fuchin solution for 15 minutes. Thereafter, they were kept in phosphomolybdic acid phosphotungstic acid solution for 10 to 15 minutes. Counterstaining was done by aniline blue solution for 5-10 minutes (Gridley, 1960).

3.7 Analysis of results

The data gathered from the study for prevalence of parasitic infection were analyzed and calculated percentage as described by Snedecor and Cochran (1994).
4. RESULTS

Gastrointestinal parasitism is a major constraint for livestock production causing heavy economic losses. They play a crucial role in reducing animal production by lowering their working capacity, growth, body weight and milk yield. The present work was conducted to know the prevalence and pathological changes associated with gastrointestinal (GI) parasites in bovine.

4.1 Herd composition and management practices

The present study was conducted on bovine above 6 month of age irrespective of sex and breed from the Livestock Farm (LSF), Adhartal, Jabalpur and other dairy farms in and around Jabalpur.

The management practice was available only from the organized Livestock Farm (LSF), Adhartal, College of Veterinary Science and A.H., Jabalpur. The farm comprises a mixed population of bovine (Murrah buffaloes/ Sahiwal and cross bred cattle). At the start of the study the farm consisted of total 221 bovine (107 buffaloes and 114 cattle).

4.2 Prevalence of gastrointestinal parasitic infections in bovine
(fecal sample)

During the study period from August 2014 to March 2015 a total 120 bovine were examined by fecal sample examination to know the presence of parasitic infections. In present study qualitative method as direct smear, sedimentation and floatation method were used for detecting parasitic eggs in feces. Direct smear was used for screening of fecal samples and sedimentation technique commonly used for detecting the trematode eggs. Whereas, floatation technique was used for detecting the nematode eggs, cestode eggs as well as coccidia oocyst in the fecal samples. Quantitative methods were used for counting of eggs of nematode, cestode and oocyst of coccidia.
Out of 120 animals examined during the study period, 88 were found positive for eggs of one or more species of gastrointestinal parasite. Thus, the overall prevalence of gastrointestinal parasitic infections was calculated as 73.33 percent. Of the total 120 animals 86 were belongs to LSF, Adhartal and 34 from other organized dairy farms in and around Jabalpur. The prevalence rates of parasitic infections were recorded in 73.25 percent (63/86) animals of LSF, Adhartal and 73.52 percent (25/34) animals of other dairy farms.

Total 120 animals comprising 44 and 76 were buffaloes and cattle respectively. The prevalence rates of parasitic infections in buffaloes were recorded as (70.45 %) and (75.00 %) in cattle. 69.76 percent and 76.74 percent prevalence was found in buffaloes and cattle of LSF and 100 percent and 72.72 percent prevalence in bovine of others farms in and around the Jabalpur, respectively (Table 01 and Figure 01).

Table 01: Prevalence of gastrointestinal parasitic infections in fecal samples

<table>
<thead>
<tr>
<th>Animals</th>
<th>Total</th>
<th>LSF</th>
<th>Others Farms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample</td>
<td>Positive</td>
<td>Percent</td>
</tr>
<tr>
<td>Buffaloes</td>
<td>44</td>
<td>31</td>
<td>70.45</td>
</tr>
<tr>
<td>Cattle</td>
<td>76</td>
<td>57</td>
<td>75.00</td>
</tr>
<tr>
<td>Bovine</td>
<td>120</td>
<td>88</td>
<td>73.33</td>
</tr>
</tbody>
</table>

Sex wise prevalence of GI parasites was recorded 83.33 percent in male and 70.83 percent in female bovine. Prevalence was determined as 85.71 percent in males and 63.33 percent in female buffaloes. However, 80.00 percent male and 74.24 percent female cattle were found positive for GI parasites. (Table 02 and Figure 02).
Table 02: Sex wise prevalence of gastrointestinal parasitic infections

<table>
<thead>
<tr>
<th>Animals</th>
<th>No. of Animals</th>
<th>Male</th>
<th>Positive</th>
<th>Percent</th>
<th>Female</th>
<th>Positive</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffaloes</td>
<td></td>
<td>14</td>
<td>12</td>
<td>85.71</td>
<td>30</td>
<td>19</td>
<td>63.33</td>
</tr>
<tr>
<td>Cattle</td>
<td></td>
<td>10</td>
<td>08</td>
<td>80.00</td>
<td>66</td>
<td>49</td>
<td>74.24</td>
</tr>
<tr>
<td>Bovine</td>
<td></td>
<td>24</td>
<td>20</td>
<td>83.33</td>
<td>96</td>
<td>68</td>
<td>70.83</td>
</tr>
</tbody>
</table>

It was found that adult bovine above 2 years of age were more affected (77.50 %) by GI parasites than the bovine of 6 months to 2 years of age ( 65.00 %). The highest prevalence 75.00 percent and 78.84 percent being in age groups above the 2 years and lowest prevalence 62.50 percent and 66.66 percent was recorded in age group between 6 months to 2 years of buffaloes and cattle, respectively (Table 03 and Figure 03).

Table 03: Age wise prevalence of gastrointestinal parasitic infections

<table>
<thead>
<tr>
<th>Animals</th>
<th>No. of Animals</th>
<th>No. of Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 Months – 2 years</td>
<td>Positive</td>
</tr>
<tr>
<td>Buffaloes</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Cattle</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Bovine</td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

The month wise prevalence of GI parasites in bovine, buffaloes and cattle is shown in table 04 and figure 04. Maximal percent of parasitic infections in bovine were recorded in the month of September (81.81 %) followed by March (80.00 %) and least parasitism was observed in December (61.11 %). In buffaloes maximal percent of parasitic infections were recorded in the month of October (100 %) followed by September (85.71 %) and least parasitism was observed in December (40.00 %). Maximal percent of parasitic
infections in cattle were recorded in the month of March (80.00 %) and least parasitism was observed in August (67.00 %).

Table 04: Monthly prevalence of gastrointestinal parasitic infections

<table>
<thead>
<tr>
<th>Months</th>
<th>Bovine</th>
<th>Positive</th>
<th>Percent</th>
<th>Buffaloes</th>
<th>Positive</th>
<th>Percent</th>
<th>Cattle</th>
<th>Positive</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug'14</td>
<td>10</td>
<td>07</td>
<td>70.00</td>
<td>07</td>
<td>05</td>
<td>71.42</td>
<td>03</td>
<td>02</td>
<td>67.00</td>
</tr>
<tr>
<td>Sep'14</td>
<td>11</td>
<td>09</td>
<td>81.81</td>
<td>07</td>
<td>06</td>
<td>85.71</td>
<td>04</td>
<td>03</td>
<td>75.00</td>
</tr>
<tr>
<td>Oct'14</td>
<td>14</td>
<td>11</td>
<td>78.57</td>
<td>03</td>
<td>03</td>
<td>100</td>
<td>11</td>
<td>08</td>
<td>73.00</td>
</tr>
<tr>
<td>Nov'14</td>
<td>20</td>
<td>15</td>
<td>75.00</td>
<td>05</td>
<td>03</td>
<td>60.00</td>
<td>15</td>
<td>12</td>
<td>80.00</td>
</tr>
<tr>
<td>Dec'14</td>
<td>18</td>
<td>11</td>
<td>61.11</td>
<td>05</td>
<td>02</td>
<td>40.00</td>
<td>13</td>
<td>09</td>
<td>69.23</td>
</tr>
<tr>
<td>Jan'15</td>
<td>18</td>
<td>13</td>
<td>72.22</td>
<td>10</td>
<td>07</td>
<td>70.00</td>
<td>08</td>
<td>06</td>
<td>75.00</td>
</tr>
<tr>
<td>Feb'15</td>
<td>14</td>
<td>10</td>
<td>71.42</td>
<td>04</td>
<td>03</td>
<td>75.00</td>
<td>10</td>
<td>07</td>
<td>70.00</td>
</tr>
<tr>
<td>Mar'15</td>
<td>15</td>
<td>12</td>
<td>80.00</td>
<td>03</td>
<td>02</td>
<td>66.66</td>
<td>12</td>
<td>10</td>
<td>83.00</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>88</td>
<td>73.33</td>
<td>44</td>
<td>31</td>
<td>70.45</td>
<td>76</td>
<td>57</td>
<td>75.27</td>
</tr>
</tbody>
</table>

Fecal samples were found positive for single parasitic infections in buffaloes, cattle and bovine as 47.72 %, 44.74 % and 45.83 %, respectively (Table 05). Highest percentage of nematode was observed as 30.83 % in buffalo, 28.94 % in cattle and 29.54 % in bovine. Higher prevalence of protozoal infections was found in buffaloes (13.63 %) followed by in cattle (10.50 %) and in bovine (10.00 %).

Table 05: Prevalence of single gastrointestinal parasitic infections

<table>
<thead>
<tr>
<th>Animals</th>
<th>Single infection (%)</th>
<th>Nematode (%)</th>
<th>Trematode (%)</th>
<th>Cestode (%)</th>
<th>Protozoa (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffaloes</td>
<td>47.72</td>
<td>29.54</td>
<td>02.27</td>
<td>02.27</td>
<td>13.63</td>
</tr>
<tr>
<td>Cattle</td>
<td>44.74</td>
<td>28.94</td>
<td>03.94</td>
<td>01.31</td>
<td>10.50</td>
</tr>
<tr>
<td>Bovine</td>
<td>45.83</td>
<td>30.83</td>
<td>03.33</td>
<td>01.66</td>
<td>10.00</td>
</tr>
</tbody>
</table>
Prevalence of mixed/multiple parasitic infections were determined as 22.72 percent in buffalo, 30.26 percent in cattle and 27.50 percent in bovine showing in table 06. Highest prevalence of mixed infections in combinations of nematode with protozoa was observed as 19.73 percent, 18.33 percent and 15.90 percent in cattle, bovine and buffalo respectively.

**Table 06: Prevalence of mixed gastrointestinal parasitic infections**

<table>
<thead>
<tr>
<th>Animals</th>
<th>Mixed infections (%)</th>
<th>Nematode /Protozoa (%)</th>
<th>Nematode /Cestode (%)</th>
<th>Trematode /Nematode (%)</th>
<th>Trematode /Cestode (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffalo</td>
<td>22.72</td>
<td>15.90</td>
<td>04.54</td>
<td>02.27</td>
<td>00.00</td>
</tr>
<tr>
<td>Cattle</td>
<td>30.26</td>
<td>19.73</td>
<td>02.63</td>
<td>03.94</td>
<td>03.94</td>
</tr>
<tr>
<td>Bovine</td>
<td>27.50</td>
<td>18.33</td>
<td>03.33</td>
<td>03.33</td>
<td>02.50</td>
</tr>
</tbody>
</table>

Monthly prevalence of different species of GI parasites in bovine, buffalo and cattle are shown in table 07, 08 and 09 (Plate 01). Highest number of sample was found positive for single parasitic infections in the month of January followed by November. Highest percentage (25.00%) of Strongyle eggs were recorded during the study period with maximal prevalence in the month of January in bovine, buffalo and cattle. Prevalence of *Eimeria* spp in bovine, buffalo and cattle were determined as (12.00 %), (6.00 %) and (5.00 %). Maximal number of fecal samples of bovine and buffalo were found positive for *Eimeria* spp in the month of November and January. Highest number of fecal samples was found to be positive for mixed infections in the month of October and March. However, in the month of November highest number of fecal samples was positive for parasites.
<table>
<thead>
<tr>
<th>Parasites</th>
<th>Aug n=10</th>
<th>Sep n=11</th>
<th>Oct n=14</th>
<th>Nov n=20</th>
<th>Dec n=18</th>
<th>Jan n=18</th>
<th>Feb n=14</th>
<th>Mar n=15</th>
<th>Total N=120 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongyle</td>
<td>01</td>
<td>00</td>
<td>02</td>
<td>05</td>
<td>04</td>
<td>07</td>
<td>06</td>
<td>05</td>
<td>30 (25.00)</td>
</tr>
<tr>
<td>Strongyloides</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>03 (02.50)</td>
</tr>
<tr>
<td>Toxocara</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>02 (1.66)</td>
</tr>
<tr>
<td>Trichuris</td>
<td>00</td>
<td>01</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>02 (1.66)</td>
</tr>
<tr>
<td>Fasciola</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>02 (1.66)</td>
</tr>
<tr>
<td>Amphistome</td>
<td>02</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>02 (1.66)</td>
</tr>
<tr>
<td>Moniezia</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>02 (1.66)</td>
</tr>
<tr>
<td>Eimeria</td>
<td>01</td>
<td>01</td>
<td>01</td>
<td>03</td>
<td>02</td>
<td>03</td>
<td>00</td>
<td>01</td>
<td>12 (10)</td>
</tr>
<tr>
<td>Single infections</td>
<td>05</td>
<td>04</td>
<td>05</td>
<td>10</td>
<td>08</td>
<td>11</td>
<td>06</td>
<td>06</td>
<td>55 (45.83)</td>
</tr>
<tr>
<td>Mixed infections</td>
<td>02</td>
<td>05</td>
<td>06</td>
<td>05</td>
<td>03</td>
<td>02</td>
<td>04</td>
<td>06</td>
<td>33 (27.50)</td>
</tr>
<tr>
<td>Total n=120</td>
<td>07 (5.83)</td>
<td>09 (7.50)</td>
<td>11 (9.16)</td>
<td>15 (12.5)</td>
<td>11 (9.16)</td>
<td>13 (10.83)</td>
<td>10 (8.33)</td>
<td>12 (10)</td>
<td>88 (73.33)</td>
</tr>
</tbody>
</table>
Table 08: Monthly prevalence of different species of gastrointestinal parasitic infections in buffaloes

<table>
<thead>
<tr>
<th>Parasites</th>
<th>Aug n=7</th>
<th>Sep n=7</th>
<th>Oct n=3</th>
<th>Nov n=5</th>
<th>Dec n=5</th>
<th>Jan n=10</th>
<th>Feb n=4</th>
<th>Mar n=3</th>
<th>Total N=44 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongyle</td>
<td>01</td>
<td>01</td>
<td>01</td>
<td>01</td>
<td>03</td>
<td>02</td>
<td>01</td>
<td></td>
<td>11 (25)</td>
</tr>
<tr>
<td>Strongyloides</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>01 (2.27)</td>
</tr>
<tr>
<td>Trichuris</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>01 (2.27)</td>
</tr>
<tr>
<td>Fasciola</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00 (0)</td>
</tr>
<tr>
<td>Amphistome</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01 (2.27)</td>
</tr>
<tr>
<td>Monezia</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01 (2.27)</td>
</tr>
<tr>
<td>Eimeria</td>
<td>01</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>02</td>
<td>00</td>
<td>01</td>
<td>06 (13.63)</td>
</tr>
<tr>
<td>Single infections</td>
<td>04</td>
<td>03</td>
<td>02</td>
<td>02</td>
<td>01</td>
<td>05</td>
<td>02</td>
<td>02</td>
<td>21 (47.72)</td>
</tr>
<tr>
<td>Mixed infections</td>
<td>01</td>
<td>03</td>
<td>01</td>
<td>01</td>
<td>01</td>
<td>01</td>
<td>01</td>
<td>01</td>
<td>10 (22.72)</td>
</tr>
<tr>
<td>Total n=44</td>
<td>05 (71.42)</td>
<td>06 (85.71)</td>
<td>03 (100)</td>
<td>03 (60)</td>
<td>02 (40)</td>
<td>07 (70)</td>
<td>03 (75)</td>
<td>02 (66.66)</td>
<td>31 (70.45)</td>
</tr>
</tbody>
</table>
Table 09: Monthly prevalence of different species of gastrointestinal parasitic infections in cattle

<table>
<thead>
<tr>
<th>Parasites</th>
<th>Aug n=3</th>
<th>Sep n=4</th>
<th>Oct n=11</th>
<th>Nov n=15</th>
<th>Dec n=13</th>
<th>Jan n=8</th>
<th>Feb n=10</th>
<th>Mar n=12</th>
<th>Total N=76 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongyle</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>04</td>
<td>02</td>
<td>05</td>
<td>03</td>
<td>04</td>
<td>19 (25)</td>
</tr>
<tr>
<td>Strongyloides</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>02 (2.63)</td>
</tr>
<tr>
<td>Toxocara</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>03 (3.94)</td>
</tr>
<tr>
<td>Trichuris</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01 (1.31)</td>
</tr>
<tr>
<td>Fasciola</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>02 (2.63)</td>
</tr>
<tr>
<td>Amphistome</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>01 (1.31)</td>
</tr>
<tr>
<td>Monezia</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01 (1.31)</td>
</tr>
<tr>
<td>Eimeria</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>02</td>
<td>02</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>05 (6.57)</td>
</tr>
<tr>
<td>Single infections</td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>08</td>
<td>06</td>
<td>06</td>
<td>04</td>
<td>04</td>
<td>34 (44.73)</td>
</tr>
<tr>
<td>Mixed infections</td>
<td>01</td>
<td>01</td>
<td>05</td>
<td>04</td>
<td>03</td>
<td>00</td>
<td>03</td>
<td>06</td>
<td>23 (30.26)</td>
</tr>
<tr>
<td>Total n=76</td>
<td>02</td>
<td>03</td>
<td>08</td>
<td>12</td>
<td>09</td>
<td>06</td>
<td>07</td>
<td>10</td>
<td>57 (75.27)</td>
</tr>
</tbody>
</table>

25
The number and percentage of eggs per gram/ oocyst per gram was counted in 120 fecal samples of bovine by Mc Master technique. Highest number of fecal samples 43 comprising 17 buffaloes and 26 cattle fecal samples were found positive for Strongyle eggs of them 09 samples including 05 buffaloes and 04 cattle fecal samples having high EPG between 300-600. *Eimeria* oocysts were observed in 31 bovine fecal samples of these 15 samples had OPG between 301-600 (Table 10).

Table 10: Egg per gram/ oocyst per gram in fecal samples

<table>
<thead>
<tr>
<th>Parasites</th>
<th>100-200</th>
<th>201-300</th>
<th>301-600</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bovine</td>
<td>Buffaloes</td>
<td>Cattle</td>
</tr>
<tr>
<td>Strongyle</td>
<td>08</td>
<td>02</td>
<td>06</td>
</tr>
<tr>
<td>Strongyloides spp</td>
<td>01</td>
<td>01</td>
<td>00</td>
</tr>
<tr>
<td>Toxocara spp</td>
<td>02</td>
<td>01</td>
<td>01</td>
</tr>
<tr>
<td>Trichuris spp</td>
<td>00</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>Eimeria spp</td>
<td>07</td>
<td>03</td>
<td>04</td>
</tr>
<tr>
<td>Moniezia spp</td>
<td>01</td>
<td>00</td>
<td>01</td>
</tr>
</tbody>
</table>

4.3 Prevalence of gastrointestinal parasitic infections in bovine (intestinal contents)

Total number of 21 carcasses of bovine above six month of age comprising 9 buffaloes and 12 cattle brought to the Department of Veterinary Pathology College of Veterinary Science and A.H., Jabalpur, during the study period of eight month (August 2014 - March 2015) for postmortem and served the source material to achieve the second objective of present study *i.e.* pathological lesions associated with gastrointestinal parasitic infections in bovine are shown in table 11.
Table 11: Animals received for postmortem examination during study periods

<table>
<thead>
<tr>
<th>Months</th>
<th>No</th>
<th>Species</th>
<th>Age</th>
<th>Sex</th>
<th>Intestinal contents</th>
<th>Parasite recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 2014</td>
<td>06</td>
<td>Cattle</td>
<td>5.0 yr</td>
<td>Female</td>
<td>Fasciola</td>
<td>Fasciola</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffalo</td>
<td>08 mth</td>
<td>Male</td>
<td>Trichuris + Eimeria</td>
<td>Trichuris</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffalo</td>
<td>07 mth</td>
<td>Female</td>
<td>Tapeworm</td>
<td>Tapeworm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffalo</td>
<td>07 mth</td>
<td>Male</td>
<td>Eimeria</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffalo</td>
<td>09 mth</td>
<td>Female</td>
<td>Strongyle + Eimeria</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffalo</td>
<td>10 mth</td>
<td>Female</td>
<td>Eimeria</td>
<td>-</td>
</tr>
<tr>
<td>September 2014</td>
<td>01</td>
<td>Cattle</td>
<td>5.0 yr</td>
<td>Female</td>
<td>Eimeria</td>
<td>-</td>
</tr>
<tr>
<td>October 2014</td>
<td>03</td>
<td>Cattle</td>
<td>3.5 yr</td>
<td>Female</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffalo</td>
<td>5.5 yr</td>
<td>Female</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cattle</td>
<td>3.0 yr</td>
<td>Female</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>November 2014</td>
<td>01</td>
<td>Cattle</td>
<td>3.5 yr</td>
<td>Male</td>
<td>Strongyle + Eimeria</td>
<td>Hydatid</td>
</tr>
<tr>
<td>December 2014</td>
<td>04</td>
<td>Cattle</td>
<td>5.0 yr</td>
<td>Female</td>
<td>Fasciola + strongyle</td>
<td>Fasciola + Hydatid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffalo</td>
<td>4.0 yr</td>
<td>Female</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cattle</td>
<td>5.0 yr</td>
<td>Female</td>
<td>Amphistome</td>
<td>Amphistome</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cattle</td>
<td>3.0 yr</td>
<td>Female</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>January 2015</td>
<td>01</td>
<td>Cattle</td>
<td>3.5 yr</td>
<td>Female</td>
<td>Fasciola + strongyle</td>
<td>Fasciola + Hydatid</td>
</tr>
<tr>
<td>February 2015</td>
<td>04</td>
<td>Cattle</td>
<td>1.0 yr</td>
<td>Female</td>
<td>Trichuris</td>
<td>Trichuris</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffalo</td>
<td>1.5 yr</td>
<td>Female</td>
<td>Tapeworm + strongyle</td>
<td>Tapeworm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cattle</td>
<td>5.0 yr</td>
<td>Female</td>
<td>Fasciola</td>
<td>Fasciola</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cattle</td>
<td>08 mth</td>
<td>Female</td>
<td>Strongyle + Eimeria</td>
<td>-</td>
</tr>
<tr>
<td>March 2015</td>
<td>01</td>
<td>Buffalo</td>
<td>09 mth</td>
<td>Female</td>
<td>Tapeworm</td>
<td>Tapeworm</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>Buffalo</td>
<td>09</td>
<td>Female</td>
<td>18</td>
<td>Buffalo: 07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cattle</td>
<td>12</td>
<td>Male</td>
<td>03</td>
<td>Cattle: 09</td>
</tr>
</tbody>
</table>
Intestinal content of all 21 carcasses were collected during necropsy for parasitological examinations. Intestinal contents of sixteen bovine were found positive for eggs of different parasites. Postmortem prevalence was determined as 76.19 percent in bovine comprised of 77.78 percent buffaloes and 75.00 percent cattle. Sex wise GI prevalence was recorded 100 percent in male bovine and 72.22 percent in female bovine. Whereas, higher prevalence 88.88 percent was determined in animals above 2 years age and lower 66.66 percent in 6 months - 2 years age animals (Table 12).

**Table 12: Prevalence of gastrointestinal parasitic infection in the intestinal contents of bovine**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>No.</th>
<th>Positive</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence</td>
<td>21</td>
<td>16</td>
<td>76.19</td>
</tr>
<tr>
<td>Male</td>
<td>03</td>
<td>03</td>
<td>100</td>
</tr>
<tr>
<td>Female</td>
<td>18</td>
<td>13</td>
<td>72.22</td>
</tr>
<tr>
<td>6 month – 2 yrs</td>
<td>09</td>
<td>07</td>
<td>77.78</td>
</tr>
<tr>
<td>Above 2 yrs</td>
<td>12</td>
<td>09</td>
<td>85.71</td>
</tr>
</tbody>
</table>

Prevalence of gastrointestinal parasitic infections in the intestinal contents of bovine revealed 42.86 percent single infections and 33.33 percent mixed infections. Highest prevalence of *Eimeria* spp was determined as 14.28 percent, followed by *Moniezia* spp and *Fasciola* spp as 9.52 percent, *Trichuris* spp and Amphistome were found in 4.76 percent samples. Mixed infections were observed in combination of nematode with cestode was 14.29 percent, nematode with protozoa was 9.52 percent and trematode with nematode was 9.52 percent in table 13.
Table 13: Prevalence of gastrointestinal parasitic infections in the intestinal contents of bovine

<table>
<thead>
<tr>
<th>Parasites</th>
<th>Aug n=6</th>
<th>Sep n=1</th>
<th>Oct n=3</th>
<th>Nov n=1</th>
<th>Dec n=4</th>
<th>Jan n=1</th>
<th>Feb n=4</th>
<th>Mar n=1</th>
<th>Positive percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trichuris</strong></td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>01 (04.76)</td>
</tr>
<tr>
<td><strong>Fasciola</strong></td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>02</td>
<td>02 (09.52)</td>
</tr>
<tr>
<td><strong>Amphistome</strong></td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01 (04.76)</td>
</tr>
<tr>
<td><strong>Monezia</strong></td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>02</td>
<td>02 (09.52)</td>
</tr>
<tr>
<td><strong>Eimeria</strong></td>
<td>02</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>03</td>
<td>03 (14.28)</td>
</tr>
<tr>
<td><strong>Single infection</strong></td>
<td>04</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>01</td>
<td>00</td>
<td>02</td>
<td>01</td>
<td>09 (42.86)</td>
</tr>
<tr>
<td><strong>Mixed infections</strong></td>
<td>02</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>01</td>
<td>02</td>
<td>00</td>
<td>07</td>
<td>07 (33.33)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>06</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>02</td>
<td>01</td>
<td>04</td>
<td>01</td>
<td>16 (76.19)</td>
</tr>
</tbody>
</table>

Monthly prevalence of different species of gastrointestinal (GI) parasites in the intestinal contents of bovine is shown in table 14. Highest number of sample was found positive for single parasitic infections in the month of August followed by February. *Eimeria* spp was found in highest percentage (14.28 %). In the month of February highest number of fecal samples was found positive for mixed infections.

Table 14: Monthly prevalence of different species of gastrointestinal parasitic infections in the intestinal contents of bovine
The number and percentage of eggs per gram/oocyst per gram was counted in 21 intestinal contents of bovine by Mc Master technique. Highest number of intestinal contents (08) comprising 02 buffaloes and 06 cattle intestinal contents were found positive for Strongyle eggs of them 01 intestinal contents of cattle having high EPG between 300-600. *Eimeria* oocysts were observed in 07 bovine intestinal contents of these 02 samples had OPG between 301-600 (Table 15).

**Table 15: Egg per gram/oocyst per gram in intestinal contents**

<table>
<thead>
<tr>
<th>Parasites</th>
<th>100-200</th>
<th>201-300</th>
<th>301-600</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bovine</td>
<td>Buffaloes</td>
<td>Cattle</td>
</tr>
<tr>
<td>Strongyle</td>
<td>04</td>
<td>01</td>
<td>03</td>
</tr>
<tr>
<td>Toxocara spp</td>
<td>02</td>
<td>01</td>
<td>01</td>
</tr>
<tr>
<td>Trichuris spp</td>
<td>00</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>Eimeria spp</td>
<td>02</td>
<td>00</td>
<td>02</td>
</tr>
<tr>
<td>Moniezia spp</td>
<td>03</td>
<td>03</td>
<td>00</td>
</tr>
</tbody>
</table>

**4.4 Pathology associated with gastrointestinal parasitic infections in bovine**

During the detailed post mortem examination, grossly adult parasites, larval stages and development stages of parasites were observed in GI tract of 16 animals were found as *Fasciola* spp in 4 animals of them 2 animals concomitant infected with hydatid cyst followed by *Moniezia* spp in 3 animals, *Trichuris* in 2 animals, *Fasciola* spp in 2 animals, Amphistome in 1 animal and hydatid cyst were observed in 1 animal. Microscopically, *Eimeria* spp were found in 5 animals with others infections.

The major pathological findings of these cases are described in detail as follows-
**Fasciola spp infections**

Of the 21 animals four (19%) cattle were found positive for *Fasciola* spp infection of them 2 were concomitant with hydatid cysts. History revealed chronic illness and foetid diarrhea.

External examination revealed emaciated, dehydrated carcasses with rough skin coat, shrunken eyes and soiled perianal region (Plate 02). Edema was observed in brisket and dewlap region and mucus membrane were pale.

Grossly, body cavities contain large amount of straw colored fluid with fibrin flakes. Gross lesions were confined to the liver. Livers were enlarged with round edges and variable sizes focal necrotic areas observed on the surface (Plate 03). Migratory tract and prominent thickened bile ducts appeared as pale white streaks. On section, thickened and prominent bile ducts contain large numbers of immature /mature flukes with yellow viscous, slimy fluid (Plate 04). Gall bladder was greatly enlarged and distended with thick bile which contains numerous adult parasites.

Concomitantly hydatid cysts with fasciola infested liver were also observed in two cases. Fluid filled variable size cysts were appeared elevated on the surface of swollen liver and embedded in to the hepatic parenchyma. Localized abscesses of variable sizes were encountered mostly near the surface. Cut surface of these livers showed cysts manifested cavities lined by a smooth membrane and numerous flukes admixed with dirty gray or yellow viscous, slimy fluid were observed in the thickened and protruding bile ducts.

Sections of liver revealed congestion of central vein and sinusoids were engorged with large number of RBCs. Degenerative changes, mild fatty changes, necrosis and cellular infiltration of neutrophils, eosinophils and lymphocytes were seen in adjoining parenchyma (Plate 05). Haemorrhagic migratory tracts formed from degenerated hepatocytes, erythrocytes and infiltration of polymorphs, eosinophils, and mononuclear cells (Plate 06). There was focal necrosis with heavy infiltration of inflammatory cells, proliferation of fibrous tissue in portal triad area. Hyalinization and mononuclear leucocytic infiltration in the wall of blood
vessels were also observed (Plate 07). Hepatic cirrhosis was observed as severe fibrous connective tissue proliferation, infiltrated with mononuclear leucocytes with the presence of hepatocellular atrophy (Plate 08). Bile ducts showed hyperplasia, desquamation and degeneration of epithelium. The fibroblasts were originated from the portal areas divided the hepatic parenchyma into lobules. Portal area showed newly formed bile ductules with infiltration of inflammatory cells and fibrosis (Plate 09). The bile ducts epithelium was highly hyperplastic and thickened with numerous eosinophils and mononuclear cells infiltration into the lamina propria (Plate 10). The hyperplastic bile ducts were forming papillomatous projections towards the lumen and containing flukes (Plate 11).

**Amphistome infection**

It was found in one cattle (4.76 %). Animal had history of chronic illness with persistent fetid diarrhoea, as well as injury in hind limb.

Carcass was emaciated and dehydrated with rough skin coat. Perianal region was swollen and soiled with feces. Submandibular edema, pale mucus membrane, straw coloured fluid in abdominal cavity and hydropericardium were noticed. Large numbers of small red flesh coloured mature and immature flukes were observed free and also attached to the mucosa of rumen. Mucosa of the upper part of the intestine was thickened, congested and covered with mucus.

Histopathologically, parasites were firmly attached with their posterior suckers to the ruminal mucosa. Necrosis of epithelium was observed at the point of attachment of fluke with the mucosa (Plate 12). Firino catarrhal inflammation, atrophy of villi and elongation of crypts were observed in the intestine. Intestinal contents revealed eggs of Amphistomes.

**Trichuris spp infections**

*Trichuris* worms were found in two buffaloes (9.52 %). History revealed marked diarrhea mixed with blood accompanied by tenesmus prior to death.

External examination revealed distended abdomen, rough body coat and pale mucous membrane. Grossly, all parts of intestine were
congested, caecum had semisolid contents. Wall of large intestine was very much thickened and mucosa was haemorrhagic with areas of ulceration. Numerous *Trichuris* worms were attached in the mucosa of caecum (Plate 13). Mesenteric lymph nodes were enlarged, oedematous and haemorrhagic (Plate 14).

Histopathologically, catarrhal and haemorrhagic inflammation found in caecum and colon. Necrotic debris in between the mucosal folds, degeneration of epithelial cells, infiltration of neutrophils, lymphocytes and eosinophils. Congested blood vessels were observed in muscularis mucosa and sub mucosa of intestine. Numerous trichuris worms embedded in the caecal mucosa (Plate 15). *Trichuris* worms body wall displayed cuticle with prominent annulations, hypodermis with hypodermal nuclei and portion of mucosa (Plate 16). Haemorrhages was seen in the mucosa and submucosa. The submucosa was thickened with increased amount of fibrous tissue (Plate 17). Haemorrhage and lymphoid depletion in the lymphnode was also noticed (Plate 18).

Intestinal content of one buffalo revealed eggs of *Trichuris* spp and intestinal content of cattle found positive of eggs of *Trichuris* spp and *Eimeria* oocyst.

**Cestode infections**

It was found in three female buffaloes (14.28 %). History revealed anorexia and intermittent diarrhea and sudden death of one buffalo.

All three carcasses were emaciated, dehydrated having rough body coat, distended abdomen and pale mucous membrane.

Grossly, straw colour fluid was found in abdominal cavity. Numerous white necrotic foci observed on the surface of liver. Ballooning of intestine and lumen were packed with numerous parasites (Plate 19) mixed with slimy mucus exudates and congested mucosa (Plate 20).

Microscopically, sections of intestine revealed villous atrophy desquamated cells and parasites in the lumen (Plate 21). Congestion of
mucosa, submucosa and cellular infiltration were also observed (Plate 22). Hyperplasia of crypt epithelium with numerous goblet cells was found.

Parasitological examination revealed eggs of *Moniezia* spp in 2 animals whereas in intestinal contents one buffalo showed eggs of *Moniezia* spp and oocyst of *Eimeria*.

**Eimeria** spp infections

It was found in 5 animals. History revealed diarrhea, feces mixed with mucus on external examination dehydrated carcasses with rectal prolapses and pale mucous membrane.

The intestinal contents were brown colour with flakes of mucous, fibrin and semi liquid in consistency. Intestinal mucosa revealed focal and diffuse congestion with edema. Mesenteric lymph nodes were enlarged and congested.

Various development stages of coccidia were observed in lining epithelium of the lamina propria of intestine. Extensive degeneration and desquamation of the mucosal epithelium and disorganization of intestine villi were also noticed (Plate 23). Flattening of villi and necrotic debris were also observed in the lumen of intestine (Plate 24). The blood vessels in mucosa and submucosa were congested and petechial hemorrhages were found in lamina propria. There was infiltration of macrophages, eosinophils and a few neutrophils and lymphocytes in the mucosa of intestine. Inflammatory cells were also evident in the lumen of intestinal glands (Plate 25). Various developmental stages of *Eimeria* spp were observed in the lamina propria below the crypt villous junction near the muscularis (Plate 26).

Intestinal contents of 3 animals revealed oocyst of *Eimeria* spp and 2 animals eggs of *Trichuris* spp and Strongyle was found with oocyst of *Eimeria*.

**Hydatid cysts infections**

It was found in 3 animals of them 2 animals were also infected with *Fasciola* spp. History showed illness and in-appetence from last 4 days and diarrhoea. Carcass was dehydrated with rough skin coat.
Gross pathology revealed pale mucous membrane, enlarged and swollen liver. Multiple pale necrotic foci and single or multiple grayish white fluid filled variable sized hydatid cyst were protruded on the surface and embedded deep in the liver parenchyma (Plate 27). The cyst formed from thick wall of double layers and lumen. The cyst contained turbid fluid in the living cyst while dead cyst contained clear fluid. In two cases liver were concomitantly infected with *Fasciola* spp. Cut surface showed cysts cavities lined by a smooth membrane which could be shelled out easily and thickened bile duct contains *Fasciola* spp (Plate 28).

Microscopically, hydatid cysts capsule was thick having from inside out a highly cellular zone rich in mononucleers and fibroblasts and an outer thick fibrous zone of concentrically arrange bundles. The cyst wall was formed of eosinophilic laminated cuticular structure (Plate 29). Some sections revealed cyst lined with degenerated germinal epithelium having a hayline layer detached from the surrounding tissue capsule and infiltration predominantly with lymphocytes and macrophages, occasionally neutrophils, eosinophils, giant cells and fibrous connective tissue were also observed (Plate 30). The hepatic parenchyma adjacent to cyst showed slight haemorrhages, leucocytic infiltration and mild hepatocellular degeneration. In one cattle hydatid scolex in the liver parenchyma in the fertile cyst were also observed (Plate 31).

Intestinal content showed eggs of Strongyle and oocyst of *Eimeria* in one cattle and *Fasciola* spp with Strongyle eggs in 2 cattle.
5. DISCUSSION

The gastrointestinal tract (GIT) of animals harbor a wide variety of parasites mainly helminths, which causes clinical and sub clinical parasitism. These parasites adversely affect the health status of animals and cause enormous economic losses to the livestock industry. The agro-climatic conditions, animal husbandry practices and pasture management have been shown to largely determine the incidence and severity of various parasitic diseases in a region. Therefore, information on the epidemiological patterns of the parasitic diseases in different agro-climatic zones of the country would provide a basis for evolving effective strategy for their management.

Total 120 fecal samples of bovine comprised of 44 samples of buffaloes and 76 samples of cattle were examined. By qualitative method as direct smear, sedimentation and flotation method were used for detecting parasitic eggs in feces. The overall prevalence of various gastrointestinal parasitic infections was recorded as 73.33 percent in bovine and was slightly higher in cattle 75.00 percent compared to 70.45 percent buffaloes. Postmortem prevalence was determined as 76.19 percent in bovine comprised of 77.78 percent buffaloes and 75.00 percent cattle. Numerically higher prevalence of parasitism was observed in animals of Livestock farm (LSF) than the animals of other dairy farms.

The prevalence of gastrointestinal (GI) parasitic infections was found in this study is much higher than the findings of Kashyap et al. (1997) reported 40.30 percent prevalence of GI helminthes in bovine of Madhya Pradesh. Whereas, this finding is more or less similar to the earlier finding of Gupta et al. (2012) who recorded 68.93 percent prevalence in bovine, 73.00 percent in buffaloes and 65.00 percent in cattle of same locality, whereas Mir et al. (2013) was reported 51.21 percent prevalence of GI parasitism in bovine, 38.70 percent in buffaloes and 67.15 percent in cattle of Jammu region. Variable prevalence of GI parasitism has been reported by different workers Hossain et al. (2011), 69.00 percent, Singh et al. (2012), 23.33 percent in buffaloes and Hirani et al. (2006) 44.2 percent, Regass et al. (2006) 50.20 percent, Rafiullah et al. (2011) 64.61 percent, Wadhawa et al. (2011) 11.
percent, Aktaruzzaman et al. (2013) 76.93 percent and Telila et al. (2014) 61.00 percent in cattle from different areas.

The variation in the findings with earlier reports might be due to the difference in the fecal samples size, selection of samples, period and place of study and geoclimatic conditions (temperature and humidity etc.) that favors the survival of infective stage of the parasites and of intermediate hosts, managemental conditions and deworming practice followed in different dairy farms. However, higher prevalence in cattle compared to buffaloes may be attributed to differences in feeding habit and hygienic habitats of the two species same justification was also supported by Bilal et al. (2009).

In present study there was higher occurrence of all gastrointestinal (GI) helminthes in male animals then female. Insignificant differences between sex was observed in similar with previous studies reported by Ardo et al. (2013).

The higher percentages of infection in male cannot be explained exactly but it might be due to neglected attitude of the farmers towards the management of male animals and preference attitude for female rising. These findings are in agreement with reported earlier by Fikru et al. (2006), Bilal et al. (2009) and Awraris et al. (2012) from different corner of the world. However, the higher prevalence was observed in female animals than the male of other farms might be due to the variation of the number of samples collected for examination.

Further, the data was analyzed on the basis of age group, it was noted that the animals above 2 years of age were more affected as 77.50 percent in bovine, 75.00 percent buffaloes and 78.84 percent cattle by gastrointestinal (GI) parasites as compared to animals of 6 months to 2 years of age as bovine 65.00 percent, 62.50 percent buffaloes and 66.66 percent cattle. Higher prevalence 88.88 percent was also determined in the intestinal contents of animals above 2 years age and lower 66.66 percent in 6 months to 2 years age animals. The prevalence of gastrointestinal parasites was at most comparable in both age groups.
The findings of present study were comparable to the reports of Telila et al. (2014) on bovine. The increase in prevalence of gastrointestinal parasites with the age has also been reported by Quershi and Tanveer (2009) they reported that the buffaloes showed higher prevalence in adults above 2 years of age (20.00 %) as compared to young ones below 2 years of age (15.00 %). This data is also in agreement with Rahman and Mondal (1983) who recorded heavy infection in cattle of 2-3 years of age than the young. The findings of this study are disagreed with the reports of Regassa et al. (2006) they stated that the younger animals are more susceptible than adult animals.

The cause of this variation in the prevalence of infection in different age groups are difficult to explain but it might be due to an immune status of animals, difference in the grazing area and management variation of animals.

In the present study single parasitic infection was observed in 45.82 percent fecal samples of them the prevalence of nematode (30.83 %), protozoa (10.00 %), trematode (3.33 %) and cestode (1.66 %), However, mixed infection was observed in 27.50 percent fecal samples.

The prevalence of trematode infections were found as Fasciola spp 1.66 percent, 0 percent and 2.63 percent, amphistome 1.66 percent, 2.27 percent and 1.31 percent in bovine, buffaloes and cattle, respectively. Higher prevalence was reported by Swarnakar et al. (2015) as Fasciola spp 4.44 percent and Amphistome in 11.06 percent in bovine and Gupta et al. (2012) found Fasciola spp 6.77 percent in buffalo and 0.99 percent in cattle, and highest prevalence of amphistome 45.00 percent in buffalo and 17.59 percent in cattle. In present study prevalence rate of snail born trematodal infection can be attributed to the fact that these animals are grazing on pasture contaminated by snail. Similar prevalence rate of amphistomosis had also been earlier reported from Punjab by Hassan et al. (2005). Among the prevalence of nematode, most prominent Strongyle type eggs (25.00 %) in bovine, buffaloes and cattle followed by Strongyloides spp type eggs (2.5 %), (2.27 %) and (2.63 %), Toxocara spp (1.66 %), (2.27 %) and (1.31%) and Trichuris spp (1.66 %), (0.0%) and (3.94 %) were found. Nematode was
higher infected with the prevalence of (30.00 %) in bovine, (29.54 %) in buffaloes and (28.94 %) in cattle compared to the other gastrointestinal (GI) parasites. *Eimeria* spp was reported in (10.00 %) bovine, (13.63 %) and (10.50 %) buffaloes and cattle, respectively.

Present investigation revealed that nematode infections was highly prevalent, followed by oocysts of coccidia, trematode and cestode species. The main nematodes recovered from the present study were Strongyle. The Strongyle eggs were highly prevalent, most common and found in large number in the domestic ruminants compared to other parasites are in agreement with Biu *et al.* (2009) and Swanakar *et al.* (2015).

The cestode observed in the present study was *Moniezia* spp with the prevalence of 1.66 percent in bovine, 2.27 percent in buffalo and 1.31 percent in cattle. The occurrence of cestode species is very few compared to others gastrointestinal parasites these findings are in line with the findings of (keyyu *et al.*, 2006 and Swanakar *et al.*, 2015). However, higher prevalence was reported as 5.2 percent by Hailu *et al.* (2011) and lower prevalence by Gupta *et al.* (2012) (0.28 percent in buffalo and 0.71 percent in cattle) and Aktaruzzaman *et al.* (2013) reported 0.7 percent prevalence in cattle. The variation in the prevalence might be due to the opportunity of exposure to the intermediate host and the free living soil mites on pasture.

The prevalence of *Eimeria* spp reported in the current study was 10.00 percent in bovine and higher in cattle 8.00 percent than the buffaloes 6.00 percent. The prevalence rate was more or less with the findings of Haque *et al.* (2011) who reported 13.42 percent prevalence in bovine. Gupta *et al.* (2012) reported higher prevalence of coccidia in cattle as 24.25 percent and 22 percent in buffaloes. The prevalence difference among the genera of helminthes in different study area indicates that the topography and climatic condition of each study area vary from one another in supporting infectivity of different parasites and development of their intermediate hosts.

The monthly prevalence of GI parasites were observed with maximal percent of parasitic infection in bovine were recorded in the month of September (81.81 %) followed by March (80.00 %) and least parasitism was
observed in December (61.11 %). According to Hailu et al. (2011) the overall prevalence of gastrointestinal helminths infection was high in October (wet month) and low in February. The reason for this could be due to the conduciveness of the environmental condition for the development of larvae.

Maximal percentage of Strongyle eggs were recorded during the study period with maximal prevalence in the month of January. Present study shows similarity with Swarnakar et al. (2015) they noted that prevalence of nematode was higher infected with (35.41 %) in bovine. Rafiuullh et al. (2011) and Mir et al. (2013) stated that heavy Strongyle infections causes reduction in fertility, work capacity, reduction weight and milk production.

The eggs/oocyst per gram of feces was considered to be the estimation of the intensity of infections of helminths in bovine. The infected animals were grouped on the basis of intensity of infections as low (100-200), moderate (201-300) and severe (301-600). During the study 9 fecal samples and only 1 intestinal contents showed the nematode egg count that ranged from 301-600 EPG, while in the range between 201-300 EPG total 32 fecal samples and 5 intestinal content were found positive and 100-200 EPG were counted in the 11 fecal samples and 6 intestinal contents. The eggs of cestode were counted in 1 fecal sample and 3 intestinal content, that ranged between 100-200 EPG and 1 fecal sample counts was in the range between 201-300 EPG. However, 15 fecal samples and 2 intestinal content counts for oocyst of Eimeria that ranged in between 301-600 EPG. 7 samples and 2 intestinal contents and 9 fecal samples and 3 intestinal contents counts were in between the ranged of 100-200 and 201-300 EPG, respectively. The degree of EPG in most of the fecal samples (43) was in between the range of 201-300 and (11) intestinal contents were in between the ranged of 100-200 EPG. The degree of EPG in the most of the study animals was moderate intensity of infection are agreeing with the earlier reports (Regassa et al., 2006) indicating the subclinical cases of gastrointestinal parasites. Soulsby (1982) suggested that the presence of 300-600 EPG of nematode in bovine can cause the infection and 100-200 EPG of cestode are pathogenic to bovine.
During the detailed post mortem examination of 21 bovine, grossly adult parasites and developmental stages of parasites were observed in gastrointestinal (GI) tract of 16 animals. Of the 21 animals 4 (19.00 %) cattle were found positive for *Fasciola* spp infection of them 2 were concomitant with hydatid cysts. The higher prevalence of *Fasciola* spp in slaughtered cattle was noted previously as (78.73 %) by Shaikh *et al.* (1983) and lower prevalence of fascioliosis (3.61 %) was mentioned by Ghoneim *et al.* (2011).

The *Fasciola* spp infection was observed in the present study probably due to animals grazing on pasture contaminated by snails or contaminated roughages provided to the animals. This variability of prevalence probably may be due to the ecological and climatic differences between different locations and availability of the suitable intermediate host and development of the parasitic stages. Chronic illness, emaciation with dehydrated rough skin coat of infected animals might be due to chronic diarrhoea affect the nutrient absorptions and fluid loss lead to deterioration of the body condition in cattle manifested with chronic stage of fascioliosis are in agreement with the findings of Woldemariam and Wossene (2007). Gross lesions as enlarged, firm, liver with multiple pin point reddish foci or haemorrhagic streaks and variable sizes focal necrotic areas on the hepatic surface were observed. These foci on the surface represented the point of entrance of the immature parasites into the liver structure. The focal necrotic areas on the surface of liver is in agreement with the study of Sayed *et al.* (2008) who proved that invasion of liver by migratory immature liver fluke damages the tissue and provide anaerobic condition, that allowed the germination and proliferation of bacteria that induce hepatocellular necrosis. Thickened and prominent bile ducts contain large numbers of immature flukes with yellow viscous, slimy fluid on cut surface of liver. These findings are in agreement with those mentioned by Carlton and McGavin *et al.* (2001), Ahmedullah *et al.* (2007) and Sayed *et al.* (2008).

Microscopic findings revealed congestion of central vein and sinusoids were engorged with large number of RBCs. Degenerative changes, mild fatty changes, necrosis and cellular infiltration of neutrophils, eosinophils
and lymphocytes were seen in adjoining parenchyma. Similar results were also recorded by McGavin et al. (2001). Haemorrhagic migratory tracts formed from degenerated hepatocytes, erythrocytes and infiltration of polymorphs, eosinophils, and mononuclear cells. Focal necrosis with heavy infiltration of inflammatory cells, proliferation of fibrous tissue in portal triad area was observed. These findings are in agreement with the findings of Doy and Hughes (1984), Okaiyeto et al. (2012) who proved that the migration of immature liver flukes through the tissue causing haemorrhage and irritation, and brought the cellular inflammatory reactions. Hyalinization and mononuclear leucocytic infiltration in the wall of blood vessels were also observed are in line with the findings of El-Dakhly et al. (2007) and Sayed et al. (2008). Bile ducts showed hyperplasia, desquamation and degeneration of epithelium. The fibroblasts were originated from the portal areas divided the hepatic parenchyma in to lobules. Portal area showed newly formed bile ductules with infiltration of inflammatory cells and fibrosis. The results are in agreement with the findings of Doy and Hughes (1984). The bile ducts epithelium was highly hyperplastic and thickened with numerous eosinophils and mononuclear cells infiltration into the lamina propria. The hyperplastic bile ducts were forming papillomatous projections towards the lumen and containing flukes. Several studies detected that the presence of mature flukes within the lumen of intrahepatic bile ducts which brought a continuous irritation caused by spiny surface of the flukes and their feeding habits lead to hyperplastic proliferations which were emphasized by papillomatous projections and newly formed bile ductules. These findings are congruent with the earlier findings of Shaikh et al. (2004).

Amphistomosis is a widespread disease of buffaloes and cattle. Acute disease has been reported in young animals while older animals are capable of withstanding massive infections (Soulsby, 1982). The postmortem prevalence of amphistome was observed in (4.76 %) in 5 year bovine. Our findings are partially correlated with the findings reported by Titi et al. (2014) who mentioned the significant prevalence and intensity of paramphistomosis were observed especially in bulls above 5 years old. The condition mainly seen in adult animals with the age may be due to an increasing accumulation
of adult paramphistomes in their rumen during the past years with repeated infections with metacercariae. According to Cheema et al. (1997), pathogenic effect of paramphistomosis depends on the number of parasites present in the animals.

Anemia, hypoproteinemia manifested as pale mucus membrane and submandibular edema and emaciation of the host ensue. In the present observation, large numbers of small red flesh coloured mature and immature flukes were observed free and also attached to the mucosa of rumen. Mucosa of the upper part of the intestine was thickened, congested and covered with mucus. These findings are in agreement with the previous reports of Siddiqui and Shah (1984), Rolfe et al. (1994) and Love and Hutchinson, (2003).

Histopathologically, parasites were firmly attached with their posterior suckers to the ruminal mucosa. Necrosis of epithelium was observed at the point of attachment of fluke with the mucosa. This may be to result from parasites sucking the rumen mucosa into the acetabulum. Similar findings were also recorded by Rolfe et al. (1994) and Ozdal et al. (2010) who reported similar microscopically lesion in the rumen of cattle. Most infections of adult flukes are harmless although large numbers of flukes can cause a chronic ulcerative rumenitis with atrophy of ruminal papillae. In present study firino catarrhal inflammation, atrophy of villi and elongation of crypts was observed in the intestine this study is partially correlated with the findings reported by (Love and Hutchinson, 2003) who mentioned the catarrhal to necrotic and haemorrhagic duodenitis with less thickening may be seen in the early stages, progressing to be thickening (mucosal edema, submucosal hypertrophy), haemorrhages and ulceration. After the juvenile fluke migrated to the rumen, the intestine repairs, leaving a thickened duodenum and jejunum as a result of diffuse mucosal and submucosal hypertrophy and fibrosis.

Trichuris spp (Whipworm) are a common haematophagous parasitic nematode of cattle worldwide. In the present study Trichuris spp were observed in 2 buffaloes with the prevalence of (9.52 %). Smith and Stevenson (1970) revealed Trichuris spp in eight calves. Bovine whipworm
Infestations are generally thought to be clinically inconsequential (Anderson, 2000 and Bowman, 2003). However, scanty literature is available regarding pathology of trichurosis in bovine. History revealed marked diarrhea mixed with blood accompanied by tenesmus prior to death; these findings are partially agreement with the previous studies of Farleigh (1966), Smith and Stevenson (1970) who stated that *Trichuris* spp infection attributed anorexia, chronic diarrhoea, dysentery and pronounced loss of condition and death of animals.

The gross pathological changes observed as congested intestine, caecum had semisolid contents, wall of large intestine was very much thickened and mucosa was haemorrhagic with areas of ulceration. Numerous *Trichuris* worms were attached in the mucosa of caecum. Mesenteric lymph nodes were enlarged, edematous and haemorrhagic. Similar findings were also reported by Smith and Stevenson (1970) and Soulsby (1982).

Microscopically, catarrhal and haemorrhagic inflammation found in caecum and colon. Necrotic debris in between the mucosal folds, degeneration of epithelial cells, infiltration of neutrophils, lymphocytes and eosinophils and congested blood vessels were observed in muscularis mucosa and submucosa of intestine. Numerous *Trichuris* worms embedded in the caecal mucosa. Smith and Stevenson (1970), Perdrizet and King (1986) and Greg (2004) also describes the similar microscopic lesions.

Adult tapeworms mainly inhibit the intestinal tract of ruminants, such as cattle, buffaloes, sheep and goats. They lack an alimentary tract and absorb nutrients through the specialized absorptive surface or tegument of the proglottids. The parasite needs an intermediate host, the oribatid mites or psocids to complete its lifecycle. Prevalence of tapeworm infection was observed to be (14.28 %) in buffaloes. Considering that the animals infected with the *Moniezia* spp via infected oribatid mites in the roughages or living in the cattle bedding litter are in agreement with the findings of (Watanabe *et al.*, 1957 and Denegri, 1993). Irie *et al.* (2013) stated that lateral transmission of infections occurs once *Moniezia* spp is introduced to a farm, the infection can
be automatically maintained. Grossly, numerous white necrotic foci observed on the surface of liver. Ballooning of intestine and lumen were packed with numerous parasites mixed with slimy mucus exudates and congested mucosa. These findings are in line with the findings of Bhatia et al. (2006) and Jubb et al. (2008).

Microscopically sections of intestine revealed villous atrophy desquamated cells and parasites in the lumen. Congestion of mucosa, submucosa and cellular infiltration were observed. Hyperplasia of crypt epithelium with numerous goblet cells and infiltration of inflammatory cells were observed around the scolex found deep in the intestinal mucosa. These results were in a compliance with those mentioned by Borthakur et al. (2006) and Maxie et al. (2007).

Bovine coccidiosis primarily confined to the intestine, principally the colon and rectum. Radostits and Stockdal (1980) also reported gametogony of Eimeria bovis and Eimeria zuernii usually occurs in epithelial cells of the caecum and colon but in heavy infections of Eimeria bovis may occur also in the lower ileum. In present study feces mixed with mucus and blood were observed. Intestinal mucosa revealed focal and diffuse congestion. The intestinal contents were brown colour with flakes of mucus, fibrin and semi liquid in consistency. These findings are congruent with the earlier findings of Soulsby (1982) and Maxie et al. (2007).

Microscopically, intestinal villi revealed disorganization, extensive degeneration and desquamation of the mucosal epithelium. These findings are in agreement with the findings of Pande et al. (1968). Flattening of villi and necrotic debris were also found in the lumen of intestine. The blood vessels in mucosa and submucosa were congested and petechial haemorrhages were found in lamina propria. These results completely agree with that obtained by Radostits and Stockdal (1980). The mucosa of intestine was infiltration of macrophages, eosinophils and a few neutrophils and lymphocytes. These findings were in accordance with those recorded by Maxie et al. (2007) and Singh et al. (2008).
*Echinococcus granulosus* is a helminth parasite, which causes a zoonotic disease known as echinococcosis or hydatid disease. The larval stage (hydatid cyst) infects livestock herbivores whereas, the adult lives in the small intestine of carnivores (mainly canines). The high prevalence of hydatidosis in the bovine has been recorded (14.28 %). These results can be compliance with the work of Verma and Swamy (2009) and Elmajdoub and Rahman (2015).

The present study revealed that the presence of hydatid cysts in the liver of bovine may arise due to differences in environmental conditions needed for persistence of the parasites in abundance of infected definitive host, nature of pasture and grazing patterns of animals.

Gross pathology revealed pale mucous membrane, enlarged and swollen liver. Fluid filled variable sized hydatid cyst were protruded on the surface and embedded deep in the liver parenchyma. Cut surface showed cysts cavities lined by a smooth membrane which could be shelled out easily. These results completely agree with that obtained by (Osman, 2008 and Verma and Swamy, 2009).

Microscopically, hydatid cysts capsule was thick having from inside out a highly cellular zone rich in mononuclear and fibroblasts and an outer thick fibrous zone of concentrically arrange bundles. The cyst wall was formed of eosinophilic laminated cuticular structure. These lesions were in a hormony with those mentioned by Dhote et al. (1992), Verma and Swamy (2009), Al Se’adawy and AlKaled (2012). Cyst lined with degenerated germinal epithelium having a hayline layer detached from the surrounding tissue capsule and infiltration predominantly with lymphocytes and macrophages, occasionally neutrophils, eosinophils, giant cells and fibrous connective tissue were also observed. The hepatic parenchyma adjacent to cyst showed slight haemorrhages, leucocytic infiltration and mild hepatocellular degeneration. Similar findings were noticed by Motwally and Sami (1982), Osman (2008) and Borai et al. (2013). suggested that the hepatocellular degeneration and necrosis may be either due to progressive action of intracellular enzymes of the injured cells or to a metabolic disturbance may led to the inhibition of protein synthesis.
In the present study gastrointestinal parasites with varying degree of severity were found in present study. However, on the basis of these lesions alone it is difficult to conclude the pin point etiology because present study emphasized only GI parasitism and could not explore the other etiological agents like bacteria, virus etc. thus it is possible that multiple pathogen may be involved for observed pathological changes and these changes differ despite same etiology and severity of lesions it may also be depends on immune status of individual animals.
6. SUMMARY, CONCLUSIONS AND SUGGESTIONS FOR FURTHER WORK

6.1 Summary

Gastrointestinal parasitism is one of the major health problems and cause considerable global economic losses as a consequence of reduced weight gain, digestive disturbance, lowered production, impaired reproductive performance, condemnation of affected organs and mortality in infected animals. Parasites, their eggs and excretion-secretion products can directly induce host pathology in many infections. The mature worms produce toxins that destroy red blood cells, leading to unthrifty anaemic condition. Immature worms migrating through the body tissues open the way for bacteria and fungi to enter, causing some other serious diseases. Keeping in view the present study was carried out with two objectives, the prevalence of gastrointestinal parasitic infection from ante-mortem and postmortem cases of pathological lesions associated with gastro intestinal parasites in young bovine.

The study was conducted for a period of eight months from August 2014 to March 2015. Buffaloes and cattle of both sex and different breeds, from Livestock Farm, Adhartal (LSF) and different dairies in and around Jabalpur were used for the study purpose. For parasitological examination 120 fecal contents were collected directly from rectum of 44 buffaloes and 76 cattle and processed by standard procedure. Total 21 bovine carcasses comprising 9 buffaloes and 12 cattle were received during the study period and used for study purpose. Detailed postmortem examination was conducted for all 21 animals. Intestinal contents of these animals were also collected for parasitological examination. Tissues (liver, intestine, mesenteric and hepatic lymph nodes) showing lesions associated with parasitic infections were collected at the time of necropsy in 10 percent buffered formalin and processed by standard techniques for histopathological examinations.
Prevalence of gastrointestinal parasitic infections was calculated as (73.33 %) in bovine comprised of (70.45 %) in buffaloes and (75.00 %) in cattle. Prevalence rate (73.25 %) and (73.52 %) were recorded in LSF, Adhartal and in other dairy farms respectively. Sex wise prevalence of GI parasites showed that the male animals were more susceptible than female animals (83.33 % male and 70.83 % female). Animals above 2 years of age were more affected when compared to animals of 6 months to 2 years of age.

Bovines found positive for single parasitic infection and their total percent were determined as 45.83 percent. A total of seven spp of helminths and one spp of protoza were identified of them trematode 3.33 percent were *Fasciola* spp 1.66 percent and Amphistome 1.66 percent, nematode 30.83 percent were Strongyle 25.00 percent, Strongyloides 2.5 percent and *Toxocara* spp1.66 percent, protozoa 10 percent was found only *Eimeria* spp 13.33 percent. Whereas, 27.50 percent prevalence of multiple parasitic infections were recorded in combination with trematode and nematode 3.33 percent, trematode and cestode 2.5 percent, nematode and cestode 3.33 percent, nematode and protozoa 18.33 percent in fecal samples.

Maximal percent of parasitic infection in bovine were recorded in the month of September 2014 (81.81 %) followed by March (80.00 %) and least parasitism was observed in December (61.11 %). Maximal percentage of Strongyle eggs were recorded during the study period (30/120) with maximal prevalence in the month of January. Higher prevalence of mixed infections was observed in the month of October and March. However, in the month of November highest number of fecal samples was positive for parasites. The highest number of strongyle eggs that ranged from 201-300 egg per gram was counted in fecal samples of bovine.

During the detailed post mortem examination the gross pathological lesions associated with parasitic infection were found in 52.38 percent animals and 76.19 percent intestinal content found positive for eggs of different parasites.
Lesions associated with presence of parasites were observed as *Fasciola* spp 19 percent, Amphistome 4.76 percent, Hydatid cyst 14.28 percent, *Trichuris* spp 9.52 percent, *Moniezia* spp 14.28 percent and *Eimeria* spp with other nematodes 23.80 percent cases.

Significant gross lesions associated with *Fasciola* spp were confined to the liver. The affected livers showed haemorrhagic migratory tract and lodgment of the parasites in the thickened bile ducts. Microscopically, haemorrhagic migratory tracts formed from degenerated hepatocytes, erythrocytes and infiltration of polymorphs, eosinophils, and mononuclear cells. Portal area showed newly formed bile ductules with infiltration of inflammatory cells and fibrosis. Part of parasite was embedded in the lumen of bile ducts associated with hyperplasia in the lining epithelium with polyps formation and periductal inflammatory cell infiltration.

Macroscopically large numbers of small flesh coloured mature and immature Amphistome flukes were observed free and also attached to the mucosa of rumen. Mucosa of the upper part of the intestine was thickened, congested and covered with catarrhal exudates. Histopathologically, Necrosis of mucosal epithelium was observed at the point of attachment of fluke and fibrino-catarrhal inflammation was observed in the intestine.

Fluid filled variable sized hydatid cyst were protruded on the surface and embedded deep in the liver parenchyma. Microscopically hydatid cysts capsule was thick having from inside out a highly cellular zone rich in mononucleers and fibroblasts with or without scolex and an outer thick fibrous zone of concentrically arrange bundles.

Grossly, thickened caecum with numerous trichuris worms were attached to the congested mucosa. Sections of caecum revealed necrotic debris, mucus, eosinophils, neutrophils, lymphocytes and parasites embedded in mucosa. Inflammatory cells infiltration also extended into the muscularis mucosa and submucosa and double-operculated eggs of *Trichuris*-like worm were also observed.
The lumen of intestine was packed with *Moniezia* and mucus exudates, mucosal surface were congested. Sections of intestine revealed congestion, necrosis and parasites in the lumen.

Grossly, intestine was congested and lumen contains fluid mixed with mucus and fibrin. Section of intestine revealed villous atrophy, hyperemia, hyperplastic epithelium, infiltration of mononuclear cells in mucosa and submucosa. Various development stage of eimeria was also observed in the lamina properia.
6.2 Conclusions

1. The prevalence of gastrointestinal parasitic infections was observed in 73.33 percent, with higher rate of infection in animals above 2 year of age.

2. Maximal percent of parasitic infection in bovine were recorded in the month of September (81.81 %) and least parasitism was observed in December (61.11 %).

3. Maximal prevalence of Strongyle 25.00 percent, followed by *Eimeria* spp 13.33 percent, *Strongyloides* spp 2.5 percent and *Toxocara* spp1.66 percent was observed. However, 27.50 percent prevalence of mixed parasitic infections was also recorded.

4. Chronic fascioliasis is characterized by presence of liver flukes within the lumen of the bile ducts.

5. Distortion and enlargement of liver is observed with intense chronic tissue reaction around cysts and inflammatory cells infiltration in hydatidosis.
6.3 Suggestions for further work

1. Molecular and immunodiagnostic methods can be used for early detection of parasitic infections in bovine.
2. Detailed ultrastructural changes associated with different parasites should be studied.
7. REFERENCES


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APPENDIX- I

Processing of samples

Faecal / Intestinal samples

- Physical examination
  - Odour
  - Consistency
  - Colour

- Microscopic examination
  - Direct smear
  - Concentration method
    - Flotation method
    - Sedimentation method
Composition of different stains used in staining

i. Weigert’ iron hematoxilin:
   Solution A
   Hematoxilin 01.0gm
   Absolute alcohol 100gm
   Solution B
   29% ferric chloride 04.0ml
   Distilled water 95.0ml
   Hydrochloric acid, concentrated 01.0ml

Working solutions
Equal parts of solution A and solution B were mixed

ii. Bouin’s solution:
   Picric acid, saturated aqueous solution 75.0ml
   Formaldehyde, 37-40% 25.0 ml
   Glacial acetic acid 05.0ml

iii. Biebrich Scarlet- Acid Fuchsin Solution:
   Biebrich scarlet, aqueous 1% 90.0ml
   Acid fuchsin, aqueous 1% 10.0ml
   Glacial acetic acid 01.0ml

iv. Phosphomolybdic – Phosphotungstic acid Solution:
   Phosphomolybdic acid 05.0gm
   Phosphotungstic acid 05.0gm
   Distilled water 200ml

v. Aniline Blue Solution:
   Aniline blue 02.5gm
   Acetic acid 02.0ml
   Distilled water 100ml

vi. 1% Acetic water
   Glacial acetic acid 01.0ml
   Distilled water 100ml

vii. Toluidine Blue
   Touidine blue 0.1gm
   Distilled water 100.0 cc