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Prevalence of coccidiosis in poultry farms in District Chakwal Punjab Pakistan

Qualab Naveed[1], Rani Faryal[2*], Nargis Aasma Rani[3], Farooq Ahmad[4], Bilal Hussain[5]

[1]*Department of Microbiology Faculty of Biological Science Quaid-I-Azam University Islamabad, Pakistan*

[2]*Department of Microbiology Faculty of Biological Science Quaid-I-Azam University Islamabad, Pakistan*

[3]*Mphil, Department of Statistics, International Islamic University, Islamabad, Pakistan*

[4]*Assistant professor Higher Education Department, Punjab, Pakistan*

[5]*Department of Microbiology Faculty of Biological Science Quaid-I-Azam University Islamabad, Pakistan*

Dr Rani Faryal, Professor, Department of Microbiology, Quaid-i-Azam University, Islamabad , Pakistan

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Abstract

Coccidiosis is one of the most deadly and costly disease of poultry. In this study prevalence of coccidiosis and different species of *Eimeria* were studied in organized poultry industry (2013-2017), of District Chakwal, Punjab, Pakistan. From February 2013 to October 2017, 5700 gut and 5700 fecal samples of broiler and Layer chickens suspected for coccidiosis were collected. Overall prevalence of coccidiosis was 59.19% (Gut 55.93% and fecal 62.46%). Seven species of *Eimeria* were detected. *E. tenella* was dominant circulatory species and *E. brunette* was least one. Young flocks show significantly high susceptibility then older. Frequency of coccidiosis in broiler was 50.24% and 9.20% in Layer. There was significant difference in prevalence of coccidiosis in rainy season (August, 85.10%), then dry and hot season (Jun, 44.9%). The prevalence of clinical diseases was 27.97% and 32.36% were subclinical. Prevalence of coccidiosis in rise hull 32.42% and 27.90% in wood shaving. Prevalence of coccidiosis in difference good, normal, and poor management conditions are 14.47%, 17.17%, and 28.5% respectively. In gut and fecal samples similar trend was observed. Study shows coccidiosis was serious problem of local poultry industry. Better management of poultry farms, use of better management technique, bio-security, Stander operating procedure tend to lower outbreaks of disease.

* **Corresponding Author:** Rani Faryal ✉ ranifaryal@gmail.com

Introduction

Coccidiosis is caused by the genus *Eimeria* and nine species are known to occur in chicken, which are widely distributed throughout the world Soulsby (1982); Lillehoj and Trout (1993); McDougald and Reid (1997); Pant *et al.* (2018). Coccidia exhibit marked degree of host specificity (Becker (1948); Boles and Becker (1954); Hadipour *et al.* (2011); Amare *et al.* (2012); Bachaya *et al.* (2012); Dinka and Tolassa (2012); Kala *et al.* (2013) and Singh and Meitei (2015). *E. tenella* and *E. necatrix* are the most pathogenic species. *E. acervulina*, *E. maxima* and *E.* mivati are common and slightly moderate pathogenic; *E. brunetti* is uncommon but pathogenic when it does occur. *E. mitis*, *E. praecox* and *E. hagani* are relatively non-pathogenic species (Reid (1978); Soulsby (1982); Guale (1990); Lillehoj and Trout (1993); Lee *et al.* (2010); Jadhav *et al.* (2011). The occurrence of clinical coccidiosis is directly related to the number of sporulated oocysts ingested by a bird at one time, the pathogenicity of the *Eimeria* species, the age of the infected chicken and the management system (Reid (1990); Lillehoj and Trout (1993); Whitmarsh (1997); Awais *et al.* (2012).

Human beings are the main mechanical transmitters in disseminating oocysts, which could be carried over by manure clinging to shoes or by utensils carried about from one pen to another. Flies, beetles, cockroaches, rodents, pets and wild birds have also been incriminated as mechanical vectors (Reid (1978); Chapman (1997); Adib-Nishaboori *et al.* (2000); Gyorke *et al.* (2013); Zhang *et al.* (2013); Sharma *et al.* (2015). Oocysts may survive as long as 86 weeks in shaded soil. But sunlight assists in destruction of oocysts. Incubator temperature for several days will kill oocysts, so there is little danger of hatchery transmission to the baby chicks. Oocysts are so resistant to disinfectants that they survive stringent attempts to kill them (Patillo and Becker (1955); Lunden *et al.* (2000).

Coccidia infections in chicken cause greater financial losses than in other domesticated birds. It costs on yearly basis, for prophilaxis, as well as therapy exceed two billion Euros (Graat *et al.* (1996); Dallouil and Lillehoj (2006); Ahad *et al.* (2015). In general, the losses caused by coccidiosis without including the sub clinical coccidiosis are estimated to be 2 billion USD throughout the world (O'Lorcain *et al.* (1996); Williams (1999; 2005); Gari *et al.* (2008). Losses due to sub clinical forms of the disease are heavy and can't be estimated (Lee *et al.* (2010); Awais *et al.* (2012). Methuselah *et al* (2002) has reported that coccidiosis contributes to 8.4% loss in profit in large scale farms and 11.86% loss in profit in small scale farms (Gari *et al.* (2008); Zaman *et al.* (2012).

In cage system the lowest rate of infection is 1% (Guale (1990); Reid (1990); Morris *et al.* (2007); Iacob and Duma (2009). In deep litter poultry houses, which offer optimal condition of temperature and humidity for oocyst sporulation, the risk of infection is further increased (Urquhart *et al.* (1996); Amin *et al.* (2014). Infection with single species of coccidium is rare in natural conditions, and mixed infections are common. Nevertheless, in many outbreaks the clinical entity can be ascribed principally to one species or occasionally a combination of two or three (Soulsby (1982); Ayaz *et al.* (2003); Gari *et al.* (2008); Gyorke *et al.* (2013). The clinical disease is dependent on the number of oocysts ingested by individual birds. If the environment hygiene is poor, this number may be very large which is particularly true for *E. tenella* that have high biotic potential. But in very light doses no clinically recognizable symptoms may occur and thus, the morbidity and mortality increase in proportion to the size of the dose ingested (Soulsby (1982); Kinung'hi *et al.* (2004); Williams (2005); Morris *et al.* (2007); Chapman (2009); Iacob and Duma (2009).

Preliminary studies on the prevalence of coccidiosis done in the past have shown that both clinical and sub clinical coccidiosis have been occurring with low prevalence rate in the local strain chicken kept under the backyard production system than in the commercially oriented production systems (Guale (1990); McDougald (1998, 2003b); Ashenafi, *et al.*

(2004); Williams (2005). The range of coccidial infection prevalence has been reported as low as less than 10 % to as high as more than 90 % in broilers globally (Morris and Gasser (2006); Haug *et al.* (2008); Karaer *et al.* (2012); Singh *et al.* (2015). The prevalence of the disease in broiler was 33.07% (Sultana *et al.,* (2009). Prevalence of coccidiosis in free-range chicken in Sidi Thabet, northeast Tunisia was 31.8% (Kaboudi *et al.* (2016). Infection rate was reported to be 54.3% in Turkey (Karaer *et al.* (2012), 20.6% and 70.9% in Ethiopia (Gari *et al.* (2008); Elmira *et al.* (2012) 31.7% and 39.6% in India (Nikam *et al.* (2012); Sharma *et al.* (2013), 36.7% and 52.9% in Nigeria (Muazu *et al.* (2008), 71.9% in Pakistan (Khan *et al.* (2006), 78% in Jordan (Al-Natour *et al.* (2002), 88.4% in Argentina (Mc-Dougald and Mattiello (1997) and 92% in Romania (Gyorke *et al.* (2013). In Iran, this rate was reported to be 75% in North, 64% in Southwest, 55.96% in Northwest, and 38% in Northeast regions (Razmi and Kalideri (2000); Nematollahi *et al.* (2009); Hadipour *et al.* (2011); Shirzad *et al.* (2011).

If we have knowledge of level of burden of species of *Eimeria* in local poultry industry, better model for control this menace will be formulated and can protect our poultry industry. Prevalence of coccidiosis will help us to formulated epidemiological database and frequencies of different species of *Eimeria* are necessary to control uncertain and sudden outbreak of disease and to design better preventive measure. It is useful with respect to geographical epidemiology of this disease.

Materials and methods

Study area

The study area comprised of Chakwal distric which is located in salt range and Chail peaks at the height of 1128 meters or 3701 feet, above sea. District has an area of 6609 square kilometers. It has five Tehsils and 68 union councils. Chakwal located in Punjab, Pakistan is a semi-arid area. Average temperatures in summers, it remains between 15° C and 40° C and may go up to a maximum of 51° C. The winter temperatures remain between –4° C and 25° C.

Ethical approval

Research work was approved by ethical committee in Department of Microbiology, Quaid-i-Azam University Islamabad.

Sampling

From February 2013 to June October 2017, 5700 gut & 5700 faecal samples of broiler and Layer chickens suspected for coccidiosis were collected from poultry sale point and poultry farms in adjacent areas reported to have signs of coccidiosis. The samples i.e. intestines along with caeca were collected in 2.5% (w/v) potassium dichromate solution and stored in the dark at 4°*C*. At the time of sample collection, information regarding age, no. of birds per house, no. of houses in the poultry farm, house dimensions, season, use of anticoccidials, ventilation system, genotype of broilers, management practices like watering and feeding methods, condition of drinkers and feeders, nature and condition of litter, frequency of change of litter; were recorded from poultry farmers.

Processing

The samples were brought to Molecular Microbiology, Quaid-i-Azam University Islamabad for further analysis. For the isolation of oocysts, each sample was processed using the method described by Eckert *et al.* (1995).

Symptom of Clinical Coccidiosis

Depression, Blood in feces, something white water feces, Decrease in food consumption, discoloration, wing drooping, slow growth, stressed birds, high mortality, intestinal lesion diarrhea, emancipation, enteritis were used as clinical symptom of Coccidiosis. Clinical status of disease means that sign and symptom of disease are present poultry farms. There is great mortality of birds in flocks in clinical form of disease. In subclinical forms of this is no or less mortality.

Gut Examination

Intestine was freed from mesentery and surface of intestine was carefully observed for the presence of

blood clotting, or pitchy patchy or inflamed area. Different species of *Eimeria* infect different part of intestine and have characteristic lesion shape and pattern. Different parts of intestine were carefully open with the help of scissors and observed. Gross lesion score were taken along with other pathological problem ranging from petechi, reddening, thickening, ballooning, hemorrhage (bleeding), caecal core, whitish spot, ladder like appearance, from ceacal destruction to swelling of whole intestine. Depending upon the amount of intestinal destruction, type of species and severity of diseases specific number were allotted ranging from 0-4.

Mucosal Scrapping Examination

When there is any clue from for the presence of Coccidiosis from fecal samples or from sign and symptom such as bloody diarrhea is due to *Eimeria tenella*, whitish diarrhea is indicator of *Eimeria acervulina*.

Fecal Examination

Fecal samples from each poultry farm were collected in plastic zipper bag. Fecal samples were collected in W shape path from each farm. Fresh feces and litter samples from each poultry farm were collected. Litter samples were also taken from places that are wet. Fecal sample were transported to laboratory and stored at 4°C till further processing (Maff, 1982; Conway and McKenzie, 2007).

Eimeria Species Identification

Combination of different methods was used for species specific identification of *Eimeria* in poultry. Pathological lesions, Oocysts index, and sporulation time help in differentiation of different species.

There is Specific infection site of each *Eimeria* species in the intestine of chicken, criteria for identification of present species was developed by Long and Reid (1982).

Data Analysis

Data was summarizing with the help of descriptive statistics by using Microsoft Excel worksheet. *SPSS* 16.0 version of SPSS statistical software package was used to analyze data. To calculate prevalence number of positive samples was divided by total number of samples and multiplied by hundred. Chi-square helps to draw relationship between prevalence of Coccidiosis and Risk factor of Coccidiosis. If resulting P-value is less than 0.05, association is statistical significant.

Results

Coccidiosis was widespread in prevalence was detected in each and every month, and Illustrate frequency of Coccidiosis in different months. Highest prevalence was in August (85.10%) and in Jun there was least (44.9%), burden of disease (Fig 1).

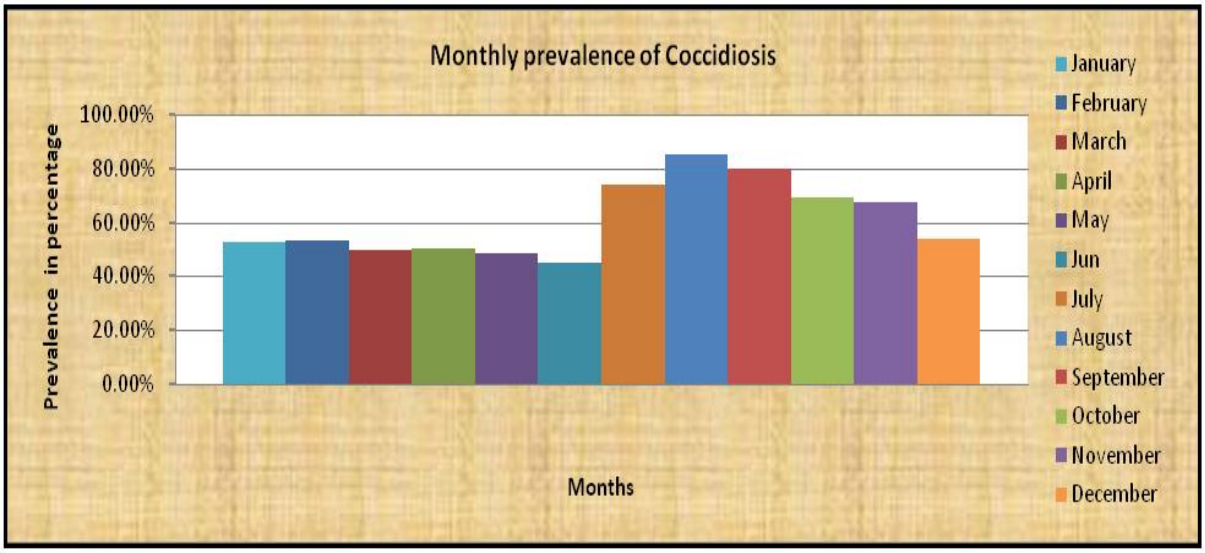

Fig. 1. Monthly variation in prevalence of coccidiosis.

Highest frequency of *Eimeria* was detected in Fecal and gut samples in August (81.2% in gut and 89% in fecal samples) during rainy season in summer and retreating Monsoon in October. In June dry and dry season, lowest (39.2 % in gut and 50.6% in fecal samples) frequency was observed (Fig 2) in average highest prevalence of *Eimeria* was detected in summer and lowest in spring.

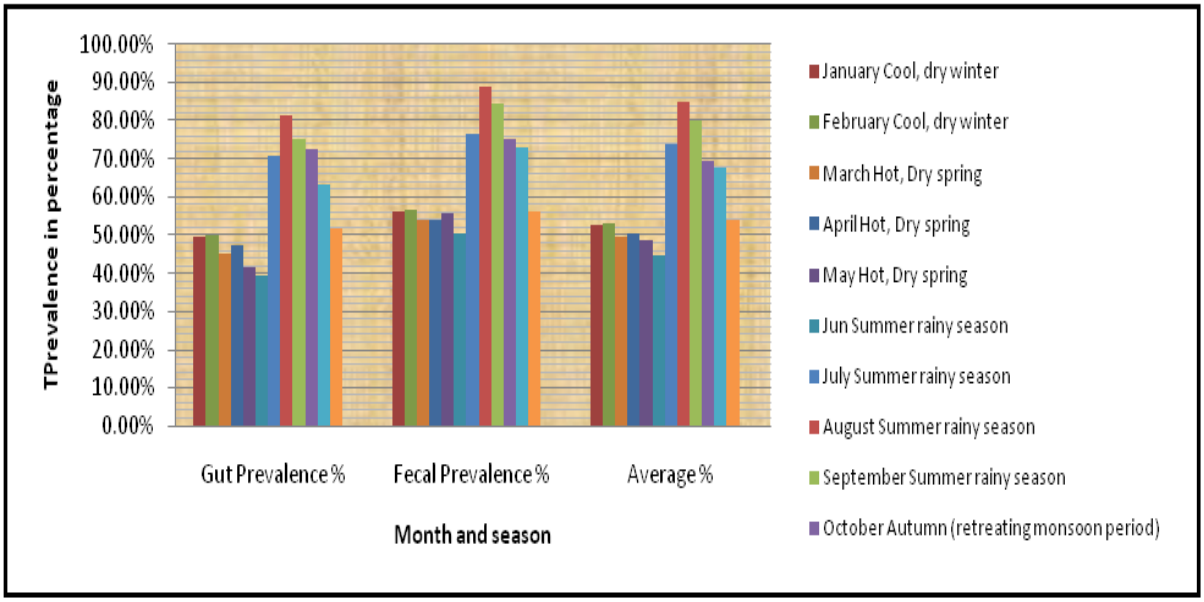

Fig. 2. Prevalence of coccidiosis in gut and intestinal samples during different month having particular weather (2013 -2017).

Similar trend was observed in gut and fecal samples (Fig 1). Gradual increase in frequency of diseases in commercial flock of poultry was observed.

While screening fecal samples 59.72% of were positive in 2013 that increased to 69.30% in 2017. Same pattern was observed in gut samples (Fig 4). Frequency of coccidiosis in different age groups in gut samples collected during study. Coccidiosis attack more in second age group and least outbreak of coccidiosis was observed in age group 4.

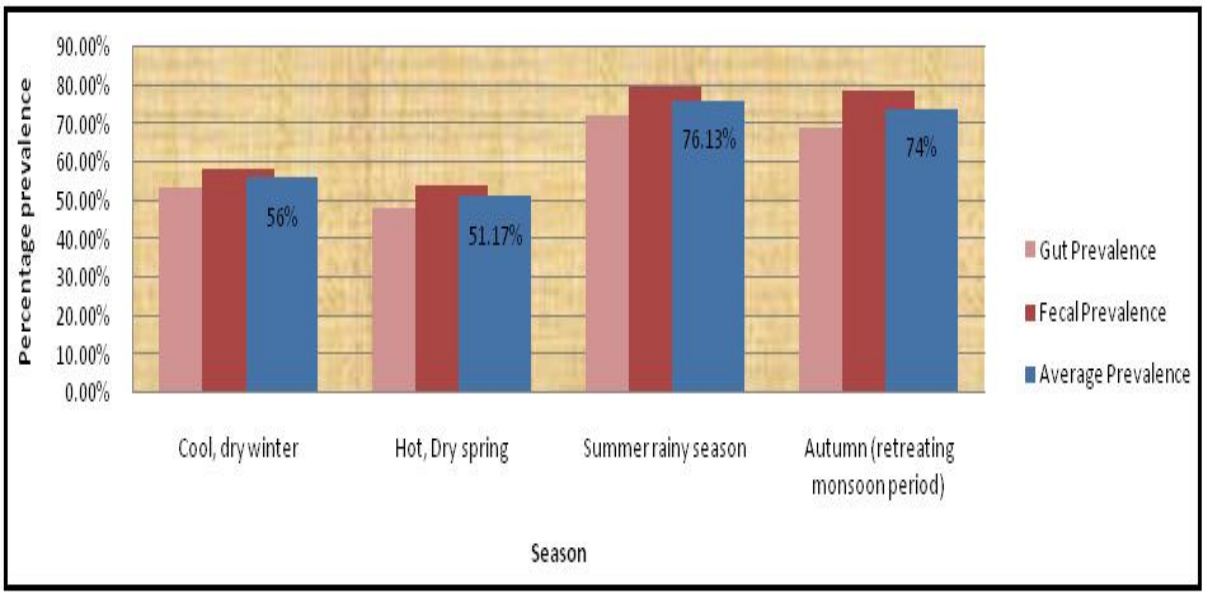

Fig. 3. Seasonal prevalence of coccidiosis.

The prevalence of disease was 55.93% out of which 25.69% in age group 1, 51.07% in group 2, 19.64% in group 3 and 3.64% in group 4. Highest burden of disease was observed during August and lowest in Jun (Fig 5). The highest infestation rate was observed in birds in age group 2 and infestation rate is lowest in fecal samples of birds of age 43 days or more. August and September are months of heaviest infestation and Jun show lowest infestation of parasites. Prevalence of coccidiosis in age group 1, age group 2, age group 3, and age group 4 was 24.07%, 52.25%, 26.07%, 3.82% respectively (Fig 6).

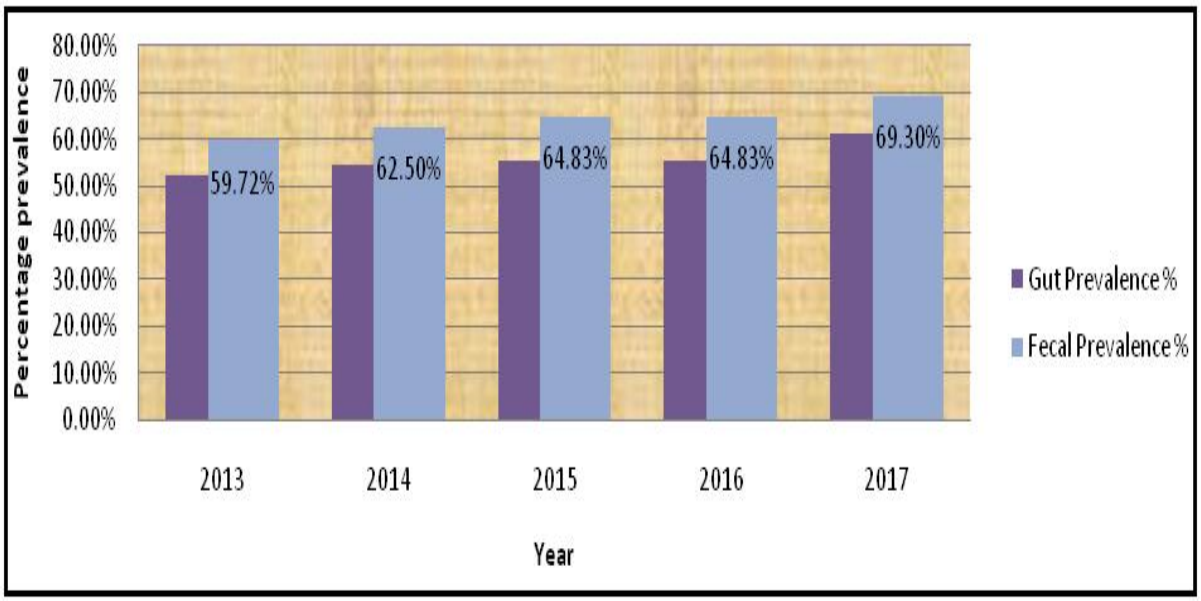

Fig. 4. Trend of coccidiosis in successive years (2013-2017).

Relative prevalence of seven species of *Eimeria,* in local poultry industry, revealed that there was little fluctuation in prevalence in circulatory species of *Eimeria* in each year. E *tenella* is the most prevalent species and E. *brunette* is least one (Fig 7).

There is gradual increase in frequency of *E. tenella* and *E. maxima* on the other hand *E. acervulina* frequency decrease on the years, other species follow zigzag pattern. Different patterns of prevalence indicated by each species.

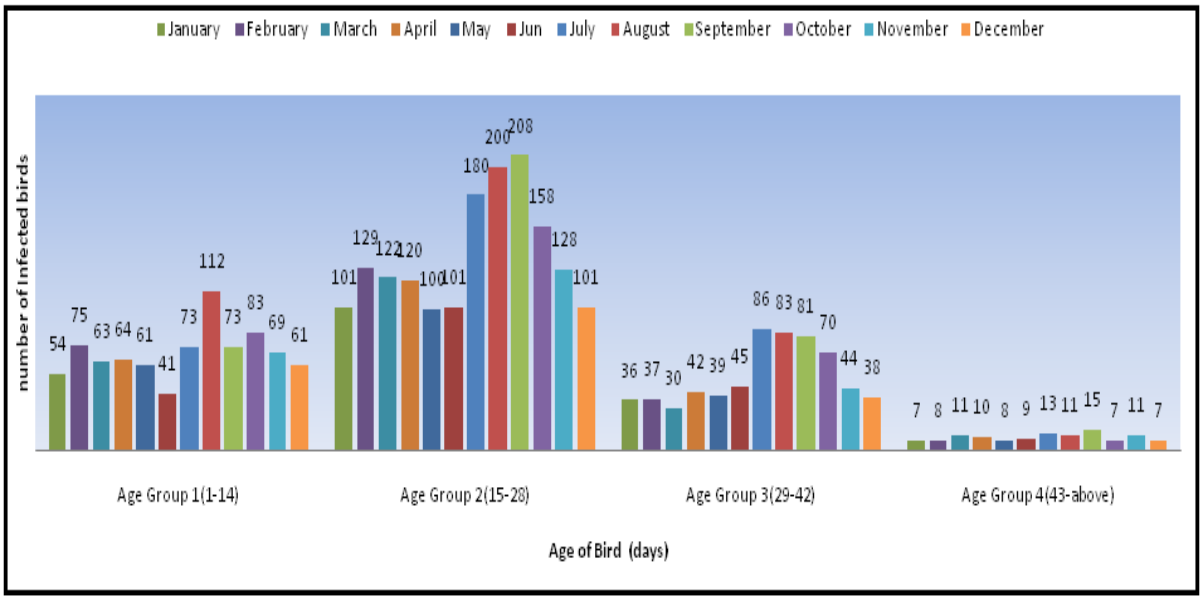

Fig. 5. Intestinal Prevalence of coccidiosis in different Age group in different months**.**

Accumulative frequency of different species of *Eimeria* was *E. tenella*, *E. acervulina*, *E. neatrix*, *E. mitis*, *E. maxima*, *E. brunette* and *E. praecox* was 33.86%, 26.33%, 25.01%, 5.60%, 22.08%, 4.87%, 14.33% respectively (Fig 8). Frequency of coccidiosis outbreaks in different poultry farms using rice hull and wood shaving as bedding material during flocks. Prevalence of coccidiosis in rise hull 32.42% and in wood shaving 27.90% was observed (Fig 9).

There is more outbreak of coccidiosis in broiler than in Layers. Frequency of outbreak in broiler was 50.24% and in 9.20% in Layer flocks.

Highest incidence was reported in August and lowest incidence was observed in Jun (Fig 10).

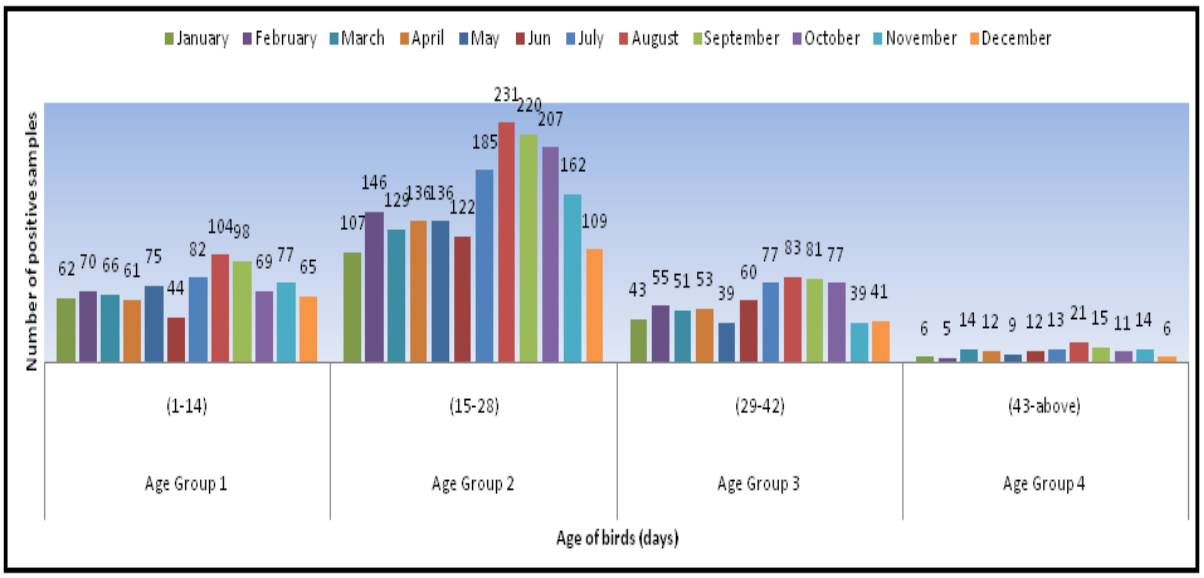

Fig. 6. Relative age wise susceptibility of Coccidiosis in fecal samples.

Represent 59.19% of observed cases are identified positive for coccidiosis. Prevalence of coccidiosis in difference good, normal, and poor management conditions are 14.47%, 17.17%, and 28.5% respectively. Highest incidences of disease were observed in August and September, most humid month in year and few incidences were come to light in June, dry and hot environment (Fig 11).

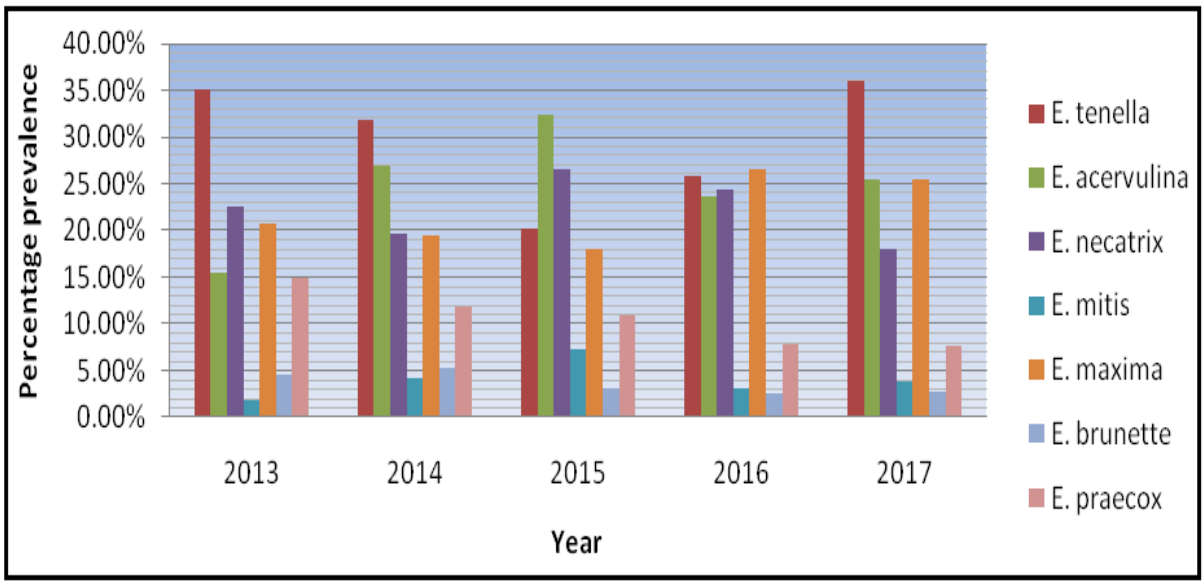

Fig. 7. Year wise relative prevalence of different species of *Eimeria* in Gut samples.

Eimeria is omnipresent parasite, present in each and every farm and in every part of world. The prevalence of clinical diseases was 27.97% and subclinical 32.36% were subclinical (Fig 12).

Discussion

In our study overall prevalence of coccidiosis was 59.19%. In disagreement to our results in northern Jordan Half (50%) of the farms surveyed clinical coccidiosis but overall prevalence of coccidiosis was 77% (Al-Natour *et al.* (2002). In Romania prevalence and distribution of *Eimeria* species, was 21 (91%) out of 23 flocks, and in 11 (92%) out of 12 farms (Gyorke *et al.* (2013). 33.33 % coccidian infection found in studies conducted by Sood *et al.* (2009) from Jammu. 46.04 % prevalence of coccidiosis was reported by Jadhav *et al.* (2011) in Aurangabad district of Maharashtra. 31.25 % coccidian infection found by Bandyopadhyay *et al.* (2006) in West Bengal.

Through microscopic examination, it was determined that 78.7% of the tested farms were positive in *Eimeria*-infection (Lee *et al.* (2010).

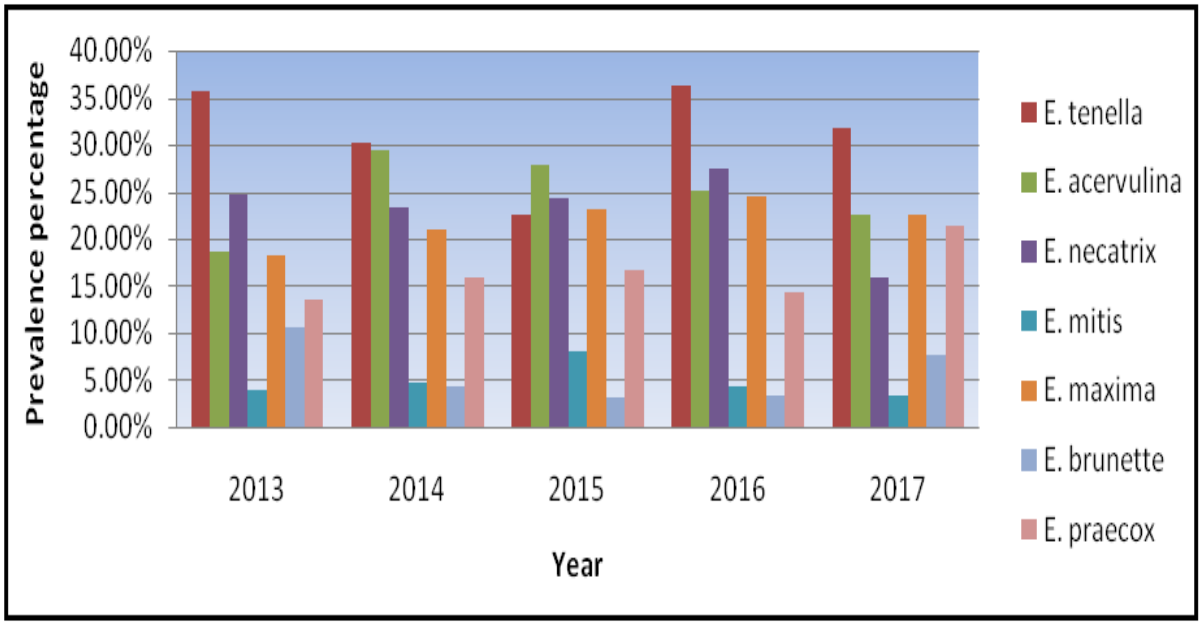

Fig. 8. Percentage prevalence of different species of *Eimeria* in feces samples during study period.

Out of total 5700 gut samples collected 3188 (55.93%) gut samples were positive. 3560 (62.46%) of total fecal 5700 isolates were positive. In disagree to this research 43.89% of chicken guts were positive in study by Awais *et al.*, (2012). Less prevalence 39.58 % of coccidiosis on examination of fecal samples was reported by Sharma *et al.,* (2015). Higher prevalence of coccidiosis may be due to more humid weather in district Chakwal and due to variation of geographical region, different type of management system and drug are used to control coccidiosis.

Frequency of outbreak in broiler was 50.24% and in 9.20% in Layer flocks. Much higher to our study Bachaya *et al.*, (2015) reported 65% rate of coccidiosis in broiler chickens in Muzaffargarh District. Khan *et al.,* (2006) reported (71.8%) prevalence of coccidiosis in broiler in District Rawalpindi. Ayaz *et al.*, (2003) reported the (37.9%) prevalence of coccidiosis in research conducted in 2000-2001 in District Faisalabad-Punjab-Pakistan. Haug *et al.* (2008) reported 30% prevalence of disease were lower than our result. Number of other studies reported different prevalence of coccidiosis than our results, in broiler farms in Hamedan province, western Iran was 31.8%. Chicks and fecal samples were collected from 220 broiler farms in this region were positive for coccidiosis (Gharekhani *et al.* (2014). An overall prevalence rate of 31.8%) was obtained. Higher prevalence rates were recorded in growing

birds 58.9% and broiler birds 68.7%. Similarly, higher infection rates were also observed among birds sampled from Mairi ward 66.7% (Lawal *et al.* (2016). Yunus *et al.* (2008) reported 19.6% broiler flocks were positive for coccidiosis. Sultana *et al.* (2009) reported the prevalence of coccidiosis was slightly different from our finding in broiler flocks was 42.85% and in layer flocks was 33.07%.

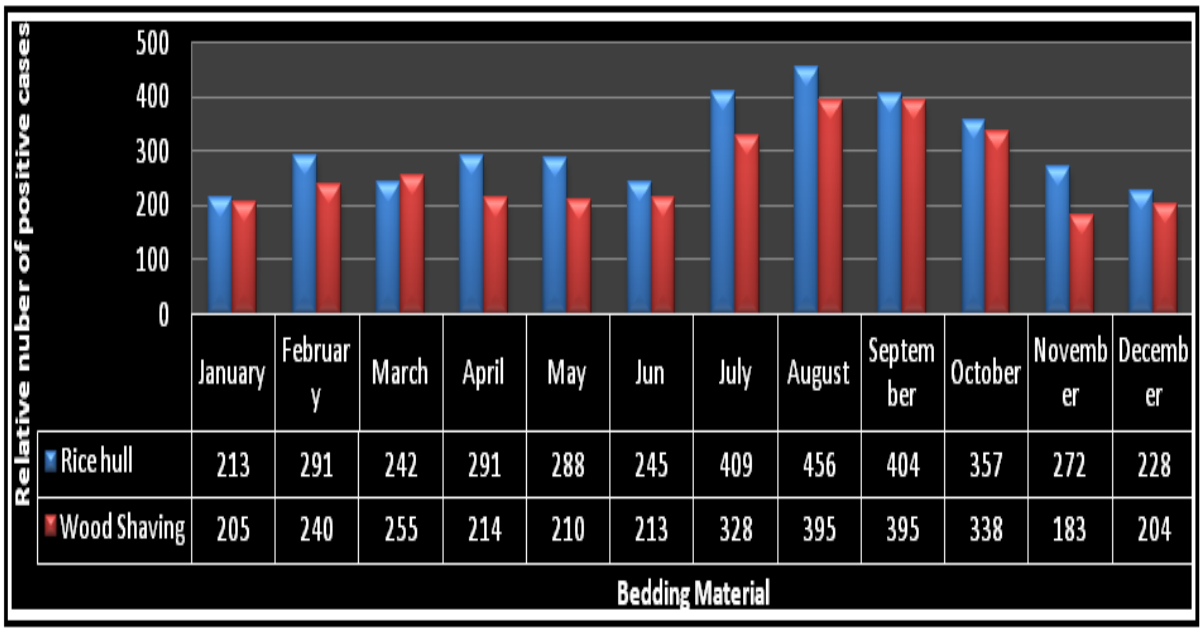

Fig. 9. Coccidiosis in different Bedding materials.

In our study mix species infection was 93.72% and 6.28% of samples reveal infection of single species. Prevalence of coccidiosis in free-range chicken in Sidi Thabet, northeast Tunisia was 31.8%. Mixed *Eimeria* species infection was 26.5% (Kaboudi *et al.* (2016).

Highest prevalence of coccidiosis was in August (85.10%) and in Jun it was least (44.9%), June outbreak of disease. Highest frequency of *Eimeria* was detected in Fecal and gut samples in August (81.2% in gut and 89% in fecal samples) during rainy season in summer and retreating Monsoon in October. In June lowest frequency was observed (39.2% in gut and 50.6% in fecal samples), the outbreak is least due to less humidity and hot season suppress the germination of *Eimeria* Oocysts was in line with Khan *et al.* (2006) and Bachaya *et al.* (2015).

Environmental conditions are different in District Muzaffargarh from District Chakwal. Different in prevalence of coccidiosis may be due to more rain fall and humid weather. It is well known fact that humidity plays a vital role for the sporulation of the coccidial oocysts (Haug *et al.,* (2008) and Bachaya *et al.* (2012). In Faisalabad, Punjab, Pakistan, Awais *et al.* (2012) reported strong co-relation of different environmental condition with prevalence of coccidiosis in broiler flocks. Temperature, rainfall and humidity are main factor contributing to increase or decrease parasitic burden of different species of *Eimeria*, in intensive broiler industry (Awais *et al.* (2012). Age group, sampling sites, management conditions, litter management, breeds and exotic breeds are factor that leads to significant difference in prevalence of coccidiosis (Lawal *et al.* (2016).

Pattern of disease prevalence that fluctuates with changing temperature was in line with our results, rain fall and humidity as these parameters are key elements associated with outbreak of coccidiosis and favours the development or sporulation of coccidial oocysts in any particular area (Sharma *et al.* (2013). Presence of *Eimeria* in poultry farms in Chakwal region and prevalence of coccidiosis reported by Amin

et al., (2014) were different due to difference in geographical and weather condition. Difference rate of infestation of poultry farms in different area could be due to variation in, study design, methods and weather condition in different geographical regions (Al-Natour *et al.* (2002); Haug *et al.* (2008); Bachaya *et al.* (2012); Nikam *et al.* (2012).

Similar to this study high prevalence of coccidiosis during the moon soon due to warmth and moisture climatic condition favors transmission and contamination of the oocytes was reported by number of researchers (Alawa *et al.* (2001); Jithendran (2001); Renaudeau *et al.* (2013). During hot and humid climatic conditions of monsoon season its prevalence was significantly high, during the spring it was lowest (Amin *et al.*, 2014). Humid weather results more outbreaks, humidity plays a vital role for the sporulation of the coccidial oocysts (Al-Natour *et al.* (2002); Haug *et al.* (2008); Bachaya *et al.* (2012); Nikam *et al.* (2012).

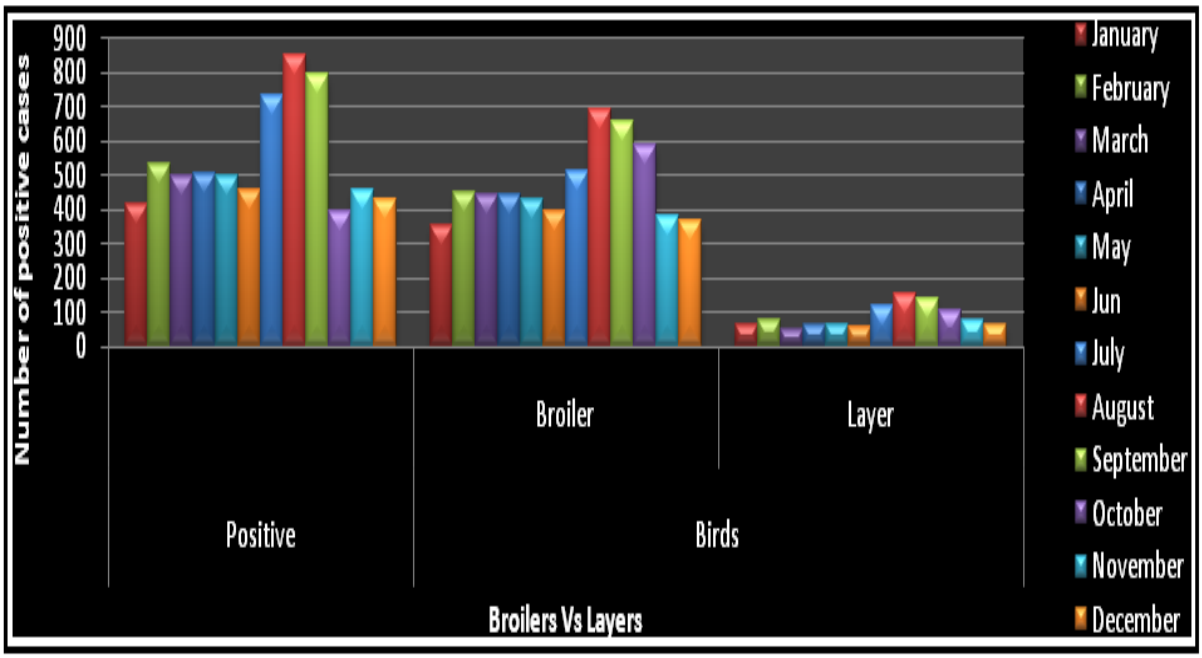

Fig. 10. Prevalence of coccidiosis in Broilers and Layers.

The highest prevalence of the disease during late summer and lowest during spring season was reported by Sultana *et al.* (2009) was in agreement to our results. Higher prevalence of infection during the rainy season of monsoon observed indicating that warmth temperature and humid condition favors the oocytes sporulation and subsequent transmission (Amin *et al.* (2014). In deviation from our study Graat *et al.* (1998) found coccidial infection to occur more often in autumn and winter in the Netherland.

Different type of material used as bedding material have different properties. Different rate of outbreak in different material is due to unique properties of each used as bedding material and different management practice used in different area. Prevalence of coccidiosis in rise hull 32.42% and in wood shaving 27.90% was observed. Wetting of litter increased outbreak and prevalence of coccidiosis in intensive poultry raring systems. Younger birds are growing at rapid pace, at the age of 4-6 weeks, birds produce large volume of feces resulting dampness in litter. Damp litter serves as breeding sanctuaries of protozoan parasite that cause coccidiosis (Sultana *et al.* (2009).

When emergence of coccidiosis was studied in poultry house having soiled or cemented floor. Type of floor and bedding material observed as critical factor in prevalence of coccidiosis was in confirmation with

Sharma *et al.,* (2013) and Amin *et al.,* (2014). The prevalence of disease in gut was 55.93% out of which 25.69% in age group 1, 51.07% in group 2, 19.64% in group 3 and 3.64% in group 4. Same pattern results by screening of fecal samples. Our study was in confirmation with Sultana *et al.,* (2009), that young birds are most affected by coccidiosis than old birds.

Prevalence of coccidiosis in difference good, normal, and poor management conditions are 14.47%, 17.17%, and 28.5% respectively. Prevalence of coccidiosis was 66.7%, intensive management system 46.5% and constructed local cages 54.0% was in line with Lawal *et al.,* (2016). Poor management conditions have important role in development of clinical coccidiosis. Contaminated and leaking drinkers, feeders, poor ventilation, overcrowding, wet litter exacerbates mortality and morbidly cause economic losses (Ruff (1993); Ashenafi *et al.* (2004). Poor management such as high humidity in litter favor sporulation of oocysts, sporulation of oocysts directly increases circulation of parasite among birds (Bachayha *et al.,* 2015). *Eimeria* was detected in backyard and intensive rearing system, poor management leads to build up of oocysts of *Eimeria* (Lawal *et al.* (2016).

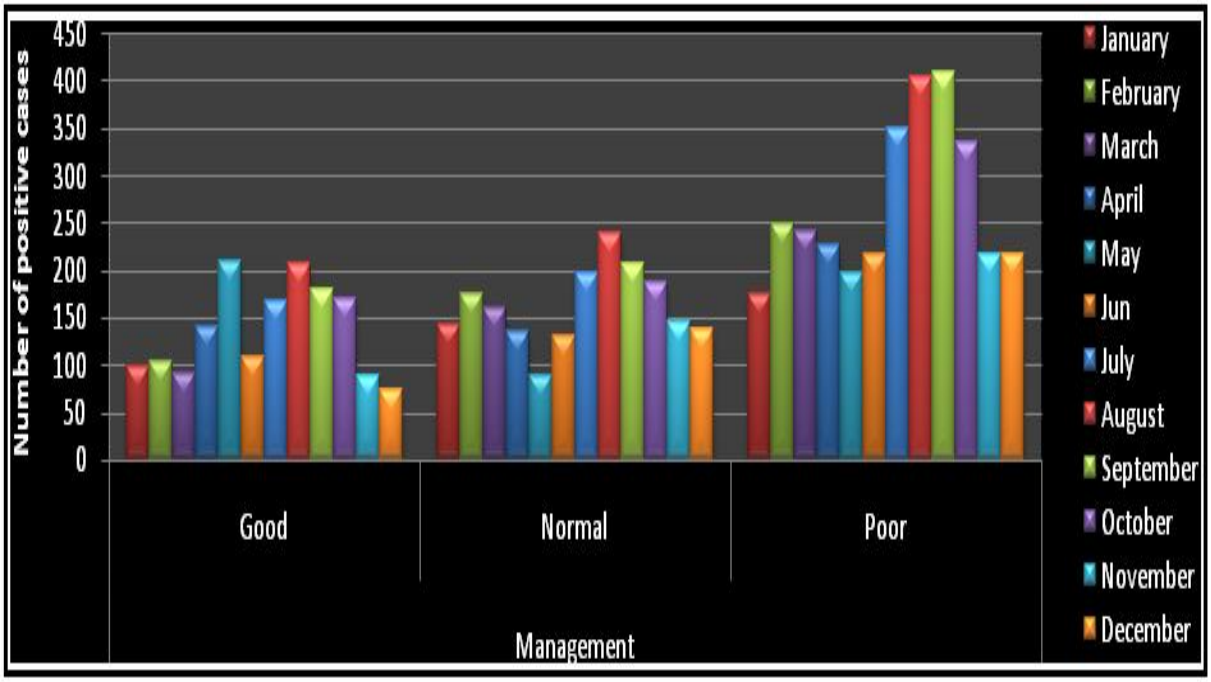

Fig. 11. Prevalence of coccidiosis in Management System.

Good management helps to reduce losses due to outbreaks and parasitic burden in poultry farm can be minimizing by improving management. Good ventilation, cleaning of drinker and feeder, use of disinfectant in poultry house between successive flocks, dry litter use of lime, timely vaccination and stander stocking densities in poultry flocks can minimize outbreak of disease (Abbas *et al.* (2011). Through cleanout of poultry house during successive flocks cannot eliminate oocysts completely but reduction in outbreaks of coccidiosis (Bachayha *et al.* (2015); Abbas *et al.* (2011); Razmi and Kalideri (2000); Sharma *et al.* (2013). Poor management conditions are major impediments to prevent outbreak. By improving management we can prevent emergence of disease in poultry flocks. If strict management protocols are followed there is great reduction in coccidiosis incidence in flocks.

The prevalence of clinical diseases was 27.97% and subclinical 32.36% were subclinical. Shirzad *et al.* (2011) study contribution of different factor in sub-clinical coccidiosis. Age of bird, size of flock show direct relation while season, strain, drugs, and poultry farms don't reveals direct relation in sub clinical form of disease.

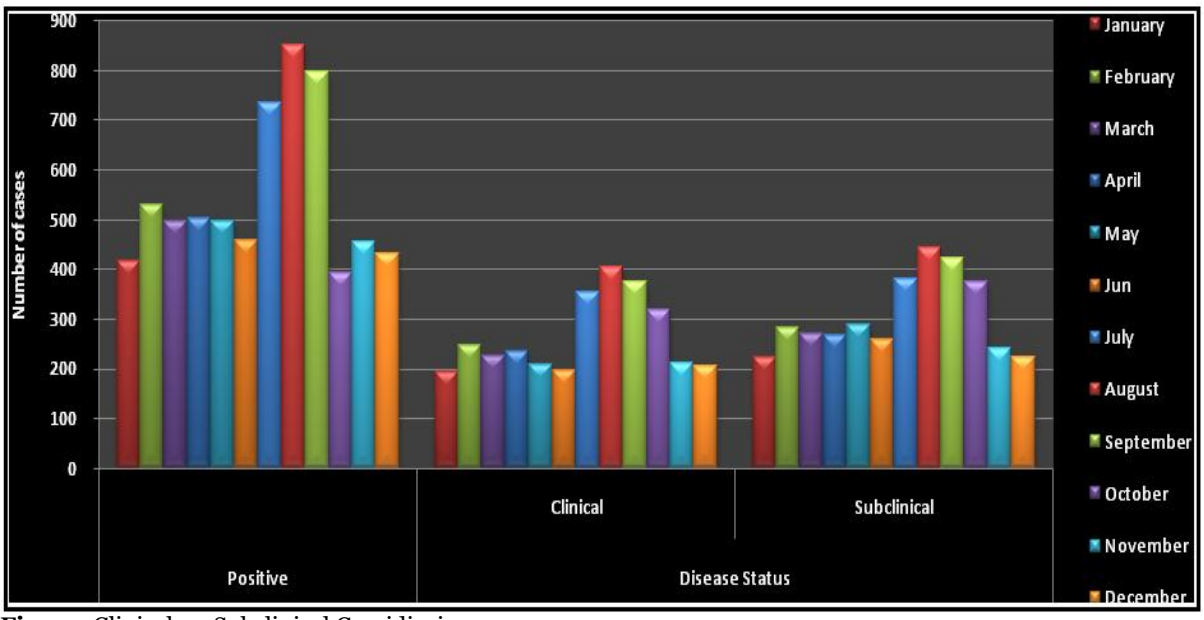

Fig. 12. Clinical vs. Subclinical Coccidiosis.

Effective control of subclinical coccidiosis depends on the knowledge of types and number of *Eimeria* species present in local poultry farms. Epidemiology of *Eimeria* helps to design efficient system to prevent and control coccidiosis. In Shandong province in Eastern China, five species of *Eimeria* were circulating in subclinical form in broiler flocks and to protect flocks from disease and to reduce economic loss to farmer at least five species of
Eimeria should present (Sun *et al.* (2009).

Conclusion

Coccidiosis is widespread disease of poultry; it was detected in all type and management system. Seven species of *Eimeria* was detected. *E. tenella* was most dominant and *E mitis* was observed in least frequency. Better management of poultry farms, use of better management technique, bio-security Stander operating procedure tend to lower outbreaks of disease.

Overcrowding, poor management system, rainy weather, less time period between successive flocks, use of same drugs for long time in same area, or in successive flocks, age of birds, bedding material and farmer level of education are critical factors that leads to emergence of disease and effect population dynamics of *Eimeria* in local poultry farms. More humidity in litter system due to rainy season, poor management or production of more fecal material in young birds, litter material of poor quality serve as sanctuaries for *Eimeria* oocyst germination and outbreaks. Better management and study of local population of parasite will help in development of epidemiological database. Knowledge of parasite infestation, parasite history, emergence of resistance in local population, effectiveness of vaccine is useful designing quick, economic, long term, sustainable control program all are based on epidemiological study of coccidiosis.

Recommendation

It is recommended there should be more research on prevalence of coccidiosis in local poultry industry. There may be discovery of more species of *Eimeria*. It will help us to develop database on population dynamics of *Eimeria*. It has been observed seven species of *Eimeria* are present in local poultry; there should be routine monitoring by veterinary authorities. We recommend epidemiological study of coccidiosis using more advance and molecular techniques. It will help to develop better and quick response from veterinary practitioners to control outbreak. Rational use of coccidiosats and shuttle program will be helpful to avoid development of resistance in local population of *Eimeria* and to

control coccidiosis outbreaks. For uplift of poultry industry long term and sustainable strategy is required on urgent basis. We recommend that vaccination combined with good management practices will provide a feasible and sustainable strategy to control coccidiosis and improve the overall health of poultry. It is recommended educate farmer about coccidiosis to avert possible loss to flocks. Infected birds should be separated from healthy birds. In order to avoid buildup of Oocyst, litter should be changed as soon as possible. Early monitoring will be helpful for intervention and reduced mortality.

Proper Bio-security and hygienic of poultry house, churning and use of disinfectant after disposal of litter material, using time gap between successive flocks and use of vaccine against coccidisosis develop from local strain of *Eimeria* will help to save our industry and early vaccination against other poultry disease is required. Moderate stocking density to avoid overcrowding and congestion special in rainy season, fecal material of young birds leads to more humidity in litter. Better litter management will reduce outbreak of disease in successive flocks. Research is need to know the effect of local herbs, antiobiotics, probiotics, cheap and effective litter material available in local area that will be more useful in local management system.

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Conflict of Interest

In this research project there is no conflict of interest among authors. There is no conflict between poultry farmer, society and authors.

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