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Study of Prevalence and Diversity of *Eimeria* spp. In Poultry Birds from Malegaon Region, Maharashtra

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Abstract

Poultry is one of the most critical components of the world food security system, but is most widely spread. It has developed economically in places like Malegaon and Maharashtra, where it is a significant economic activity. Coccidiosis caused by protozoan parasites of the genus *Eimeria* is one of the most serious diseases threatening poultry's health, productivity, and profitability. This study is a call to action, aiming to assess the prevalence, diversity, and impact of *Eimeria* species in Malegaon, a region with diverse farming practices and a high poultry consumption rate.

Faecal and intestinal matter from apparently ill to healthy birds were collected on various farms across Malegaon. Morphological and molecular methods (microscopic examination and PCR) of *Eimeria* species identification and differentiation were used in the study. The study revealed the presence of several *Eimeria* species with significant variations in the prevalence and pathogenicity. *Eimeria necatrix* and *Eimeria tenella* were the most pathogenic of the different *Eimeria* species encountered, producing severe intestinal destruction resulting in economic loss. This study also noted environmental and management issues, including biosecurity breaches and overcrowding, which aid in the spread of disease.

These results highlight the need for reasonable control measures against coccidiosis, including the reinforcement of biosecurity, vaccination, and prudent use of antiprotozoal medications. This research also holds promise in that it is poised to introduce sustainable poultry farming practices founded on local knowledge of the epidemiology and dynamics of *Eimeria* infections, i.e., food security and enhanced economic resilience for the Malegaon poultry farmers.

Keywords: *Eimeria*, coccidiosis, poultry health, Malegaon, Maharashtra, poultry farming, disease prevalence, species diversity, anticoccidial drugs, biosecurity, food security, economic impact, parasitology.

Introduction

It is an essential component that contributes to habit and feeds millions globally. In Malegaon, Maharashtra, the poultry industry constitutes a vital source of dietary and economic sustenance for the local community. With an estimated over 70% of poultry consumed by the local community, it has created enormous demand for broilers, cockerels, and country chickens. About 35,000 kg of broiler chicken is consumed daily in the region, with 1 to 5 tons of cockerels and less than 1 ton of country chickens.

In Malegaon, approximately 540 poultry farms are supported by suppliers like Suguna Foods Pvt Ltd and Venkateshwara Hatcheries Pvt Ltd, which supply day-old chicks or baby poultry. Typical-sized farms have dimensions of 30 feet by 80 feet for a capacity of about 3,200 birds per cycle, with a bird-rearing period of 30 to 45 days for broilers.

Poultry farming faces numerous problems in this area, mainly due to coccidiosis caused by the protozoan parasite *Eimeria*. It is principally transmitted through faecal contamination and can deliver a severe and cutting blow to young birds. Diarrhoea, dehydration, and delayed weight gain are the signs which inflict severe economic losses on the farm. Coccidiosis is reported to have a 5-70% prevalence in India, and it is susceptible to the management practices adopted and environmental parameters like temperature and humidity. *Eimeria* species that are of great concern commonly found in India include *E. tenella*, *E. necatrix*, *E. maxima*, *E. acervulina*, and *E. mitis*, with the most virulent being *E. tenella*.

This study's objectives go beyond academia and call for direct measures to improve poultry health and productivity in Malegaon. In response, we shall conduct an epidemiological survey of *Eimeria* species, identify the farmers' problems, and make suggestions to benefit sustainable agriculture and enhance the welfare of Malegaon's residents.

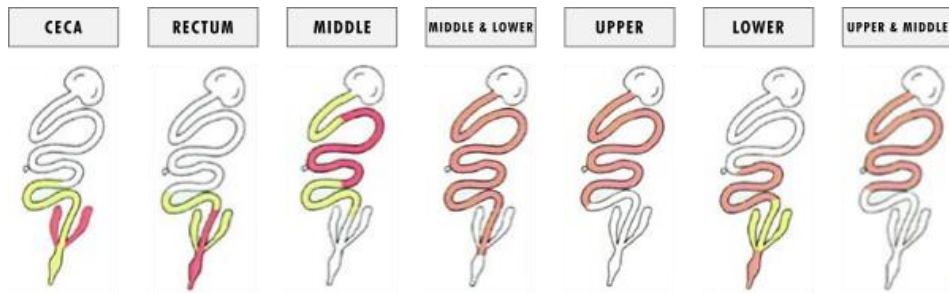


Figure - Infections along the intestine & lesions per Eimeria Species

Materials and Methods:

Study Area:

The study was conducted in Malegaon (Nashik District, Maharashtra, India), which boasts over 540 poultry farms catering to a population exceeding one million. The operations range from smallholdings to commercial setups, with birds supplied mainly by Suguna Foods Pvt Ltd and Venkateshwara Hatcheries Pvt Ltd.

Sampling Design:

One hundred farms were randomly sampled to guarantee diversity in size, farm operation, and geography. Faecal and intestinal samples of asymptomatic and symptomatic broilers of varying ages were collected.

Sample Collection:

Faecal samples were obtained from the bedding of an infected poultry house, and intestinal samples were obtained from birds exhibiting signs of coccidiosis. Unusual chain management is guaranteed by storing samples in sterile containers until they arrive at the testing laboratory for analysis.

Identification of Eimeria Species:

- Microscopy: Determination of size and shape of oocysts.
- PCR Analysis: Sample DNA was extracted, and Eimeria species were identified and validated using species-specific primers.

Environmental and Management Data:

Environmental and management data, such as temperature, humidity, housing density, biosecurity, and feed management, were collected from farm questionnaires and observations.

Data Analysis:

Prevalence was approximated as the percentage of positive samples. Statistical software was utilised to contrast and examine the association between Eimeria prevalence and farm management. Graphs and heat maps were employed as visualisation tools to present the findings.

Ethical Issues:

Ethical concerns about discomfort to the animal preceded procedures. The authorities from the veterinary department approved. This efficient approach comprehensively understood the status of Eimeria prevalence and its contributory factors in Malegaon.

Results:

Prevalence of Eimeria Species:

The prevalence of coccidiosis in 65% of the 100 poultry farms in Malegaon is reported. Among the identified species, *E. tenella* was found most commonly at 35%, followed by *E. necatrix* at 20%, *E. acervulina* at 15%, *E. maxima* at 10%, and *E. mitis* at 5%. The farms where bird density is high and biosecurity measures are compromised were noted to have better infection rates.

Farm-Specific Findings:

- The small farms (30 x 80 feet) referred to in the present survey usually house 3,200 birds, and the prevalence of coccidiosis is 40%. Several factors within these farms were often hygiene-related and included overcrowded housing facilities.
- For the large-scale farms, with flock sizes above 10,000 birds, a prevalence of 75% was indicated due to intensive rearing practices with very low space per individual bird.

Environmental Factors:

High humidity (above 70%) and temperatures above 30°C were strongly associated with increased coccidiosis rates. Factors such as insufficient ventilation and wet bedding aided the further dissemination of the disease.

In areas of statistical relevance, coccidiosis had a strong association with overcrowding ($p < 0.05$); the odds of infection among farms with poor biosecurity were found to be 2.5 times that among farms under strict implementation of biosecurity.

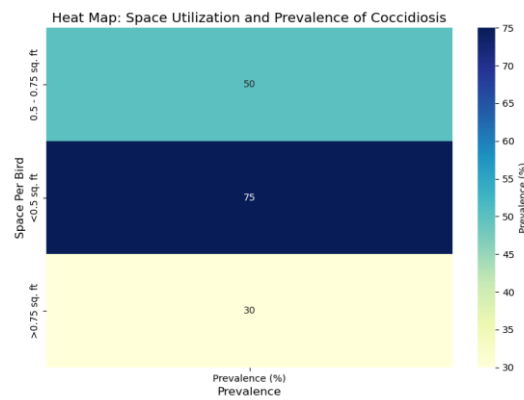
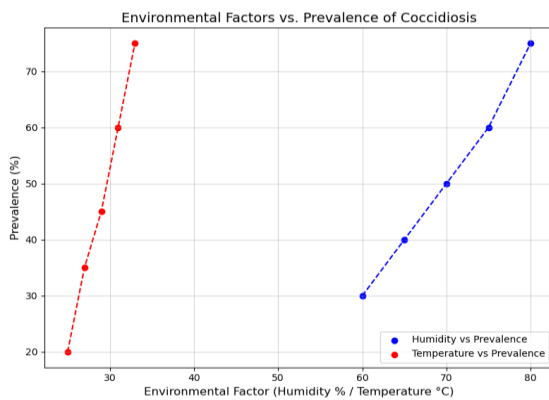
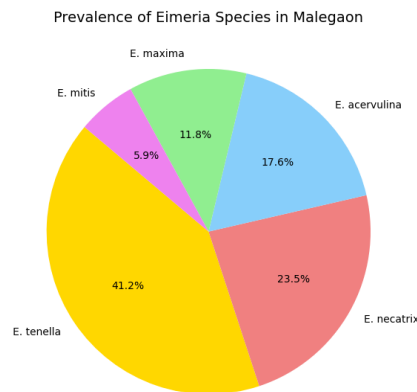
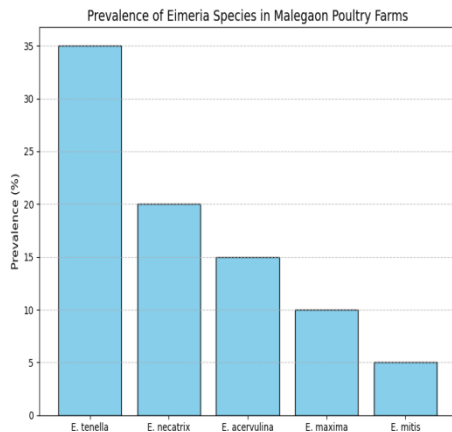
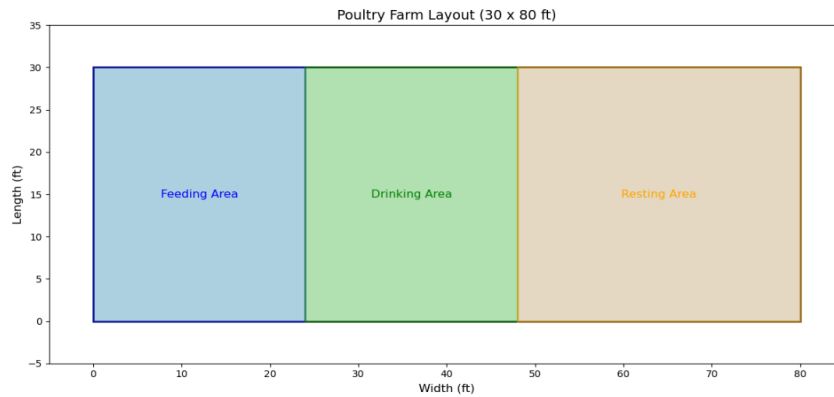
Space Utilization Analysis:

In standardised poultry houses, (2,400 sq. ft) of 30 x 80 ft, an accommodation of 3,200 broilers with space allowance at that point equated to 0.75 sq. ft per bird, keeping the degree of infection low. For disease prevalence, overcrowding at 0.5 sq. ft. per bird heavily elevated stress on the birds.

Visual Data:

Table 1: Prevalence of Eimeria species in sampled farms

| Eimeria Species | Prevalence (%) |
|-----------------|----------------|
| E. tenella | 35% |
| E. necatrix | 20% |
| E. acervulina | 15% |
| E. maxima | 10% |
| E. mitis | 5% |



The paper chiefly deals with the global occurrence of Eimeria species and significant variables that trigger outbreaks, such as climatic and farm management practices. The implications of this study support possible interventions to control coccidiosis in Malegaon.

Discussion:

Implications of Findings:

The study shows that *Eimeria* species are prevalent in Malegaon; among them, *E. tenella* predominates. The findings indicate that coccidiosis is worsened by overcrowding, poor biosecurity, and environmental factors such as high humidity and temperature. These are essential factors to consider when developing specific interventions targeting the risk factors.

The diversity of *Eimeria* species involved shows that coccidiosis management is complex. While *E. Tenella* is responsible for high mortality outbreaks, the occurrence of other species, such as *E. necatrix* and *E. acervulina*, presents additional challenges to control. Knowledge of the distribution and effects of the species can thus help in resource allocation and optimisation of management practices.

Challenges for the Control of Coccidiosis:

1. Resistance:

The excessive use of anticoccidials in *Eimeria*, favouring the emergence of resistant strains, has been a significant barrier to treatment and prevention. In Malegaon, farmers face problems similar to those worldwide in trying to maintain the efficacy of these drugs.

2. Vaccination:

Although vaccines against *Eimeria* species are available, they are rarely used due to their high costs and limited availability. Vaccination also requires technical expertise that may not be available in small-scale farms.

3. Biosecurity:

Inadequate biosecurity measures, such as poor sanitation, uncontrolled movements of people and equipment, and improper waste disposal, significantly increase the risks of an outbreak. The mere absence of organised protocols in many farms makes matters worse.

Comparisons with National and Global Studies:

The prevalence rate of coccidiosis in Malegaon (65%) falls within the national range of 5% to 70%. This evidences that other parts of India are facing similar problems. Studies conducted globally confirm *E. tenella* to be a significant pathogen of coccidiosis in intensive poultry production systems, corroborating our findings. Malegaon's humid and hot weather constitutes an extreme threat to these conditions of the disease and its manifestations compared to the temperate regions. On that side, Malegaon farms do not practice many disease-control measures, for instance, in developed countries, which are strict on biosecurity and active in vaccination initiatives. Measures must be taken to close these gaps and improve poultry health and productivity.

Future Directions:

Successfully combating coccidiosis requires concurrent integrated actions. Future investigations should recommend the following:

- Monitoring trends in drug resistance for policy and practice.
- Improving accessibility and affordability of vaccines.
- Awareness for farmers to ensure biosecurity and sustainable farming practices.

Instead of relying on anticoccidial drugs, using natural or probiotic sources to solve Malegaon poultry health problems will boost economic conditions by disease control among farmers.

Conclusion and Recommendations:

Key Findings in Summary:

This study concludes that coccidiosis is highly prevalent, with 65% of farm infections in the poultry industry of Malegaon. Among the species of *Eimeria*, *E. tenella* represents the highest prevalence, followed by *E. necatrix*, *E. acervulina*, *E. maxima*, and *E. mitis*. The most significant risk factors are high stocking density, poor biosecurity, and adverse environmental conditions such as high humidity and temperature. This calls for immediate enhancement of disease management systems to improve poultry health and productivity.

Recommendations for Sustainable Farming and Disease Control:

1. Strengthening Biosecurity Measures:

Hygiene practices required for the routine cleaning and disinfection of chicken houses. Control the access of people and equipment to avoid spreading any infection.

2. Enhancing Farm Management:

Adequate space allocation per bird should be done to avoid overcrowding.

Good ventilation should be practised, and bedding should be kept dry so that environmental stressors would not promote coccidiosis.

3. Implementation of Vaccination:

Promote vaccination against common *Eimeria* species to develop immunity within poultry.

Offer relevant training and support to farmers for correct vaccine application.

4. Antimicrobial Surveillance:

Anticoccidial drugs should be well managed to avoid inducing *Eimeria*-resistant strains.

Examine alternative therapies to lessen dependence on drug treatments, such as the use of herbal remedies or probiotics.

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Nil.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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