INCIDENCE, PATHOGENESIS AND THERAPEUTIC MANAGEMENT OF GASTROINTESTINAL PARASITES OF POULTRY REARED UNDER BACKYARD SYSTEM OF FARMING

THESIS

SUBMITTED TO THE

RAJENDRA AGRICULTURAL UNIVERSITY

(FACULTY OF POST-GRADUATE STUDIES)

PUSA (SAMASTIPUR), B I H A R

In Partial fulfillment of the requirements

FOR THE DEGREE OF

Master of Veterinary Science

(Veterinary Parasitology)

By

Dr. Prabha Bharti

Registration No. - M/V.Para/38/2004-2005

DEPARTMENT OF VETERINARY PARASITOLOGY

BIHAR VETERINARY COLLEGE

P A T N A – 800 014

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2009

Dedicated
to
My Husband
& Daughters

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to
My Husband
& Daughters

DEPARTMENT OF VETERINARY PARASITOLOGY
BIHAR VETERINARY COLLEGE, PATNA – 14
RAJENDRA AGRICULTURAL UNIVERSITY
PUSA (SAMASTIPUR), BIHAR

CERTIFICATE – I

This is to certify that the thesis entitled ***"Incidence, Pathogenesis and Therapeutic Management of Gastrointestinal Parasites of Poultry Reared Under Backyard System of Farming"*** submitted in partial fulfilment of the requirements for the Degree of Master of Veterinary Science **(Veterinary Parasitology)** of the faculty of post-graduate studies, Rajendra Agricultural University, PUSA, Samastipur, Bihar is the record of bonafide research work carried out by **Dr. Prabha Bharti,** Registration No. **M/V. PARA/38/2004-05,** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

It is further certified that the assistance and help received during the course of this investigation and preparation of the thesis have been fully acknowledged.

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CERTIFICATE – II

We, the undersigned members of the Advisory Committee of **Dr. Prabha Bharti**, Registration No. **M/V. PARA/38/2004-05**, a candidate for the Degree of Master of Veterinary Science with major in **Veterinary Parasitology** have gone through the manuscript of the thesis and agree that the thesis entitled ***"Incidence, Pathogenesis and Therapeutic Management of Gastrointestinal Parasites of Poultry Reared Under Backyard System of Farming"*** may be submitted by **Dr. Prabha Bharti** in partial fulfilment of the requirements for the degree.

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Advisory Committee &
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PUSA (SAMASTIPUR), BIHAR

CERTIFICATE – III

This is to certify that the thesis entitled ***"Incidence, Pathogenesis and Therapeutic Management of Gastrointestinal Parasites of Poultry Reared Under Backyard System of Farming"*** submitted by **Dr. Prabha Bharti,** Registration No. **M/V. PARA/38/2004-05** in partial fulfilment of the requirements for the Degree of Master of Veterinary Science **(Veterinary Parasitology)** of the Faculty of Post-Graduate Studies, Rajendra Agricultural University, PUSA, Samastipur, Bihar was examined and approved on 25 / 9 / 2010

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Finally my respected and grateful thanks to "Almighty" who is master designer- Director of my heart soul and mind, seek blessing for rest of life.

Date: 30.09.09

Place: B.V.C., Patna-14

Prabha Bharti

(Prabha Bharti)

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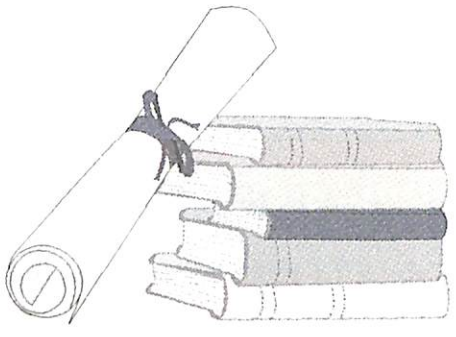
Chapter - I

INTRODUCTION



INTRODUCTION

Poultry has influenced the civilization in many ways. Eggs and meat of birds are being consumed since pre historic times. Compared to eggs there is no single food of animal origin eaten and relished by so many people in the world over. Eggs and poultry meat are almost an unsurpassed product in nutritive excellence and also used extensively as a delicious food. Eggs and chicken meat are perhaps, the cheapest sources of protein to fight protein malnutrition in rural India. Poultry products are not only highly nutritious but is also palatable and digestible.

Poultry farming has now recognized as an organized and scientifically based industry with tremendous employment potential both in rural and urban India. In India, if proper atmosphere is provided for the growth of this industry it can yield annual growth of Rs.26000 Crores to gross national product for next 30 years and provide remunerative jobs to approximately 3.7 billion people in rural areas. Therefore, it can be adopted as whole time business or on large scale; it can fit very well in mixed farming system to provide additional income to farmers engaged in arable farming. With a view to combat the acute shortage of high quality animal protein, three types of intensive poultry farming are adopted in India. Cage, battery and deep litter systems of commercial rearing comprised of exotic and high yielding varieties of fowls, whereas backyard keeping usually involves non descript desi breeds of poultry.

However, free range poultry keeping is considered to be an efficient converter of edible wastes, insects etc .into animal protein of high quality and thus the production cost becomes almost negligible along with elevation in nutritional status of low income group of poultry keepers.

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However, free range poultry keeping is considered to be an efficient converter of edible wastes, insects etc .into animal protein of high quality and thus the production cost becomes almost negligible along with elevation in nutritional status of low income group of poultry keepers.

The backyard poultry farming is now greatly recognized as one of the most important effective economical occupation for the integrated rural development. This is because, unlike agriculture, it could be adopted easily by small, marginal and landless rural farmer and urban people. Besides, it may be adopted as a mean of livelihood and a source of regular income for unemployed people. However, adoption of improved high yielding exotic breeds of poultry at the first instance looks quite promising at its production level (meat/ egg), but they require costlier management and health coverage programme because of being highly susceptible to many diseases. Whereas, indigenous non- descript or desi poultry stock are resistant to majority of parasitic diseases. Unfortunately backyard poultry farming have not been followed on a large scale together with health coverage. Since liberal food habits of Indians make them bound to adoption of western products with indigenous flavour hence taste delicacies of high priced non-descript desi poultry are supposed to be superior to most consumed varieties like exotic broilers. Desi poultry also contributes family food and income to unprivileged farmers. However, their potential as a source of food and income to people has remained often unexplored because of the lack of coordination between poultry keeper and disease control personnel.

In the tropical country like India, the climates as well as environmental factors provide ideal conditions for rapid propagation of parasitic stage of various endoparasites and their vectors. This leads to widespread contamination of pasture and soil. In rural areas there is acute lack of hygiene in poultry keeping and usually the birds are left free in unorganized fields. This makes these birds easy prey to many parasitic diseases and rural population rarely adopt prescribed deworming schedule and parasitic diseases so acquired by this pattern of rearing act as a slow killer for these birds and sap the hard earned livelihood and profits.

All birds managed in free range are always in constant contact with soil which serves as an important reservoir and transmission site for external larval stages of helminths and insects. The latter eventually become vectors for helminths. These factors explain the presence of wide range of gastrointestinal helminths in desi chicken in traditional backyard keeping which are partly responsible for low productivity of these birds. Helminth infections are associated with unthriftiness, poor growth due to poor feed conversion ratio, reduced egg production and fertility and in acute worm infestations it leads to death. Many worms are potentially pathogenic for poultry which may cause enteritis, ulceration or grannuloma followed by anorexia, depression, emaciation and death. Single infection with embryonated *Ascaridia galli* eggs leads to a significant impact on the establishment rate due to detrimental host reaction. Also, infection with *Syngamus trachea, Prosthogonimus spp.,Heterakis gallinarum, Capillaria spp, Raillietina spp* .and *Davainea spp.* have been reported to cause severe pathological lesions and death. Prevalence of these parasites have been reported to be of very alarming rate as single or mixed infection in exotic broilers but information on the extent and importance of helminthosis in non descript desi birds in our country is still lacking for proper control strategies. In free-range chickens parasitic infections/infestations are often neglected despite their role in significant losses in terms of reduced growth rate and mortality due to small scale production. Studies in domestic chickens have demonstrated that worm infection can be of great economic importance as previous records indicated up to 100 percent prevalence of worms in scavenging chickens (Permin *etal.* 1997). These worms were reported to have impact in the health and growth of these chickens and can be a setback for small scale breeders. Thus, recommendations for control of these parasites is a necessity. In spite of several investigations on helminths in the commercially reared chickens very little work has been done on

investigating importance of intestinal helminths in non-descript birds raised under backyard keeping. This study was therefore designed to investigate prevalence of gastrointestinal helminths in free-range backyard poultry in three districts of Bihar and also to compare the efficacy of three popular drugs against natural gastrointestinal helminthosis in domestic chicken, ultimately suggesting control measures relevant to free range management.

Keeping above points in view the present study was conducted with the following objectives:

1. To study the incidence of various gastrointestinal (G.I.) parasites in poultry population reared under backyard system of farming in three districts of Bihar.
2. To study the effect of seasons and ages on the incidence of various intestinal helminth parasites in domestic chickens.
3. To observe the haematological changes in poultry infected with different types of gastrointestinal helminths.
4. To evaluate the efficacy of commonly used anthelmintics against natural G.I. helminthosis.

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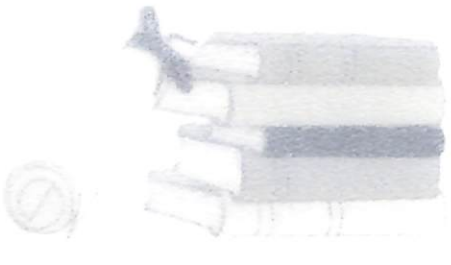
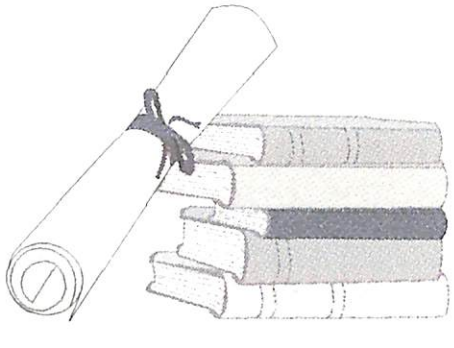
Chapter - II

REVIEW OF LITERATURE



Chapter - II

REVIEW OF LITERATURE



REVIEW OF LITERATURE

Poultry industry all over the world is based on modern poultry farming. Backyard system of farming was a practice which existed several decades ago has returned very recently due to large scale loss of poultry birds due to rapid spread of infectious diseases in intensively reared birds. Hence the literature on backyard system of poultry farming is very meagre.

: Prevalence of Gastro-intestinal parasites in poultry :

A scientific study on quantitative analysis of helminthic fauna in *Gallus gallus* [illegible] of Chandigarh was condented by Virk *etal* (1987). The study recorded a total infection rate of 76.5 percent among the birds. The most [illegible] helminthic spp. recorded were *Ascaridia galli* followed by *Heterakis gallinae, Raillietina tetragona, Raillietina cesticillus, Raillietina* [illegible] *Cotugnia digonopora* and *Choanotaenia infundibulum*. They observed that though the infection rate was higher in [illegible] but [illegible] *Ascaridia* infection was prevalent throughout [illegible]

Srivastava *et al* (1989) on PM examinations of 4603 [illegible] between 1985 and 1987 found that *Ascaridia galli* accounted for [illegible] while *Raillietina* spp. were the main helminth parasites encounted in birds.

Virk (1989) conducted P.M examination of 396 birds in Ludhiana and noted presence of five cestode spp. He observed that 63.58 percent of birds were infected with *Raillietina tetragona* while 24.57 percent were infected with *Raillietina, cesticillus.*, 5.93 percent with *Raillietina echinobothrida*, 5.10 percent with *Cotugnia digonopora* and 1.69 percent with *Choanotaenia infundibulum*.. On a therapeutic trial on these birds he

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I. Prevalence of Gastro-intestinal parasites in poultry :

A similar study on quantitative analysis of helminthic fauna in *Gallus gallus domesticus* of Chandigarh was condented by Virk *etal* (1987). The study revealed a total infection rate of 76.5 percent among the birds. The most common helminthic spp. recorded were *Ascaridia galli* followed by *Heterakis gallinae, Raillietina tetragona, Raillietina cesticillus,Raillietina birmanick, Cotugnia digonopora* and *Choanotaenia infundibulum*. They observed that though the infection rate was higher in summer but predominance of *Ascaridia* infection was prevalent throughout the year.

Srinivasa *et al.* (1989) on PM examinations of 4603 chickens between 1983 and 1988 found that *Ascaridia galli* accounted for 58 deaths while *Raillietina* sp. were the main helminth parasites encounted in birds.

Tuli (1989) conducted P.M. examination of 396 birds in Ludhiana and noted presence of five cestode spp. He observed that 63.55 percent of birds were infected with *Raillietina.tetragona* while 24.57 percent were infected with *Raillietina, cesticillus,,* 5.93 percent with *Raillietina. echinobothrida,* 16.10 percent with *Cotugnia, digonopora* and 1.69 percent with *Choanotaenia infundibulum..* On a therapeutic trial on these birds he

observed that praziquintal the was most effective (95%) followed by niclosamide (90%), albendazole (85 percent), dibutyl tin oxide (70 percent) for treatment of these infections.

While investigating into the helminthic infections of domestic fowl in Meghalaya Yadav and Tandon (1991) found 90.9 percent prevalence of nematode infection. Ten species of helminths were encountered, of which *Capillaria contorta* was recorded for the first time from fowls in India. *Ascaridia galli* was the most prevalent spp followed by *Raillietina sp.* and *Heterakis gallinae.*

Szelagiewicz and Sokol (1991) carried out a study on poultry parasites in suburban small holdings in Poland and examined faeces of hens. Out of 50 hens examined, 33 percent of birds were infected with intestinal nematodes and coccidia. The most prevalent helminthic infections were *Ascaridia galli* (17.3%) and *Capillaria* sp. 9.6 percent, but these infections did not affect body wt. gain and egg laying.

The prevalence of gastro - intestinal helminths of native free range chickens was 95.7 percent in comparison to 11 percent in intensively reared exotic chickens in Zaria, Nigeria as reported by Fatihu *et al.* (1991). There were 18 species of various helminth species (11 nematode and seven cestodes) prevalent in free ranged birds.

In a survey work conducted by Buriro *et al.* (1992) in Sind province of Pakistan, they observed that out of 1487 infected birds 1252 birds (84.2 percent) were infected with cestodes, 6.7 percent with nematodes and 9.0 percent had mixed infections. Five spp. of cestodes viz. *Raillietina*

tetragona, Raillietina echinobothrida, Cotugnia digonopora, Amoebotaenia sphenoides and Choanotaenia infundibulum and one nematode *(Ascaridia galli)* were recorded. Higher prevalence rates were found in Hyderabad and Karachi compared with Sukkur.

While reporting the incidence of helminth parasites in poultry in five unadapted and five adapted village in the Ranchi region of Bihar, India, Singh *et al.* (1993) found the higher incidence of *Ascaridia galli* and *Raillietina* spp. in un-adapted village, whereas the incidence of *Heterakis gallinae* and *Davainea proglottina* was similar in both types of village.

Kunjara *et al.* (1993) reported the prevalence of *Raillietina* spp. (73.8%) , *Hymenolepis* spp. (2.5%), *Ascaridia galli* (21.9%), *Heterakis gallinarum* (25.6%), *Acuaria (Dispharynx) spiralis* (13.8%), *Tetrameres fissispina* (31.9%), *Capillaria* spp. (1.9%) in a P.M. examination of native chickens in Thailand.

Negesse (1993) examined the intestines of 120 chickens in Leku, Southern Ethiopia and found the prevalence of roundworms, tapeworms and flukes was 88%, 73% and 2% respectively.

Anandi *et al.* (1994) examined 30 chickens in Imphal district Manipur, India and found that 18 were infected with helminths. The species identified were *Ascaridia galli, Raillietina tetragona* and *Echinostoma revolutum.*

Khan *et. al* (1994) examined the guts of domestic fowls from the hyderabad district of Sindh, Pakistan for helminths, and found that the cestodes were more prevalent (44%) than nematodes (40%).

In an epidemiological study in West Cameroon 350 fowls were examined for the prevalence of gastro intestinal helminth by Mpoame and Agbede (1995). They found *Heterakis brevispiculum* (59.3%), *Ascaridia galli* (51.6%), *Hymenolepis carioca* (48.4%), *Dispharynx spiralis* (20.8%), *Tetrameres americana* (17.1%), *Amoebotaenia cuneata* (15.1%) *Raillietina tetragona* (14.5%), *Syngamus trachea* (13.7%), *Hymenolepis cantaniana* (5.7%) and *Capillaria contorta* (2.0%). Infections were found predominantly mixed (93.5%) with more than one parasite. The infection rates were not influenced by host sex except for *Ascaridia galli* which was more prevalent in males. Older fowls showed some resistance to *Amoebotaenia cuneata* and *Syngamus trachea.* Parasite prevalence and or worm burdens were generally higher during the rainy season. (April to October.).

Choudhury *et. al* (1995) examined the intestines of chickens in Assam for the presence of nematodes and found the following spp. : *Ascaridia galli* (51.50%), *Heterakis gallinarum* (49.03%) *capillaria columbae* (9.88%), *Strongyloides avium* (0.64%), *H. brevispiculum* (0.09%) and *subulura brunpti* (0.09%).

After faecal and PM examination of 1253 pheasants 493 patridges and 662 pigeons in Belgrade area, Pavlovic *et al.* (1996all) found a total of 14 helminth species. *Davainea proglottina, Raillietina echinobothrida, Raillietina tetragona, Ascaridia columbae, Ascaridia galli, Heterakis gallinae, Heterakis isolonche, Ornithostrongylus quadriradiatus, Syngamus trachea, Acuaria hamulosa, capillaria annulata, eapillaria columbae, Capillaria gallinae and Capillaria phasiana* were identified in the pheasants, three species in the patridges

(Ascaridia galli, Heterakis gallinae and Syngamus trachea) and in the pigeons-*Davainea proglottina, Raillietina bonini, Raillietina tetragona, Ascaridia columbae, Ornithostrongylus quadriradiatus, Syngamus trachea, Acuaria hamulosa, Tetrameres fissispina, Capillaria annulata, Capillaria columbae* and *Capillaria gallinae*. Faecal examination was negative 1- 2 weeks after giving mebendazole in feed for 14 days at 120 mg/kg feed.

Prevalence of helminth parasites of poultry under different management conditions was studied by Maqbool *et al.* (1998) in Faisalabad. The prevalence of nematode was diagnosed in all birds. However, prevalence of *Ascaridia galli* was found to be highest (36 percent) in indigenous fowls followed by *Raillietina* sp. (23 percent) *Heterakis* spp. (20 percent), and *Capillaria* sp. (9 percent) but *Postharmostomum commutatum* was found two percent only.

Rina *et al.* (1999) conducted a survey on gastrointestinal nematodes among *Gallus gallus domesticus*. The overall prevalence rate of the nematodes was recorded 78 percent in Bihar state. *Ascaridia galli* (91%) and *Heterakis gallinae* (91 percent) were identified among the total samples examined.

Terregino *et al.* (1999) had done a preliminary study of the helminths of the chicken digestive tract in Somalia. They selected 140 chickens of a local breed from two different types of rearing systems for study . 125 free range Chickens had been taken to a slaughter house in Mogadishu and 15 were obtained from an intensive rearing farm . Of the 140 chickens examined 110 were infected (79%), out of which 104 were from free range flocks and six from the intensive rearing farm.

Hence, 83 percent of the chickens of the first group and 40 percent of the second were infected. Difference in prevalence of endoparasites in two management systems were significant. The identified parasites spp. were *Ascaridia galli, Subulura suctoria, Raillietina tetragona, Raillietina echinobothrida, Raillietina cesticillus, Raillietina spp. (Paroniella); Cotugnia spp.* and *Mediorhynchus gallinarum.*

In a cross- sectional prevalence study of gastrointestinal helminths among 268 adult hens in big industrialized farm in Denmark (Permin *et al.,* 1999) a total of six species of helminths were identified. The prevalence varied considerably between the investigated production systems. For *Ascaridia galli,* the prevalence was 63.8 percent in the free- range/ organic system , 41.9 percent in the deep litter system, percent in the battery cage system and 37.5 percent in the backyard system. *Heterakis gallinarum* was found in free- range / organic system at a rate of 72.5 percent , 19.4 percent in the deep litter system and 68.8 percent in the backyard system. The prevalence of *Capillaria obsignata* was 53.6 percent in the free range / organic system, 51.6 percent in the deep litter system, 1.6 percent in the parent stock of the broiler production and 50.0 percent in the backyard chickens. Even though the broiler parent stocks were kept in deep litter systems, *Capillaria obsignata* was the only helminth species demonstrated. *Capillaria anatis* and *Capillaria caudinflata* were only indentified in the free range/ organic system, where the prevalence was 31.9 percent and 1.5 percent, respectively and in the backyard systems where the prevalence were 56.3 percent and 6.3 respectively. The study confirmed a higher risk of hilminth infections including *Ascaridia galli* in free range / organic and

backyard systems compared with the indoor battery cage and parent stock..

In a survey of 1000 domestic fowls from the local markets of Rajasthan, Mathur (2000) reported the incidence of helminth parasites in the alimentary canal of fowls. He revealed that 77 percent of the intestines were infected by *Ascaridia galli, Heterakis gallinarum, Raillietina, tetragona, Raillietina echinobothrida, Raillietina cesticillus, Hymenolepis carioca and Paronia galli*. Thus it was concluded that *Ascaridia. galli* had the highest intensity while *Raillietina. tetragona* had average intensity and dominance percentage.

In a study on the prevalence of gastrointestinal parasites in captive birds of Gujarat zoos Patel *et al.* (2000) found that 48.11 percent of birds were positive for helminthic infections. *Ascaris* and *Capillaria* ova were observed in 20.75 percent and 13.2 per cent faecal samples, respectively. *Ascaridia galli and Cotugnia. digonopora* were recovered during P.M exam. of three pigeons and *Ascaradia galli* alone was found during P.M. of a parrot peacock and cockatiel.

Sevinc *et al.* (2000) examined gastrointestinal system of 40 turkeys and faecal samples of 450 tukeys macroscopically in konya. They found 52.5 percent of turkeys were infected with G.I. parasites. *Eimeria* spp., *Heterakis gallinarum, Subulura differens, Echinostoma revolutum* and *Ascaridia galli* were detected in 37.5, 15, 7.5, 5 and 2.5 percent of samples, respectively. Oocysts of *Eimeria* spp. and the eggs of *Capillaria* spp., *Ascaridia* spp., *Choanotaenia infundibulum, Trichostrongylus tenuis* and *Heterakis gallinarum* were detected in 12.88, 7.11, 6.44, 1.55, 1.33, and 0.88 percent faecal samples, respectively.

In a similar study, 13 adult indigenous chickens from Oodi, Kgatleng district, Botswana were examined for helminth parasites by Mushi *et al.* (2000). Two species of nematodes, *Ascaridia galli* and *Heterakis gallinarum* and species of the cestode genus, *Raillietina* spp. were recovered. *Ascaridia galli* and *Heterakis gallinarum* were the most commonly seen parasites. *Ascaridia galli* occurred concurrently with *Raillietina* spp.

Sayyed *et al.* (2000) reported the prevalence of intestinal nematodes in indigenous chickens in Swat district of Pakistan and 51 percent of birds were diagnosed with the infection. Mixed nematode infestation was diagnosed in 16 percent of birds. *Ascaridia galli* was identified in 42 percent of birds and *Heterakis gallinarum* in nine percent of birds.

Subsequently a cross- sectional study was conducted by Poulsen *et al.* (2000) to determine the prevalence and species of gastrointestinal helminth in 100 chickens kept under extensive management systems in Ghana of West Africa. A total of 18 species of helminths were detected. *Acuaria hamulosa* (25%), *Allodapa suctoria* (20%), *Ascaridia galli* (24%), *Caprillaria* spp. (60%), *Choanotaenia infundibulum* (13%), *Hymenolepis* spp. (66%), *Raillietina cesticillus* (12%), *Raillietina echinobothrida* (81%), *Raillietina tetragona* (59%), *Strongyloides avium* (2%), *Subulura strongylina* (10%), *Tetrameres fissispina* (58%), *Trichostrongylus tenuis* (2%) and finally one unidentified trematode (1%) were isolated. Association between chicken sex and prevalence was found not significant. An over-dispersed distribution was seen for most of the helminth species.

A study on the occurrence and pathology of various poultry diseases was done by Kurade *et al.* (2001) in Himachal Pradesh, India. They analysed the necropsy findings of layers and broiler over a period of five years according to different age groups and seasons and found that parasitic problems, mainly coccidiosis and *Ascaridia galli* infection, were the major causes of mortality in the chickens.

Kulkarni *et al.* (2001) in a survey of 250 desi fowls in Marathwada region of Maharashtra state observed 53.20 percent overall prevalence of helminthic infections. 62.30 percent were found infected with nematodes, 37.14 percent with cestodes and 0.57 percent with trematodes.

A study was conducted by Kidanemariam (2001) to determine the fauna of gastrointestinal helminths and their prevalence in fowls kept extensively in Ethiopia. Of the 106 chickens examined 98 were infected with one or more species of helminth parasites. A total of 10 species of helminths were identified. The species of helminths indentified and their prevalence were like : *Amoebotaenia sphenoides* (12.2%), *Ascaridia galli* (62.2%), *Choanotaenia infundibulum* (8.4%), *Dyspharynix nasuta* (3.7%), *Heterakis gallinarum* (25.4 %), *Hymenolepis cantiana* (27.3%), *Raillietina cesticillus* (6.6%) , *Raillietina echinobothrida* (33%), *Raillietina tetragona* (32%) and *Subulura brumpti* (8.4%). Total 83.7 percent of the fowls examined had multiple infections ranging from two spp. (45.92 percent) to six (7.14%). The present study showed a higher prevalence of G.I. helminths of fowls in Bahir Dar.

In a screening study conducted by Eshetu *et al.* (2001) on gastrointestinal helminths of scavenging chickens in four rural districts of Amhara region, Ethiopia, it was found that 91.01 percent chickens

harbour one to nine different helminth parasites and 8.99 percent were free of helminth parasites. It was further observed that the highest prevalence was in the lowland areas. This suggests that agroecology has a major influence on the distribution of helminth parasites. Nematodes recovered included *Heterakis gallinarum* (17.28%), *Subulura brumpti* (17.60%) , *Ascaridia galli* (35.58%), *Cheilospirura hamulosa* (0.75%) and *Dyspharynx spiralis* (2.62%). Cestodes were *Raillietina echinobothrida* (25.84%), *Raillietina tetragona* (45.69%), *Raillietina cesticillus* (5.62%), *Amoebotaenia sphenoides* (40.45%), *Davainea proglottina* (1.12%) and *Choanotaenia infundibulum* (4.49%).

Altinoz (2002) carried out a study to determine the type of helminth sp. found in the digestive tract and their prevalence in the modern poultry farms in Ankara and surrounding areas. Samples from a total of 352 necropsied chickens were examined. The general infection rate of helminths was found to be 5.39 percent (3.69 percent *Ascaridia galli* and 2.27 percent *Heterakis gallinae* and 0.28 percent *Subulura differens.* Infection was higher in hens (6.45%) than roosters (1.36%). The infection rate in breeding and laying hen was 16.30 and 2.50 percent, respectively. Infection rate in free roaming chickens was 8.87 percent.

Carlos and Eduardo (2002) recorded prevalence of intestinal helminth parasites in fighting cocks. The prevalence of *Raillietina echinobothrida* (73.96%), *Heterakis gallinarum* (50%), *Heterakis beramporiae* (20.8%), *Ascaridia galli* (25%) and *Capillaria* spp. (11.46%) were found. A total of 95 percent of the birds examined

were found positive for any of the above helminth species as single or mixed infection.

In a cross-sectional study Permin *et al.* (2002) determined the prevalence of ecto-endo and haemo-parasites in free - range chickens in Zimbabwe. Fifty young and 50 adult birds were selected randomly. The mean (± S.D.) number of helminth species per chickens was 6.7 ± 2.0 for young chickens and 6.4 ± 2.0 for adult chickens with a range of 1 - 10 for young chickens and a range of 1 - 11 for adult chickens. The most prevalent nematodes identified were : *Allodapa suctoria* (76.72), *Ascaridia galli* (48.24), *Gongylonema ingluvicola* (28.56), *Heterakis gallinarum* (64.62) and *Tetrameres americana* (70.62), for cestodes the prevalence were : *Amoebotaenia cuneata* (60.68), *Hymenolepis nana* (62.80) , *Raillietina echinobothrida* (66.34) , *Raillietina tetragona* (94.100) and *Skrjabinia cesticillus* (50.76). The young chickens had higher prevalence of *Ascaridia galli* and *Raillietina echinobothrida* compared to adults but lower prevalence of *Gongylonema ingluvicola and Skrjabinia cesticillus.*

Magwisha *et al.* (2002) studied on the comparative prevalence and burdens of helminth infections in grower and adult free range chickens in Tanzania from the beginning to the end of the long rainy season. At necropsy, the trachea, gastrointestinal tract and oviduct were examined for the helminth infections. The helminth spp. isolated comprised of 18 nematodes and eight cestodes but no trematodes. They observed that the number of species of parasites isolated per chicken increased as the rainy season advanced. They also observed higher incidence of helminth parasites in growing male than female.

While reporting on the prevalence of gastrointestinal nematodes in common peafowl at Lahore zoo (Pakistan), Ashraf *et al.* (2002) found that 42 samples out of 52 were positive (80.77%) for single or mixed infections of *Capillaria* spp, *Ascaridia galli* and *Heterakis gallinae,* the individual percentage being 59.62, 38.46 and 13.46, respectively. After that , they also studied the comparative efficacy of albendazole, levamisole HCl and oxfendazole and observed that oxfendazole was most effective (98.88%) among the three anthelmintics followed by levamisole (97.3%) and albendazole (95.60%).

After examination of helminths from gastrointestinal tracts of 125 free range chickens in Zambia, Phiri *et al.* (2007) revealed prevalence rate of 95.2 percent. No trematodes or *Syngamus trachea* were found. Mixed infections accounted for 88.2 percent as compared to 7.2 percent of single infections. Effects of helminthoses on weight gain were investigated in 100 growing chickens randomly assigned to treatment (levamisole) and untreated control groups. There was a significant average weight gain (grams) of 812.8 in the treatment group and 623 in the control group ($0<0.01$). The average worm burdens from the control group and the treatment groups were 96.3 grams and 22.05 grams, respectively. The results confirmed the higher risk of helminth infections in free range systems and might explain the deleterious effects in chickens.

Shide *et al.* (2004) examined intestine of *Gallus gallus domesticus* collected from various markets in Beed district, Maharastra and observed that 70 percent of fowls were infected with nematode parasites. The infecting

species were *Ascaridia galli* (73 percent) and *Heterakis gallinatum* (27 percent).

II. Clinico-pathological and Biochemical changes in poultry due to gastrointestinal parasites :

In a study related to pathogenicity of *Ascaridia galli* in Nigeria, Fatihu *et al.* (1992) observed that significant weight loss was observed in chickens infected with 1000 ova, but they did not observe any significant difference in the values of PCV and plasma protein between the control and the infected group of birds. The general symptoms observed in infected chicken were blood tinged diarrhoea, increased thirst, stunted growth. The common intestinal lesion was ecchymotic haemorrhages on the serous surface and catarrhal enteritis on the mucous surface. Necrosis and desquamation of intestinal villi was seen in the histological sections of small intestine of infected birds.

A preliminary haematological study was carried out by Nguyen *et al.* (2000) in 120 uninfected chickens and 80 chickens infected with *Ascaridia galli* and *Raillietina* spp. TEC and hemoglobin study concentration was found decreased and TLC increased in infected birds.

Dubinsky *et al.* (1974) analysed the levels of various blood components in young chickens 11, 17, 23 and 52 days after infection with 300 eggs each of *Ascaridia galli* and compared the same values in uninfected controls. After the analysis, the total protein, total lipid and total glucose levels showed no changes that could be related to infection; however, protein levels showed a tendency to increase and lipids to decrease, with the age of

the host. The level of serum glutamic – oxalo-acetate, transaminase was reduced in infected chickens on day 17 and 52 after infection and that of serum glutamic – pyruvic transaminase on days 17 and 23.

Kaushik (1975) reported that there was no significant difference in the serum protein levels in six chicks infected with 300 *Ascaridia galli* embryonated ova and two uninfected chicks during the first two weeks of infection. There was a significant increase in protein level in infected chicks in the third and fourth weeks but by the sixth week it was the same as in controls, and thereafter it continued to fall below the control level. The increase in serum protein concentration coincided with the end of the tissue phase.

In an experimental study, Dubinsky and Rybos in 1977 concluded that helminthosis depressed the plasma content of free amino acids and the serum aspartate and alanine aminotransferase activities. *Ascaridia galli* in the intestines affected the quantity of amino acids in the intestinal contents by inhibiting digestion of proteins and absorption of amino acids despite the serum protein level and growth rates of the chicks were not affected. It was further concluded that during a single experimental infection chicks receiving feed of full nutritional value were able to compensate for the adverse effect of the helminths.

The serum protein levels were determined in uninfected and Ascaridia – infected chickens by Vovchenko in 1980. He found that the total proteins, albumin, beta – and gamma globulins remain unchanged in uninfected controls. In birds with adult nematodes, total protein and albumin levels were reduced, those of alpha – and beta – globulins were normal.

Haematological values were determined by Sekhar *et al.* in 1988 in cockerels and pullets infected with various species of cestodes and *Ascaridia galli.* They reported that total erythrocyte count was depleted but haematocrit was elevated because of increase in individual cell size. The volume index was high implying macrocytic anaemia, Haemoglobin level was lowered, corpuscular haemoglobin level was raised due to the increase in corpuscular size. The colour index was high suggesting hyper chromic anaemia.

Sharma *et al.* 1990 observed the effect of Cambendazole and Haloxon on the carbohydrate metabolism of *Ascaridia galli*, *Heterakis gallinae* in poultry. They reported that the exposure for 10 – 60 min to cambendazole significantly reduced the glycogen content in *Ascaridia galli* and *Heterakis gallinae* and significantly increased the level of lactic acid. Maximum decrease in oxygen consumption recorded was 90 percent for *Ascaridia galli* and 94 percent for *Heterakis gallinae.* However, Haloxon did not significantly change lactogen and lactic acid.

While reporting the effect of *Ascaridia galli* infection on plasma proteins of normal and immuno-suppressed chicks Raote *et al.* (1991) observed that the plasma protein levels after infection were increased on day 10 but decreased from 20 days onwards in the infected chicks that were not immuno suppressed with the similar results in all of the immunosuppressed groups. On day 10 albumin levels were increased in all of the immuno suppressed groups but were reduced in the infected, non – immunosuppressed group. Globulin levels were highest in all of the treated groups, gradually declining up to day 30 in the infected, non suppressed group and up to day 40 in the immuno suppressed groups. On day 10 the

albumin globulin ratio in all treated groups was lower than that of uninfected, non – immuno suppressed controls.

While studying the biochemical parameters of experimentally infected chickens with *Ascaridia galli,* Ramadan and Znada in 1991 observed that there was marked decrease in both glycogen and protein content and an increase in fat content of muscle and liver of infected chickens when compared with those of normal chicken tissues.

Baraket *et al.* (1997) recorded that chickens experimentally infected with *Ascaridia galli* at different ages showed decrease in zinc concentration and copper level. Total plasma protein and globulin level increased significantly in the infected birds.

III. Chemotherapy of Gastrointestinal parasites in poultry :

While performing an experiment Anwar *et al.* (1985) reported that serum protein concentrations in the two *Ascaridia galli* infected group of chickens were lower than in the controls, before and three days after treatment with oxfendazole (7.5mg/kg body wt.), but were only slightly lower seven days after treatment. Differences in serum concentration of sodium, potassium and chloride between the groups were slight. The reduction in body wt. gain caused by infection was reversed by oxytetracycline treatment.

Statescu *et al.* (1992) conducted a drug therapy with albendazole derivatives in broiler fowls (laying hens) for treatment of helminthic parasites and compared its efficacy with piperazine adipate. Moderate helminth infections persisted after the piperazine adipate treatment but complete removal of all the alimentary tract helminthic parasite were

observed following the use of albendazole derivatives. Very good weight gains were found following the treatment (albendazole derivatives).

Padmaja and Sathianesan (1993) did a comparative study on the efficacy of albendazole, morantel citrate and ivermectin with piperazine hydrate against 5, 15, 25 and 35 day old *Ascaridia galli* in experimentally infected chickens and reported that albendazole was 100 percent effective against all stages except for 5 day old larvae against which it was 99.85 percent. Morantel citrate was 100 percent effective for 25 and 35 day old and 99.16 percent and 80.14 percent against 5 and 15 day old larvae, respectively. Piperazine hydrate was 100 percent effective against 35 days old worms only and against 5, 15 and 25 days old, the efficacies were 85.08 percent, 61.86 and 92.71 percent, respectively. Maximum efficacy of 82.25 percent for ivermectin was noticed only against 35 day old larvae and against 5, 15 and 25 day old larvae, its efficacies were 70.70, 51.67 and 77.51 percent, respectively.

Levamisole given orally at 40 mg/ kg twice at weekly interval was 100 percent effective against *Ascaridia galli* and 90 percent against *Capillaria* at 3 weeks post treatment of 2nd dose. This had been reported by Kuczynske *et al.* (1994) in Poland.

An experimental study done by Maqbool *et al.* (1995), 100 chickens were infected with 40 larvae of *Ascaridia galli* orally for 4 consecutive days. The birds were divided into 4 groups and treated orally with 7.5 mg/kg of oxfendazole, 100mg/kg of mebendazole, 200mg/kg of piperazine and group four left untreated. The drugs were found more

effective against mature worms than the immature worms and caused reduction in the number of egg/gm. of faeces.

Pavlovic *et al.* (1996) evaluated that mebendazole was 100 percent efficacious at dose rate of 120 mg/kg in feed for 14 days for treating helminthosis in game birds and pheasants maintained in controlled condition.

The anthelmintic activities of albendazole (10.0 mg/kg) against nematodes and praziquantel (6.0 mg/kg) against cestodes ,given as a single dose via mash, were evaluated in naturally infected chickens by Silva *et al.*(1999) and they found that albendazole was 100 percent effective in the elimination of *Ascaridia galli,* 78.57 percent effective against *Heterakis gallinarum* and was ineffective against cestodes. Praziquantel was effective against *Hymenolepis cantaniana* (96.86%), *Amoebotaenia cuneata* (95.89%), *Raillietina tetragona* (95.74%) and *Raillietina echinobothrida* (97.57%).

A study was carried out to evaluate the efficacy of fenbendazole (Panacur) by Hayat *et al.* (2002) against *Ascaridia galli* and *Raillietina tetragona* infection in layers. 100 white leghorn layers naturally infested with *Ascaridia galli* and *Raillietina tetragona* were randomly divided into four groups of 25 birds each. Fenbendazole (panacur) was added to feed at a dose level of 48 and 16 mg/kg body wt. and allotted to groups A, B and C, respectively. Group D was served as infected untreated control. The efficacy of fenbendazole was evaluated on the reduction in the number of whole worms and eggs per gram (EPG) of droppings. A 100 percent reduction in EPG was observed for all dose levels studied seven days after administration of the

medicated feed. No apparent adverse effects were observed in the layers.

Abdel Wahab (2003) studied that the efficacy of a new formulation of albendazole (flubendazole) on the eradication of nematodes in laying hens. If was found 100 percent efficacious at a dose rate of 30ppm. for seven consecutive days. There was marked improvement in general health condition and mean number of laid eggs.

Efficacy of albendazole at 14 mg/ kg body wt was found 100 percent effective in reducing the egg per gm of faeces and also 100 percent effective in reducing the P.M. worm count in poultry. Levamisole was also found 100 percent effective in reducing E P G and worm count at 10 mg, 20mg, 40 mg/kg body wt. This experiment was couducted by Deepali Chaddha *et al.* (2005) in Palampur.

Tucker *et al.* (2007) evaluated the anthelmintic efficacy of albendazole at a dose rate of 0.0, 5.0, 10.0 and 20.0 mg/kg body wt. for the treatment of ascarosis in chickens. On seven days post treatment, reduction in worm burden from control levels were seen at the 5.0 mg/ kg dose level for adult and larval stages of *Ascaridia galli.*

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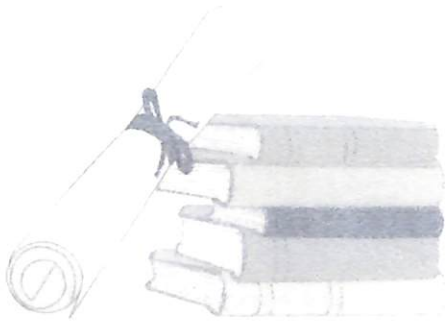
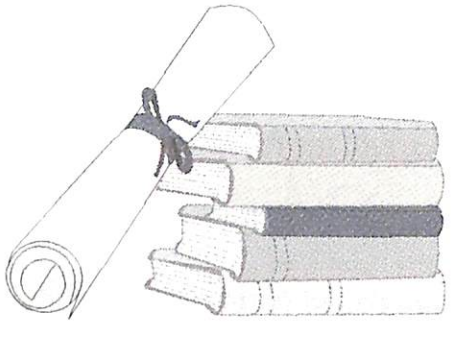
Chapter - III

MATERIALS AND METHODS



Chapter - III

MATERIALS AND METHODS



MATRIALS AND METHODS

Poultry birds maintained under backyard system of farming in areas of Begusarai, Nalanda and Madhepura were screened for the presence of gastrointestinal parasites.

Collection of samples : Dropping (faeces), viscera and carcasses samples of birds were collected, processed and examined for the presence of gastro-intestinal parasites.

A. Dropping and intestinal contents from viscera were processed by direct and indirect techniques for the presence of ova of the endoparasites.

B. The intestinal part from the carcasses was removed, incised and examined for the presence of helminth parasites. The nematodes were cleared in lactophenol and cestode were flattened and stained with acetic alum carmine for further identification.

C. Technique for counting nematodes of the alimentary tract. The technique described is that used for the examination of the intestinal contents of the poultry (Reference).

   a. The crop, oesophagus, trachea, gizzard, small intestine, colon, caecum and cloaca were removed or ligated from the poultry and washed separately.

   b. The gastro intestinal tracts (G.I.T.) were cut open over a bowl in which the contents were collected. The wall of G.I.T. was washed thoroughly under a stream of water from a tap, the

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   b. The gastro intestinal tracts (G.I.T.) were cut open over a bowl in which the contents were collected. The wall of G.I.T. was washed thoroughly under a stream of water from a tap, the

mucous membranes were carefully rubbed with the fingers to remove any worms adhering to it.

c. The contents of the bowl were then poured a little at a time on to a wire mesh screen with an aperture of 0.15 mm which was then washed with a stream of water from a rubber tube attached to the tap until no more coloured matter or food particles passed through. When all the materials had been screened and washed in this way, the screen was inverted over a pneumatic trough and by means of a stream of water the food material and worms collected on the screen were washed into it.

d. The contents of the trough were made up to a volume of 4000 ml by the addition of water and sufficient formalin to give a final concentration of 10 percent.

e. The content was then agitated vigorously and samples were removed by means of a wide mouthed pipette with an orifice of not less then 5mm diameter. The vigorous stirring was continued throughout the process of sampling. The samples were then transferred to a measuring cylinder until a total of 40 ml was collected.

f. Small quantities of this 40ml were placed in a glass-petri-dish having parallel lines marked on it, 5 mm apart, diluted with water and the worms were counted under a dissecting microscope. The total number of worms counted in the 40 ml sample was then multiplied by 100 to give the number of worms present in the intestinal part.

Differential Worm Count :- Having made a total worm count the main species of worms present were identified. A given number of adult worms were picked out at random and identified. The numbers of the different species were estimated. At least 50 worms have been identified, but when the total count was high more worms had to be identified.

Identification of parasites:- Collected parasites were identified as per the description available in the literature (Soulsby, 1982, Bhatia *et al*; 2004).

Preservation and Staining of Helminths:

Preservation of nematodes :- The cuticle of these worms is very thick and therefore it is preferable to go for hot fixation. Seventy percent alcohol or a 3 to 5 percent formalin solution was heated to 71-82^{0}C (160-180^{0}F); then thoroughly washed off worms were thrown into the hot fixing fluid. After the liquid had cooled they were stored in clean fluid of the same kind.

Preservation of cestodes : Before proceeding to fix the cestodes, some attempt was made to wash them in one percent salt solution, care was taken not to break them or allow them to become badly tangled. They were then fixed in 5 or 10 percent formalin, between two pieces of glass slides and tied with a thread and then dipped in the fixing liquid and allowed to hang between the dipping jar suspended by the posterior end from the forceps. This slight traction maintained them in a favourable stretched position and facilitated the subsequent examination.

Examination of helminths : Minute nematodes were best examined fresh in physiological saline, between slide and cover slip under the microscope. Larger ones were fixed as already described, and cleared in phenol or lactophenol.

General staining methods for cestodes and nematodes:- The helminths were first fixed as described above and were then brought into 70 percent alcohol. They were then transferred to potash alum and was left in the stain for one day. They were then washed in 70 percent alcohol and placed in the acid alcohol for differentiation, the process was watched under the microscope and when completed, the helminths were transferred to 70 percent alcohol. They were then dehydrated in a series of ascending grade of alcohol as follows :

Three changes of 70 percent alcohol remaining 50 minutes in each, 95 percent alcohol for one hour and three changes of absolute alcohol for 15 minutes each. They were then cleared in Xylol and mounted in Canada balsam or DPX mountant.

Examination of Faecal Samples:

The faecal samples collected from different birds were examined by direct smear examination as well as by concentration technique like centrifugation and salt floatation technique as per the procedure described below :

(a) Direct Smear Examination : A small quantity of faeces was placed on a slide, mixed with some droplets of water and cover slip was placed on the fluid. The slide was then examined using the 10x & 40 x 0bjective.

(b)Salt floatation technique :

(i) 1 gm of faecal samples were taken in a pestle and mortar and a little quantity of water was added to it.

(ii) It was mixed thoroughly and strained to a centrifuge tube.

(iii) The centrifuge tube was then filled with tap water.

(iv) Centrifuged for 5-10 minutes at 1500 r.p.m.

(v) The supernatant fluid was discarded.

(vi) The above procedure was repeated, that is the tap water was added & discarded until the supernatant water became clear.

(vii) The sediment was suspended with 33 percent Zinc sulphate solution (specific gravity – 1.18).

(viii) The content was centrifuged for one minute at 1500 r.p.m. Then, the centrifuge tube was allowed to stand undisturbed.

(ix) A loopful of scum was examined by mixing with 1 percent iodine solution.

(x) Then, it was examined under a microscope.

(c) Centrifugation technique :

(i) 1 gm of faeces samples were taken in a pestle and mortar and a little quantity of water was added to it.

(ii) It was mixed thoroughly and strained to a centrifuge tube.

(iii) The centrifuge tube was filled with tap water.

(iv) It was then centrifuged for 5 – 10 minutes at 1500 r.p.m.

(v) The supernatant was discarded carefully to a remaining sediment of approx.

(vi) The above procedure was repeated (addition and discarding of tap water).

(vii) By using a pipette, the sediment was transferred to one or more with a drop of iodine solution (1%) and cover glass was placed on it.

(viii) Then, the slide was examined under the microscope. Records of prevalence of parasites in different season, sex and age

groups were maintained and tabulated as per following details.

(i) **Season** – According to the temperature, rainfall and humidity season wise study was carried out –

a. March to June (Summer & Early Monsoon)
b. July to October (Post Monsoon)
c. November to February (winter)

(ii) **Sex :** Male and Female

(iii) **Age groups of birds :**

a. Birds from 0-1 wk
b. Birds from 1 week to 18 weeks (Approx.)
c. Birds of 18 weeks to 1 year (Approx.)

Comparative efficacy of anthelmintics against helminth parasites of poultry :-

Poultry birds found positive for parasitic infection by qualitative test of faecal samples were used in the farmers backyard for study of comparative efficacy of anthelmintics.

The birds found positive for mixed infection of helminth parasites were grouped having seven birds for each trial.

For trial three drugs namely Fenbendazole, Albendazole and Mebendazole were used. The experiment was conducted as per the given protocol.

Group	No. of birds/group	Drug used for trial	Dose of Drug	Mode of Administration
I	7	Fenbendazole	1ml/250ml of drinking water	Through drinking water
II	7	Albendazole 2.5% w/v	35ml/1 litre of drinking water	- Do -
III	7	Mebendazole susp.- 100mg/5ml w/v	3ml/1 litre of drinking water	- Do -
IV	7	Nil	Nil	Nil

The assessment of the drug in respect to its efficacy was done by estimation of EPG of faeces, Hb%, TLC and TEC of the blood at 7 day interval.

The EPG was conducted on pooled droppings of all the seven birds from 0 day post treatment till 21st day by employing modified Stoll's technique using the formula given below.

$$\text{\% Efficacy} = \frac{\text{EPG Pre-treatment} - \text{EPG post-treatment}}{\text{EPG Pre-treatment}} \times 100$$

Haematological Studies :

Various haematological studies were conducted in 10 infected poultry whose faecal samples were found positive for the ova of helminthic parasites. Similarly, haematological studies of 10 healthy birds were also conducted for comparative study as per the method described below :-

(i) **Haemoglobin (Hb%)** – Haemoglobin value of poultry birds naturally infected with helminths and healthy control was obtained by the method described by Schalm *et al.* (1975).

(ii) **Total Erythrocyte Count (TEC)** – The blood sample was taken upto 0.5 mark in the R.B.C. diluting pipette of Haemocytometer and then diluted with R.B.C. diluting fluid up to 101 mark. The content of the pipette was mixed with twisting motion. A few drops of this diluted blood was discarded and then a drop of it was allowed to trickle in the gap between cover glass and Neubauer's counting chamber of Haemocytometer touching all the sides of the wall . All the cells of 5 big squares or 80 small squares for counting cells of R.B.C. were counted and the total number of erythrocyte count per cubic mm was calculated.

(iii) **Total Leucocyte Count (TLC)** – Blood was sucked upto 0.5 mark of the W.B.C. diluting pipette and was diluted with the W.B.C. diluting fluid up to 11 mark taking care that no air bubble was included. The pipette was shaked and the Neubauer's counting chamber was filled as described for R.B.C. counting method. The white cells were counted in the four large corner squares of the

chamber and the total number of leucocyte count per cubic mm was calculated.

(iv) **Differential Leucocyte Count (DLC)** – For DLC thin and uniform smear of blood was prepared on a clean grease free slide and dried in the air. The smear was stained with Leishman's stain. The stained blood film was seen under low power objective of the microscope to see whether the film was homogeneously stained or not and then examined under oil immersion objective of the microscope placing a drop of cedar oil in well prepared film. While counting, the edges were avoided and the cells running in strips in the whole length of the film was examined. During examination of the cell, 200 cells were counted and the percentage of different cells was recorded. Leucocytes were differentiated as per standard technique.

Statistical analysis :-

The collected data were tabulated and influence of parasitism in different system of management was evaluated using the statistical analysis described by Snedecor and Cochran (1967).

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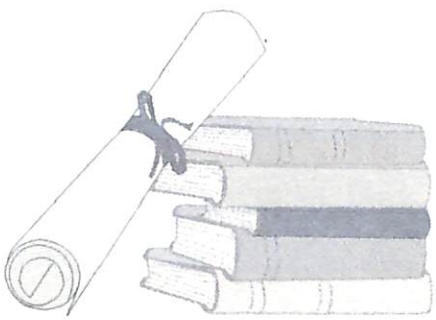
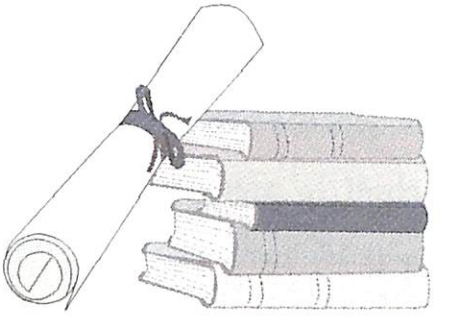
Chapter - IV

RESULTS AND OBSERVATION



Chapter - IV

RESULTS AND OBSERVATION



RESULTS AND OBSERVATIONS

Gastrointestinal parasitism is one of the major problems which inflict heavy economic losses in the form of retarded growth, reduced weight gain decreased egg production, diarrhoea , obstruction of intestine, morbidity and mortality. Nematodes and cestodes are of prime importance in domestic poultry. The results and observations of present investigation present the prevalence of various gastrointestinal helminthic parasites in the population of domestic poultry raised in farmers' backyard in three districts of Bihar farmers' Comparative efficacy of mebendazole, albendazole and fenbendazole were also evaluated against natural gastrointestinal helminthosis in domestic poultry.

Incidence of various gastro-intestinal parasitic infections in backyard poultry farming in three districts of Bihar:

A total of 1060 and 1530 faecal samples and intestinal scrapings, respectively were screened to estimate the rate of gastrointestinal parasitic infection in backyard poultry management in the three districts viz Nalanda, Begusarai and Madhepura of Bihar.

(a) Incidence of gastrointestinal parasites during faecal sample examination (Table – 1) :

Within the three districts i.e, Nalanda, Begusarai and Madhepura total 360, 350 and 350, respectively, individual anal dropping of birds were examined and maximum (82%) rate of infection was noted in Begusarai district followed by Madhepura district (78.57%) and minimum rate of infection was observed in Nalanda district (69.72%) in backyard poultry population. Chi-square test revealed highly significant rate of distribution of

parasitic infection in different districts of Bihar during faecal sample examination.

(b) Incidence of gastro-intestinal parasites on intestinal scraping examination (Table-2) :

In the present investigation 630, 500 and 400 intestinal scrapings collected from backyard poultry in the three districts – Nalanda, Begusarai and Madhepura, respectively were examined. The statistical analysis revealed highly significant rate of distribution of parasitic incidence among three districts but highest rate was recorded in Begusarai district (81.20%) and lowest was in Madhepura district (77.00%) while 72.06% birds from Nalanda district were found infected with various intestinal parasites.

B. Prevalence of various gastrointestinal parasites in different districts of Bihar on faecal sample examination :

(a) Nalanda : In Nalanda district, out of 360 faecal samples examined only 251 samples (69.72%) were found positive **(Table-3).** The parasites detected were *Ascaridia galli* in 204 samples, *Raillietina* sp. in 232 samples and *Heterakis gallinarum* in 12 faecal samples as single or mixed infection.

Below the table no.3 the diagonal values showed the no. of poultry carrying individual infection as three cases of faecal sample were having single infection of *A. galli* likewise *Raillietina* infection was found singly in 31 faecal samples and *Heterakis gallinarum* was individually detected in 12 examined faecal samples.

(b) Begusarai : In Begusarai district, out of 350 examined (Table-4) faecal samples 287 (82.00%) were found positive with the following parasites : *A. galli* in 205 samples, *Raillietina* sp. in 228 samples and *Heterakis*

galliranum in 26 examined faecal samples as single or mixed infection. The diagonal values below table 4 were showing the single infection with 53,76 and 6 samples positive for *A. galli, Raillietina* sp. and *H. gallinarum,* respectively.

(c) Madhepura : In Madhepura district, out of 350 examined faecal samples altogether 275 (78.57%) were found positive **(table-5)**, in which *Ascaridia galli* was detected in 193 samples, whereas 225 samples were positive for *Raillietina* sp. infection and similarly 22 faecal samples were found positive with *Heterakis gallinarum* as single or mixed infection.

The diagonal values shown were having 43 cases of single *Ascaridia galli* infection and 76 cases positive with single infection of *Raillietina* sp., whereas 7 cases of individual *Heterakis gallinarum* infection were detected in this case.

C. Prevalence of various gastrointestinal parasites in different districts on intestinal content examination with diagonal representation of single and mixed infection :

(a) Nalanda : On intestinal content examination in Nalanda district, 454 (72.06%) were found positive with G.I. parasites out of 630 intestinal content examined **(table no-6)**. The parasites detected during intestinal content examination were – *A. galli* in 303 cases, *Raillietina* sp. in 410 cases and *Heterakis gallinarum* in 25 cases as single or mixed infection.

Below the above table, the diagonal values shown indicated the single infection with *A. galli* in 93 cases, *Raillietina* sp. in 185 cases and no case of individual *Heterakis gallinarum* was detected .

(b) Begusarai : In Begusarai district, out of 500 intestinal samples examined 406 (81.20%) were found positive **(table no-7),** the helminths observed were *A. galli* in 287 intestinal samples, *Raillietina* spp. in 350 samples and *H. gallinarum* in 31 samples as single or mixed infection.

From the diagonal values shown below the table it has been recorded that *A. galli* was present singly in 52 intestinal contents, the single infection of *Raillietina* sp. was detected in 107 cases and only one case was having the single infection of *H. gallinarum.*

(c) Madhepura : Out of the total 400 examined intestinal contents in Madhepura district, 308 (77.0%) had the infection with the following parasites as single or mixed infection - *A. galli* (225), *Raillietina* spp. (210) and *H. gallinarum* (51) **(Table no.8).**

Below the table, the diagonal values were indicating 78 cases of single infection of *A. galli, Raillietina* sp. in 39 cases as individual infection and *H. gallinarum* in 12 cases out of the examined intestinal contents.

D. Prevalence of *Ascaridia galli* in three districts of Bihar :

(a) On faecal sample examination:

As it has been indicated in **table- 9** *Ascaridia galli* infection was highest (58.57%) in Begusarai district, followed by Nalanda district (56.66%) and least in Madhepura district (55.14%). Here it has been observed that *Ascaridia galli* was almost equally prevalent in all the three districts as the data indicated non-significant difference in the values.

(b) On intestinal content examination :

It has been found that the distribution of *A. galli* was highly significant **(Table no.10)** between the three districts and maximum infection rate was found in Begusarai district (57.40%) followed by Madhepura district (56.50%) and least in Nalanda district (48.09%) out of 500, 400, 630 examined intestinal contents, respectively.

E. Prevalence of *Raillietina* sp. in the three districts of Bihar :

(a) Faecal samples examination (Table no.11) :

The maximum incidence of *Raillietina* sp. infection was recorded in Begusarai district followed by Nalanda district and least in Madhepura district. And the range of infection of *Raillietina* spp. was found between 64.28% to 65.14% and hence the distribution was observed to be non-significant.

(b) Intestinal content examination :

It has been concluded that the maximum infection rate of *Raillietina* sp. was noted in Begusarai district (70.00%) out of 500 examined intestinal contents, 65.07% in Nalanda district out of 630 examined samples and (52.50%) least in Madhepura district out of examined 400 intestinal samples. The distribution of *Raillietina* spp. in the three districts was found highly significant **(Table no.12).**

F. Prevalence of *Heterakis gallinarum* in the three districts of Bihar :

(a) Faecal sample examination :

Prevalence of *Heterakis gallinarum* in the three districts of Bihar during faecal sample examination was found non-significant with a maximum percentage in Begusarai district (7.42%) followed by Madhepura

district (6.28%) and 3.33% in Nalanda district out of 350, 350 and 360 examined faecal samples, respectively **(Table no.-13).**

(b) On intestinal content examination :

Again during intestinal content examination the prevalence of *Heterakis gallinarum* was found highly significant and maximum infection rate was recorded in Madhepura district that is 12.75% out of 400 examined intestines, Nalanda district 8.96% among 630 intestinal content examined and in Begusarai district 6.2% among 500 intestinal content examined **(Table no.14).**

G. Influence of age on the incidence of parasites recorded in the three districts of Bihar :

Backyard poultry birds of all the three districts were categorized in three groups according to their age groups as chicks, the newly born birds aged between 0-8 weeks; grower birds aged between 9-18 weeks and layers or adult birds aged above 18 weeks. In the present study influence of various age groups was observed on the prevalence of various parasitic infection in the three districts.

(a) On intestinal content examination :

Altogether 1530 intestinal contents were collected from backyard poultry of all the three districts, out of them 361 intestinal contents were collected from chicks, 448 from grower and 721 from adults. The incidence of *Ascaridia galli* infection was noted maximum (48.78%) in grower followed by 32.05% in adult and minimum (19.15%) in chicks **(Table no.15).** However, it was found that the distribution of *A. galli* between among age groups of birds was highly significant ($P<0.01$).

The incidence of *Raillietina* sp. among the three age groups was found highest (40.82%) in grower, followed by 32.98% in adults and minimum (26.18%) in chicks. Here also the distribution of *Raillietina* sp. among the three age groups was found highly significant ($P<0.01$).

Again in case of *Heterakis gallinarum* infection, the percentage of infection was noted maximum (39.25%) in grower, followed by 32.71% in adults and minimum 28.03% in chicks. And the distribution of *H. gallinarum* among the age groups was found significant ($P<0.01$).

(b) On faecal sample examination :

Similarly, during examination of faecal sample of birds a total of 1060 faecal samples were examined. Out of them, 260 faecal samples were collected from chicks, 380 from grower and 420 from adults and the examination revealed that highest percentage of *A. galli* infection was (51.49%) in grower, 36.87% in adults and 11.62% in chicks **(Table no. 16).**

H. Sex wise prevalence of different parasites in the three districts of Bihar :

(a) On intestinal content examination (table no.17):

Intestinal contents of 853 males and 677 females were examined out of total 1530 intestinal samples. The incidence of *Ascaridia galli* was found 51.23% in males and 51.10% in females. It has been estimated that infection of *A. galli* was almost equally prevalent in both males and females. Hence, the effect of sex was found non-significant in the present study. But in case of *Raillietina* spp. infection, the incidence was noted more (66.00%) in males than in females (60.11%). The effect of sex was found significant in

the present study. In case of *Heterakis gallinarum* infection, the incidence was higher in females (8.41%) than males (5.83%), and influence of age was found significant in the present study.

(b) On faecal sample examination (Table no.18).

During faecal sample examination, out of total 1060 faecal samples, 547 faecal samples were examined from males and 513 from females. The infection of *Ascaridia galli* was recorded maximum in males (63.80%) than females (49.31%) and the effect of sex was found highly significant. But the incidence of *Raillietina* spp. was recorded more in females (76.02%) than males (53.93%). And the difference was found highly significant. In case of *Heterakis gallinarum* infection, the incidence was higher in males (7.12%) than in females (4.09%) and influence of age was found significant in present study.

I. Season-wise prevalence of various parasites in three districts of Bihar:

(a) On intestinal content examination(Table:19) :

1530 total intestinal contents were examined in the districts during different seasons. 330, 390, 420 and 390 intestinal contents were examined in summer, monsoon, post monsoon and winter seasons, respectively. The incidence of *Ascarida galli* was found highest (70.0%) in monsoon followed by post monsoon season (53.57%) ,summer (48.18%) and 32.30% in winter season. Statistically, effect of season on the incidence of *A. galli* was found significant.

Incidence of *Raillietina* sp. was also observed higher (79.74%) in monsoon season followed by 75.23% in post monsoon season, 57.27% in

summer season and minimum (39.48%) in winter season. Here also the effect of season was found highly significant.

Season wise incidence of *Heterakis gallinarum* was recorded with 9.23%, 8.80%, 5.75% and 3.80% incidence rate in monsoon, post monsoon summer and winter seasons, respectively. The effect of season on *H. gallinarum* was found significant.

(b) On faecal sample examination(Table-20) :

Out of total faecal samples, 270, 265, 265 and 260 were examined in summer, monsoon, post monsoon and winter seasons, respectively.

The incidence of *A. galli* was noted (68.67%) maximum in monsoon season, followed by 65.92% in summer season, 50.56% in post monsoon season and 41.53% in winter season.. Statistically effect of seasons on prevalence of *A.. galli* was found highly significant.

Incidence of *Raillietina* sp. was also observed higher (75.84%) in monsoon season, followed by 69.05% in post monsoon season, 62.96% in summer season and minimum (50.38%) in winter season. The influence of season on the incidence of *Raillietina* sp. was found significant ($P < 0.01$).

The infection rate of *Heterakis gallinarum* was also recorded higher (9.43%) in monsoon season followed by 6.41% and 4.44% in post monsoon and summer seasons, respectively and minimum was in winter season.

From the whole observations, it was noticed that prevalence rate of all the parasitic infections was highest in monsoon season followed by post monsoon, summer and least in winter season.

J. Efficacy of various anthelmintics against natural helminthosis in desi poultry (Table no.-21) :

To evaluate the comparative efficacy of anthelmintics :

Efficacies of mebendazole, albendazole and fenbendazole were evaluated against natural helminthosis of desi poultry. To conduct this trial 28 naturally infected desi birds (poultry) infected with G.I. parasites were selected and randomly divided into four groups. The group I (Gr. I) were treated with Mebendazole susp. (100mg/5ml), @ 3ml/litre of drinking water, group II (Gr. II) were treated with albendazole susp. (2.5% w/v) @ 35ml/lit. of drinking water, group III (Gr. III) were treated with fenbendazole susp. (2.5% w/v) @ 100 ml in 1 lit. of drinking water and group IV (Gr. IV) remained as infected untreated control group. The average EPG on 0 day, prior to commencement of treatment and on 7^{th}, 14^{th} and 21^{st} day of post-treatment of the drug in each group were counted. Mean value along with their standard error (S.E.) were calculated which is presented in Table – 21. The average EPG in mebendazole treated group (Gr. I) were gradually decreased from 925.35 on 0 day to 9.50, 0.14, 00 on 7^{th}, 14^{th} and 21^{st} day of post – treatment respectively and they differed significantly ($P<0.05$) from day 0. It was observed that average no. of EPG had declined significantly with advancement of treatment and on that basis, it was estimated that the efficacy of mebendazole was 98.97% 99.98% and 100% on 7^{th} 14^{th} and 21^{st} day of post treatment respectively.

The group II treated with albendazole was observed similarly as group I. The mean EPG on 0 day was observed to be decreased significantly ($P<0.05$) from 886.49 to 70.42, 22.068 and 00 on 7^{th}, 14^{th} and 21^{st} days of post-treatment respectively. The efficacy of albendazole was found to be

92.05%, 97.51% and 100% on 7th, 14th and 21st day of post-treatment respectively.

The group IV was kept as infected untreated control group throughout the period of experiment. The average EPG of infected untreated control group from day 0 to 21 day of observation ranged between 890.09 to 991.80. There was an increasing trend in EPG count observed throughout the period of experiment.

On the basis of percent efficacy, Mebendazole was found to be superior to albendazole and fenbendazole on all the 3-periods of observation.

K. Haematological studies to evaluate the efficacy of anthelmintics against natural helminthosis in indigenous poultry :

Twenty-eight infected birds were selected and randomly divided into 4- groups (I, II, III, IV). Then treatment was provided with Mebendazole susp. (100 mg/5ml) at the rate 3ml/lit of drinking water, Albendazole susp. (2.5% w/v) @ 35 ml/lit. of drinking water, fenbendazole susp. (2.5 % w/v), 100ml. in 1 lit. of drinking water to the birds of group I, II and III, respectively. Whereas birds of group IV remained infected untreated as control. Another group of 7 healthy birds were also kept as healthy control group to conduct comparative study.

Efficacy of anthelmintics were assessed in terms of haematological values like Hb% **(Table no.-21)** at 0 (pre-treatment) and 7, 14, 21 post treatment days.

(a) Haemoglobin % : The Hb values in Mebendazole treated group (group-I) was significantly increased from 0 day to 7 day. However,

improvement on 14th and 21st days post treatment was also observed but it was significant between 7th day and 21st days only.

In Albendazole treated group increase in all post-treatment days was observed but significant changes were recorded between 0 and 7 days, 7 and 21st day only.

In case of fenbendazole treated group also the increase in Hb% was noted in all post treatment days but significant values were recorded between 0-7 day, 7-21st day only.

In infected untreated control group, there was continuous and significant fall in Hb%, recorded on all observation days. In healthy control group, Hb percentage was recorded 8.723%, which increased till conclusion of the experiment and on 21st day 9.157% It was recorded. Significant increase in the values of Hb percentage were noted in various observation days. The comparison between different treatment groups revealed significant variation between groups. Analysis of variance **(Table-22)** revealed that effect of treatment, that is, drugs and between observation periods had highly significant effect on Hb percentage.

(b) TEC : Average total erythrocyte count (TEC) in poultry due to mebendazole treatment showed significant increase **(Table-23)** from 0 day (1.985) to 7th day (2.685), however changes between 14 and 21st day were also significant in respect of 0 day but between different days post treatment, the increase was not significant. Significant rise in level of TEC was also recorded with the advancement of treatment days in albendazole treatment group. But the changes were significant compared with 0 day to all other treatment days. Likewise, in case of fenbendazole treated group, there was

significant increase in TEC level with the advancement of post, But the changes were only significant when 0 day compared with other treatment days. In infected untreated control group, there was continuous fall in TEC values as recorded on all post infection days with significant changes. In healthy control group, at 0 day, average TEC count was 3.271 which increased significantly on 7th day (3.214) followed by 14th day (3.328) and 21st day (3.228). Analysis of variance (Table-24) revealed that effect of different treatment on TEC was highly significant, whereas at different periods of observations it was non-significant.

L. Total Leucocyte Count (TLC) in poultry due to treatment at different periods of interval :

Total Leucocyte Count (TLC) on mebendazole, albendazole and fenbendazole treatment showed significant decline from day 7 to day 21. However, the changes were not significant in all the groups on day 7 but on 14th day post treatment, significant changes from the day 0 were recorded but it was non-significant with day 7 and day 21. In infected untreated control group, there was significant rise in TLC from day 0 to 21st on all post-treatment days. In healthy control group, on 0 day, average TLC count was 9.371, which slightly decreased on day 7 of observation and remained stable up to 21st days. The analysis of variance (Table-26) revealed that effect of different treatment on TLC was highly significant, whereas at different periods of observation it was non- significant.

Table - 1 : Prevalence of gastrointestinal helminthosis on faecal examination in three different districts of Bihar.

District	No. of samples examined	No. of Positive	Percentage	χ^2_2df
Nalanda	360	251	69.72	15.997**
Begusarai	350	287	82.00	
Madhepura	350	275	78.57	
Total	**1060**	**813**	**76.69**	

** = Significant at P<0.01

Fig.-1 : Bar diagram showing prevalence of gastrointestinal helminthosis on faecal examination in three different districts of Bihar.

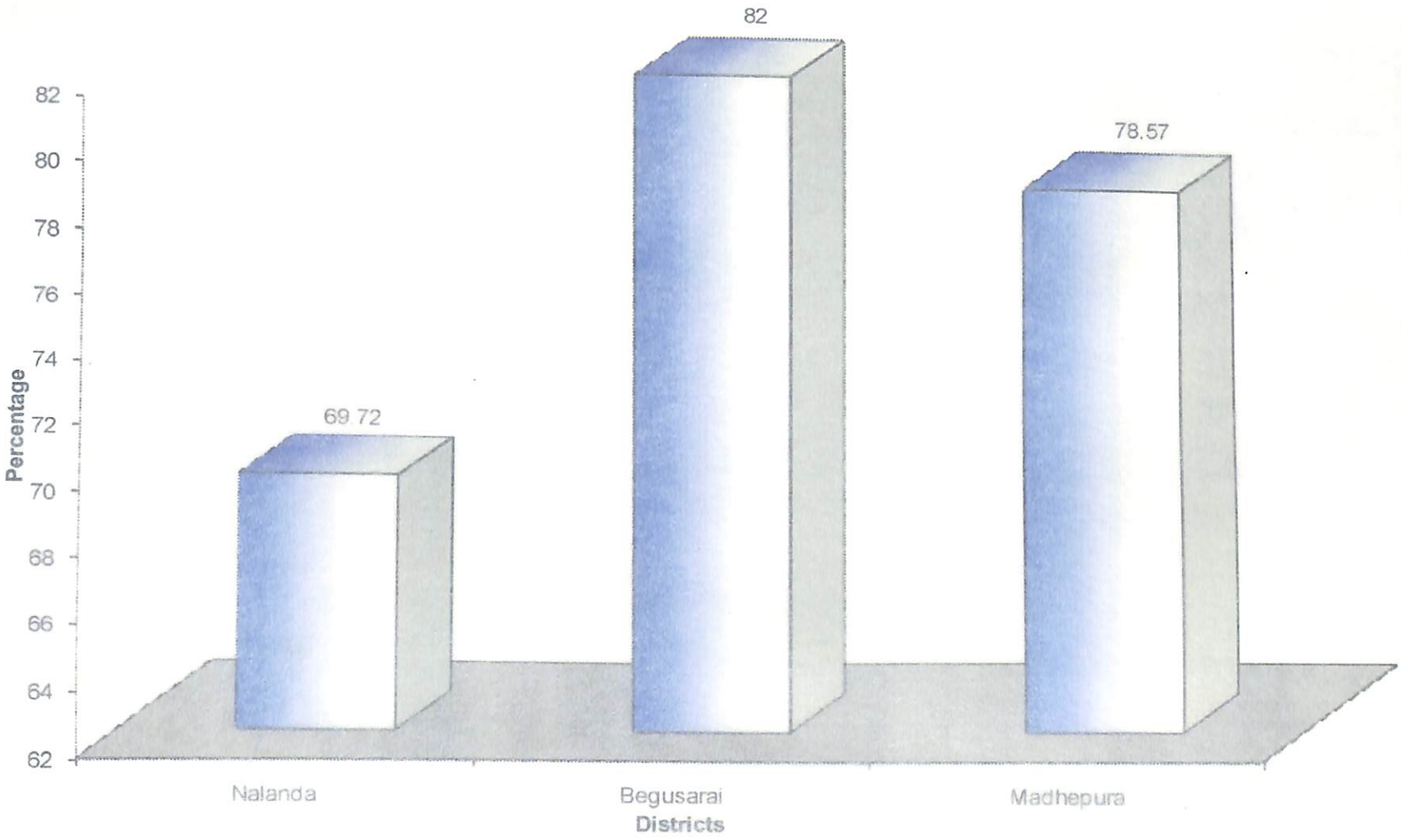


Fig.-1 : Bar diagram showing prevalence of gastrointestinal helminthosis on faecal examination in three different districts of Bihar.

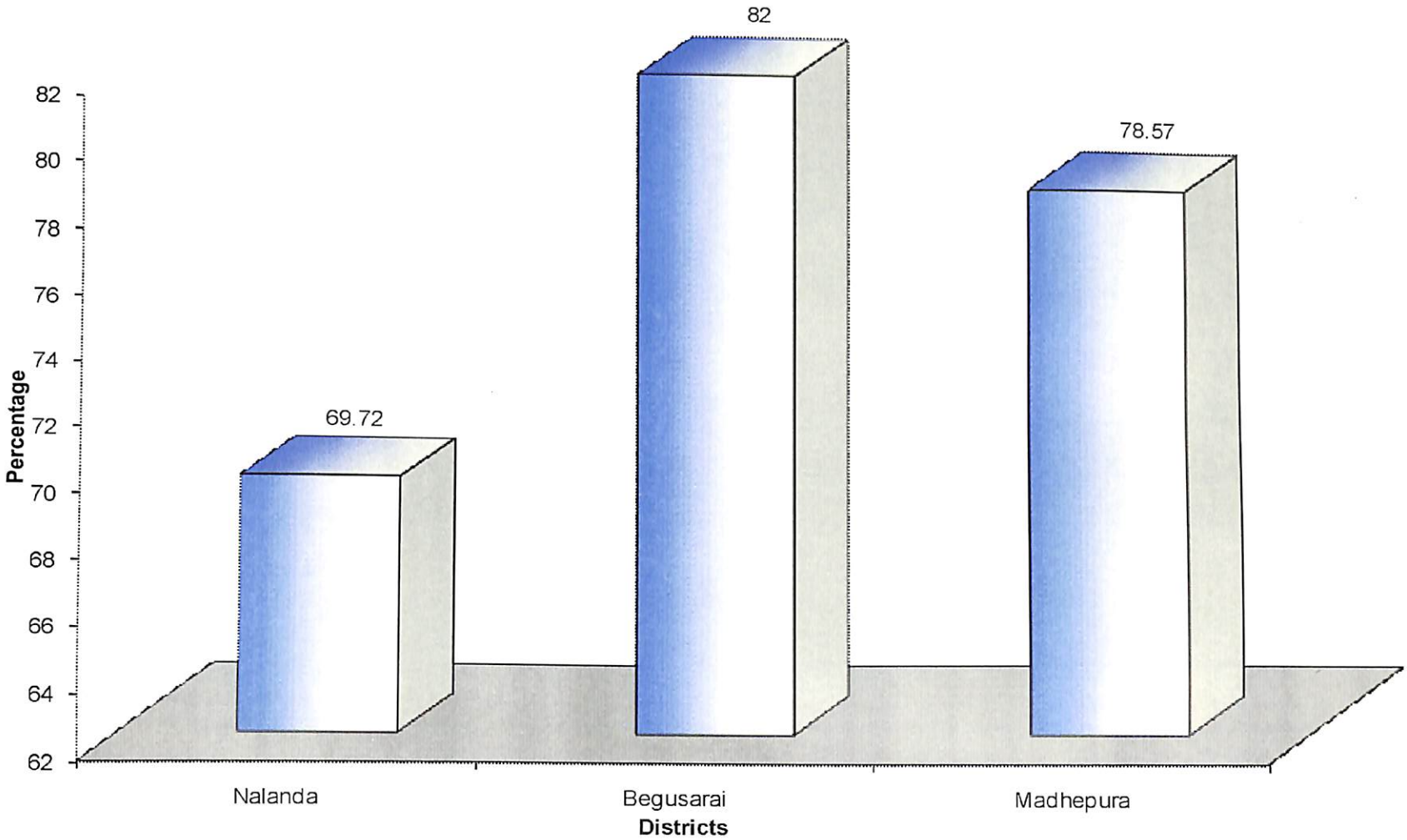


Table - 2 : Prevalence of gastrointestinal helminthosis on intestinal content examination in three districts of Bihar.

District	No. of samples examined	No. of Positive	Percentage	χ^2_2df
Nalanda	630	454	72.06	13.011**
Begusarai	500	406	81.20	
Madhepura	400	308	77.00	
Total	**1530**	**1168**	**76.33**	

** = Significant at P<0.01

Fig. - 2 : Bar diagram showing prevalence of gastrointestinal helminthosis on intestinal content examination in three districts of Bihar.

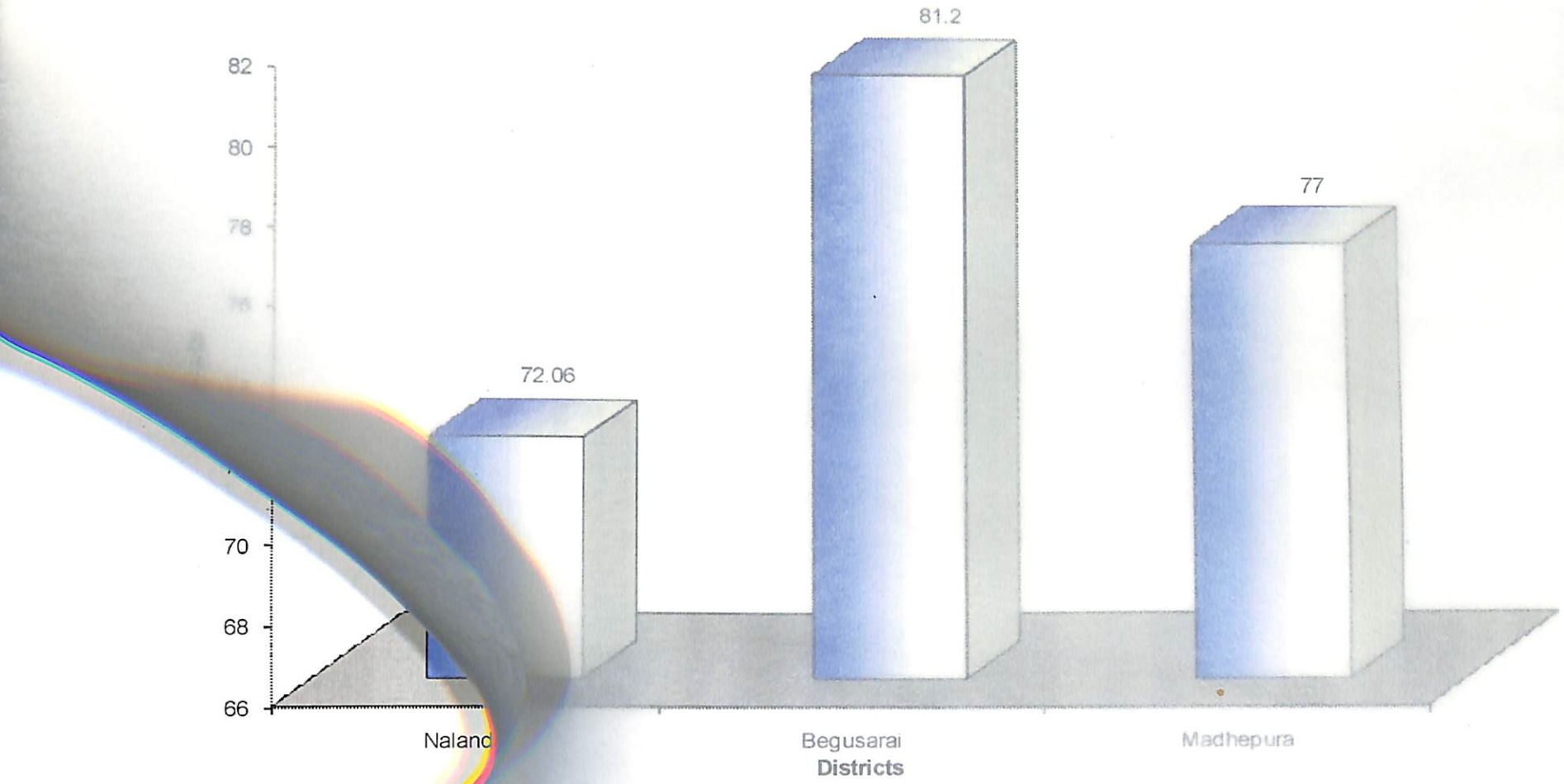


Fig. - 2 : Bar diagram showing prevalence of gastrointestinal helminthosis on intestinal content examination in three districts of Bihar.

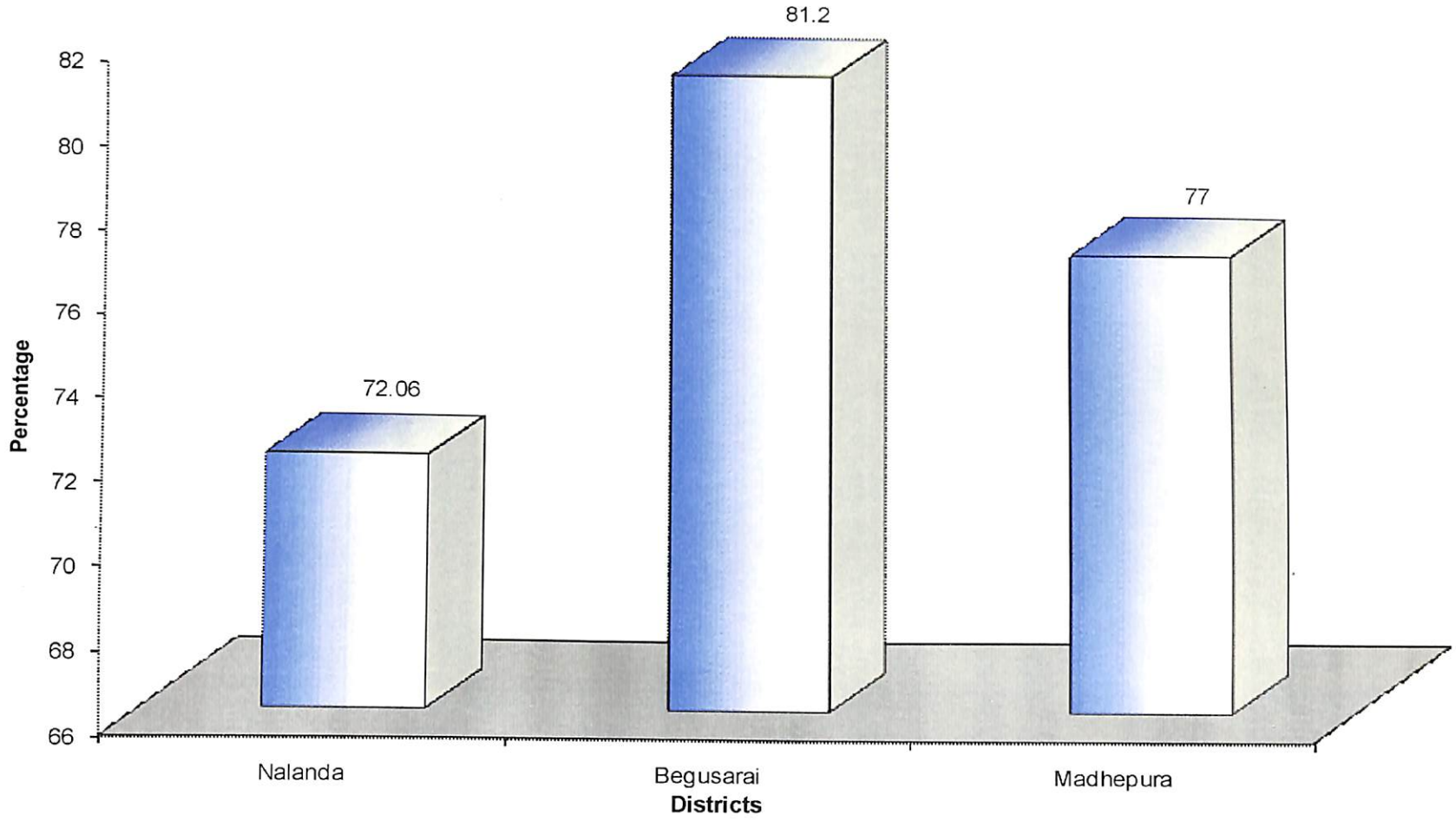


Table - 3 : Prevalence of various gastrointestinal parasites in Nalanda on faecal sample examination.

Total Examined	Positive	Name of Parasite
360	251 (69.72%)	*Ascaridia galli* – 204 *Raillietina spp.* – 232 *Heterakis gallinarum* - 12

Diagonal values indicating the number of poultry carrying individual infection and number of samples above & below the diagonal indicating mixed infection.

Species	*A. galli*	*Raillietina spp.*	*Heterakis gallinaurm*	Total
A. galli	3	201	-	204
Raillietina spp.	201	31	-	232
Heterakis gallinarum	-	-	12	12
Total	**204**	**232**	**12**	

Fig. - 3 : Bar diagram showing prevalence of *Ascaridia galli* on faecal sample examined in three districts of Bihar.

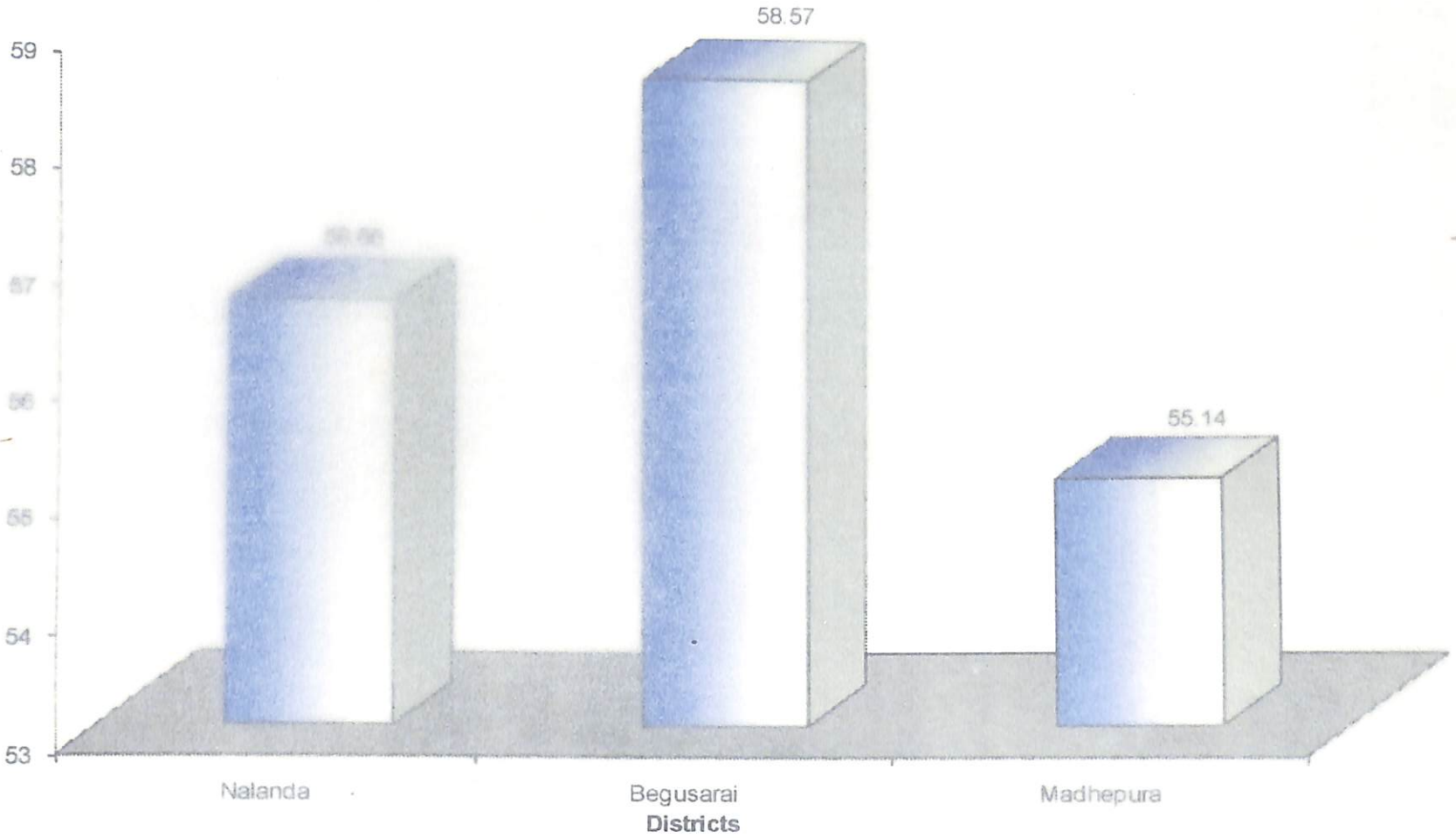


Fig. - 3 : Bar diagram showing prevalence of *Ascaridia galli* on faecal sample examination in three districts of Bihar.

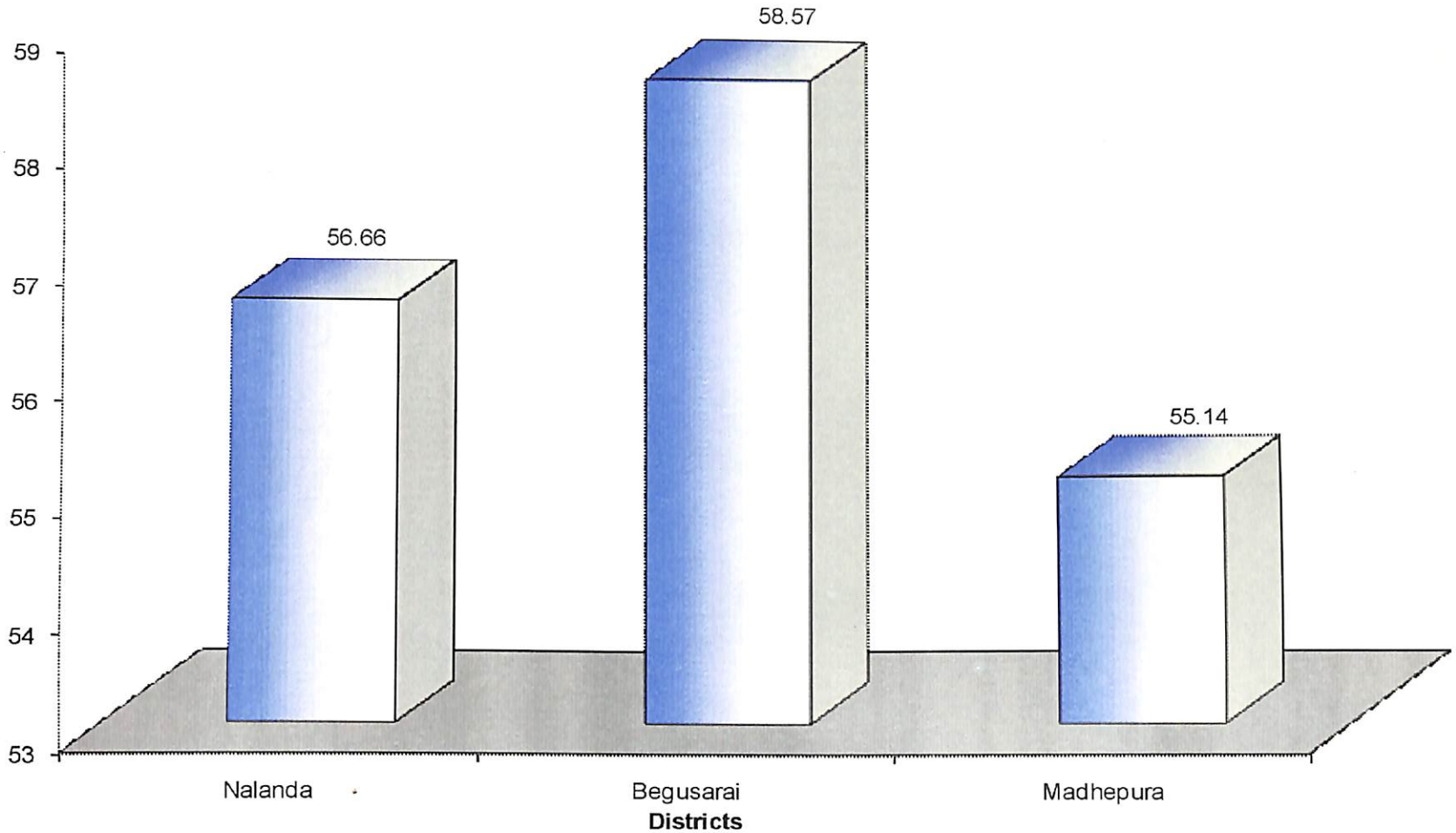


Table - 4 : Prevalence of various gastrointestinal parasites in Begusarai on faecal sample examination.

Total Examined	Positive	Name of Parasite
350	287 (82.00%)	*Ascaridia galli* – 205 *Raillietina spp.* – 228 *Heterakis gallinarum* - 26

Diagonal values indicating the number of poultry carrying individual infection and number of samples above & below the diagonal indicating mixed infection.

Species	*A. galli*	*Raillietina spp.*	*Heterakis gallinaurm*	Total
A. galli	53	142	10	205
Raillietina spp.	142	76	10	228
Heterakis gallinarum	10	10	6	26
Total	**205**	**228**	**26**	

Fig.- 4 : Bar diagram showing prevalence of *A. galli* on intestinal content examination.

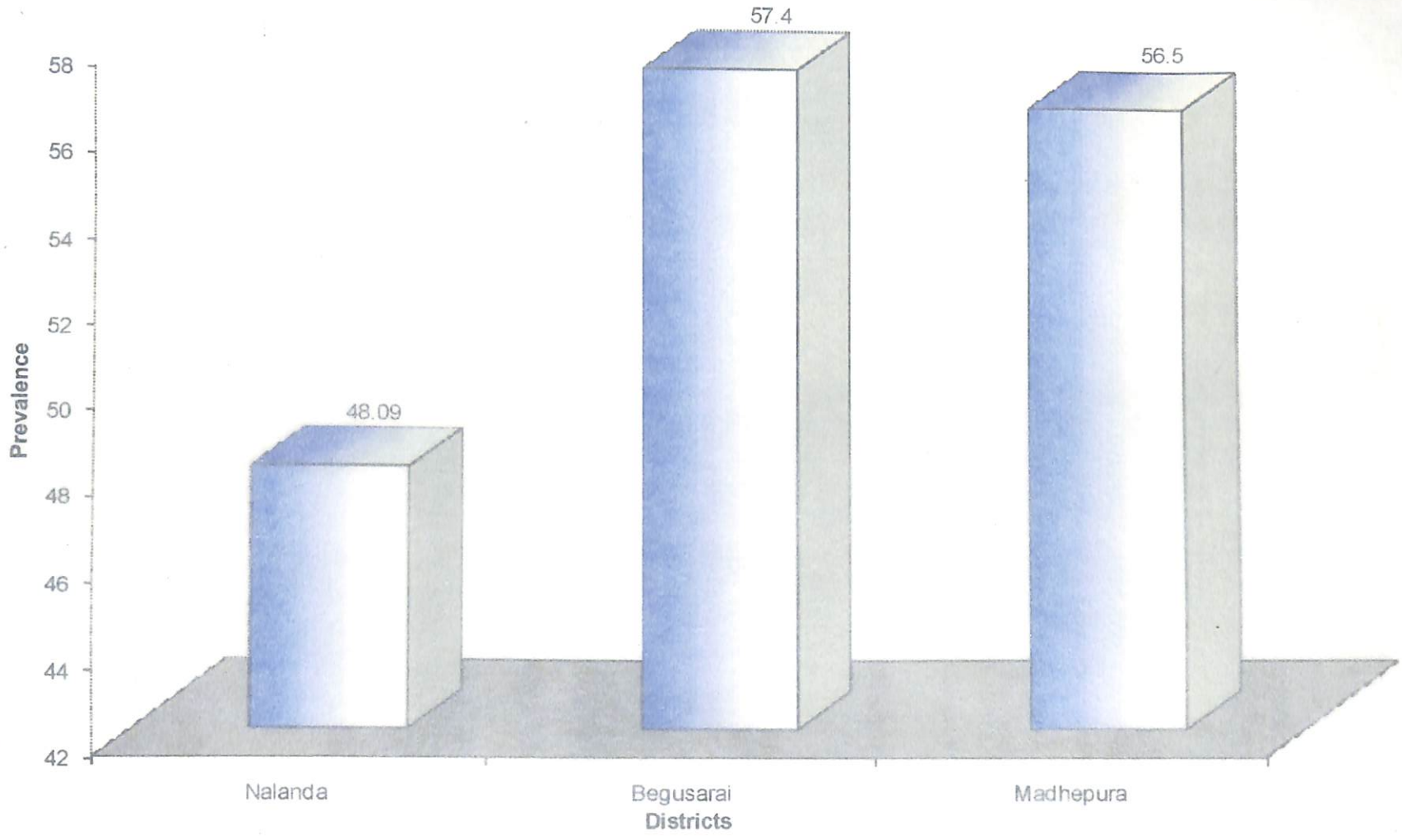


Fig.- 4 : Bar diagram showing prevalence of *A. galli* on intestinal content examination.

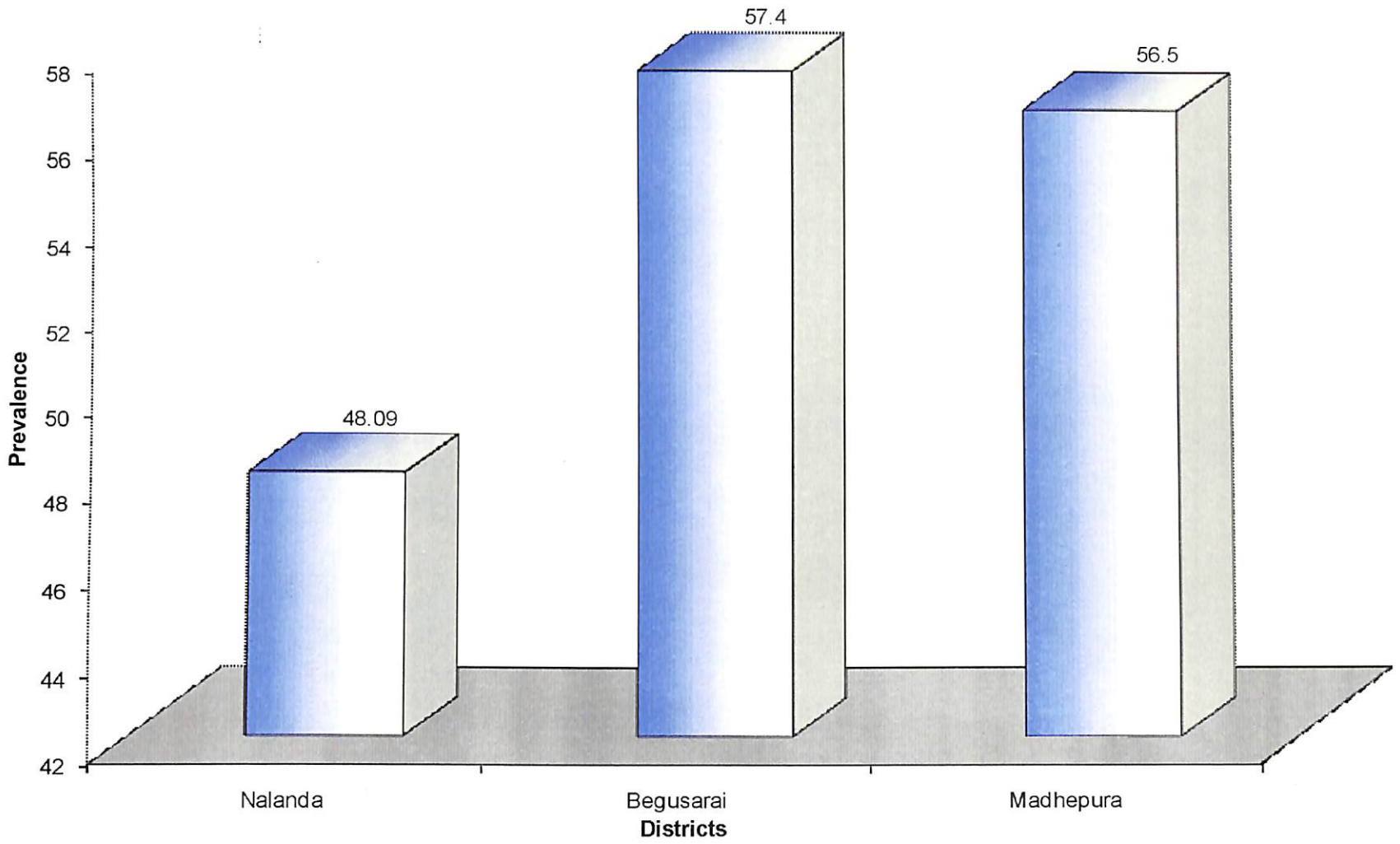


Table - 5 : Prevalence of various gastrointestinal parasites in Madhepura on faecal sample examination.

Total Examined	Positive	Name of Parasite
350	275 (78.57%)	*Ascaridia galli* – 193 *Raillietina spp.* – 225 *Heterakis gallinarum* - 22

Diagonal values indicating the number of poultry carrying individual infection and number of samples above & below the diagonal indicating mixed infection.

Species	*A. galli*	*Raillietina spp.*	*Heterakis gallinaurm*	Total
A. galli	43	142	8	193
Raillietina spp.	142	76	7	225
Heterakis gallinarum	8	7	7	22
Total	**193**	**225**	**22**	

Fig. - 5 : Bar diagram showing prevalence of *Raillietina spp.* on faecal sample examination.

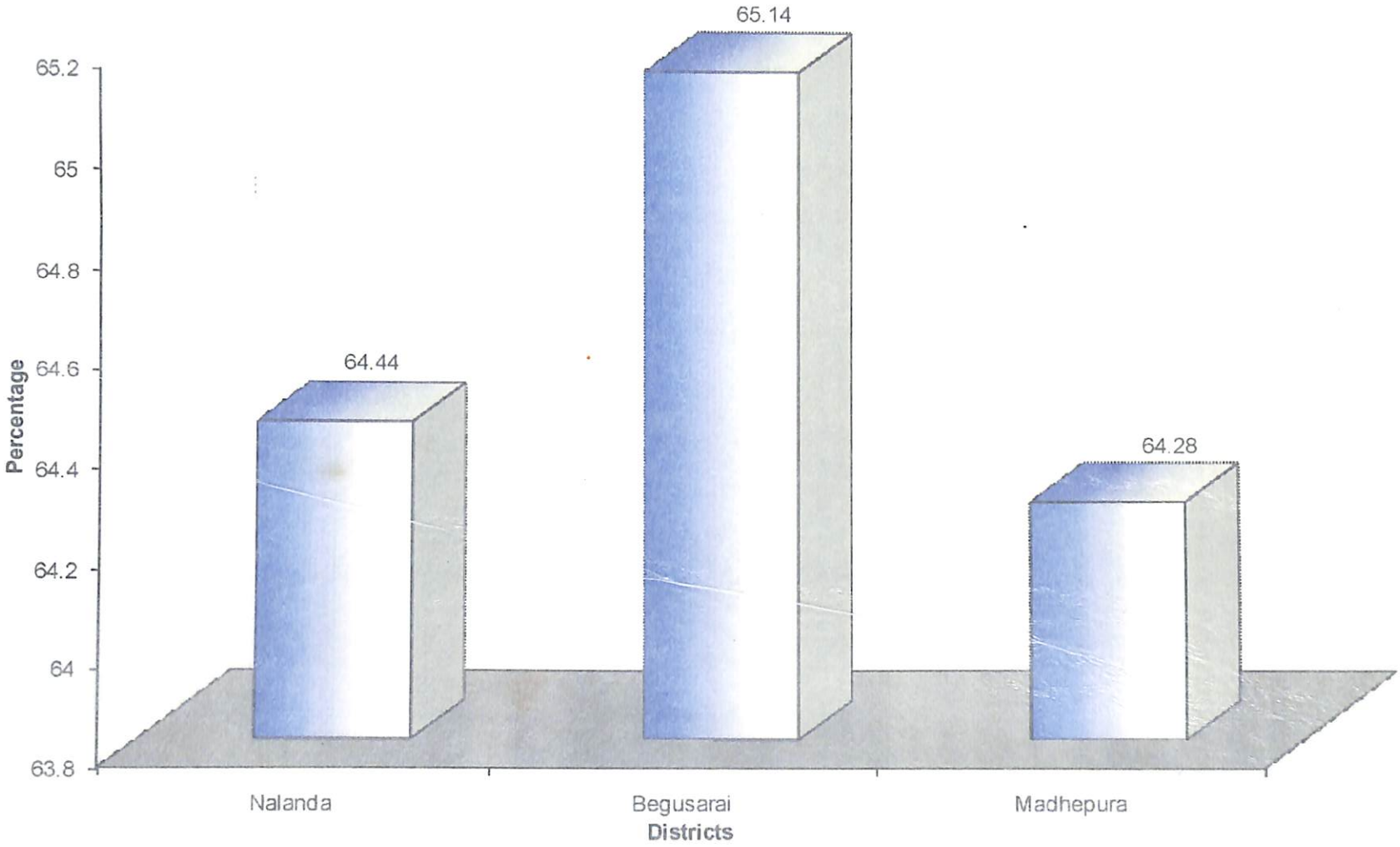


Fig. - 5 : Bar diagram showing prevalence of *Raillietina spp.* on faecal sample examination.

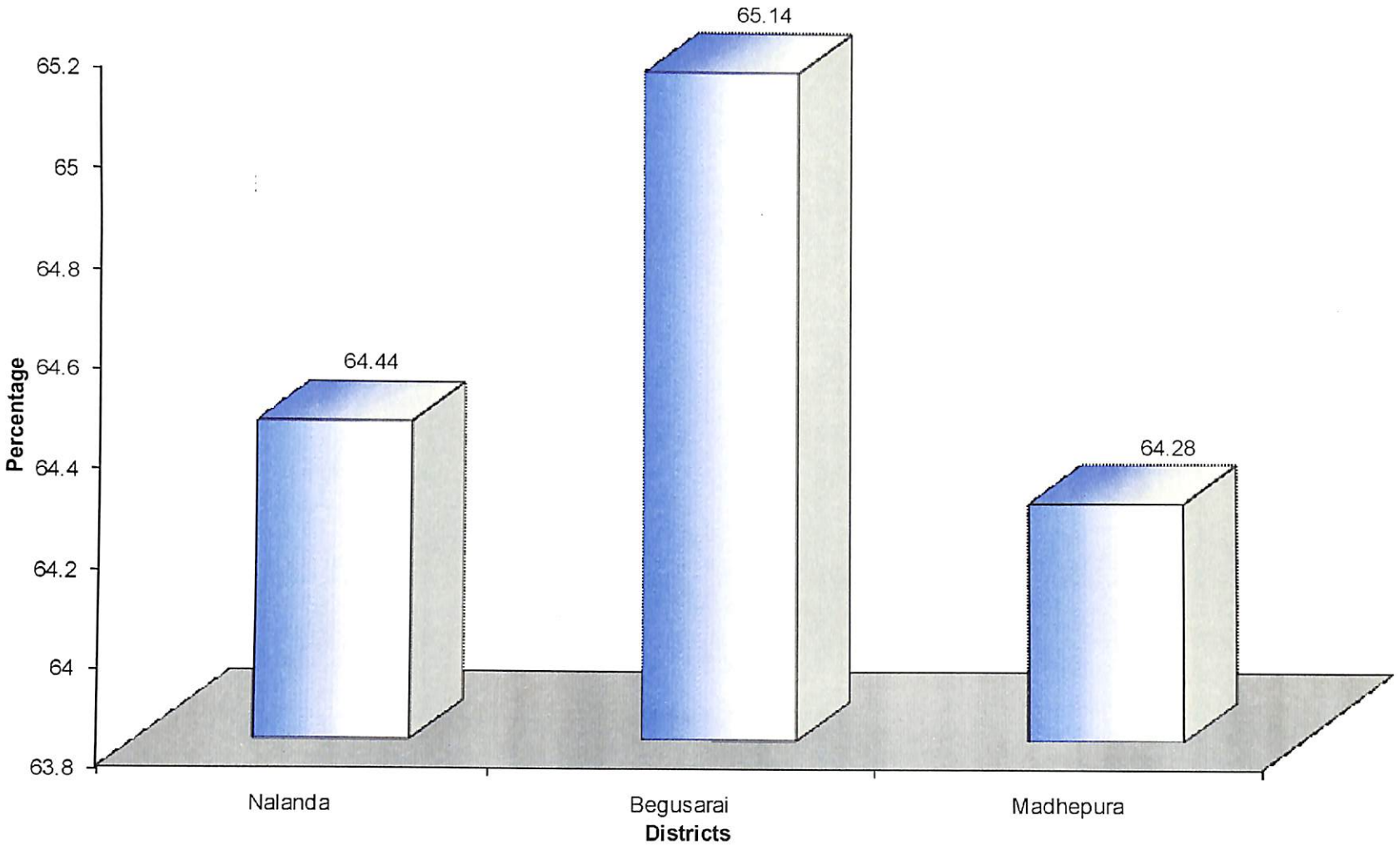


Table - 6 : Prevalence of various gastrointestinal parasites in Nalanda on intestinal content examination.

Total Examined	Positive	Name of Parasite
630	454 (72.06%)	*Ascaridia galli* – 303 *Raillietina spp.* – 410 *Heterakis gallinarum* - 25

Diagonal values indicating the number of poultry carrying individual infection and number of samples above & below the diagonal indicating mixed infection.

Species	*A. galli*	*Raillietina spp.*	*Heterakis gallinaurm*	Total
A. galli	93	205	5	303
Raillietina spp.	205	185	20	410
Heterakis gallinarum	5	20	-	25
Total	**303**	**410**	**25**	

Fig. - 6 : Bar diagram showing prevalence of *Raillietina spp*. in three districts of Bihar on intestinal content examination.

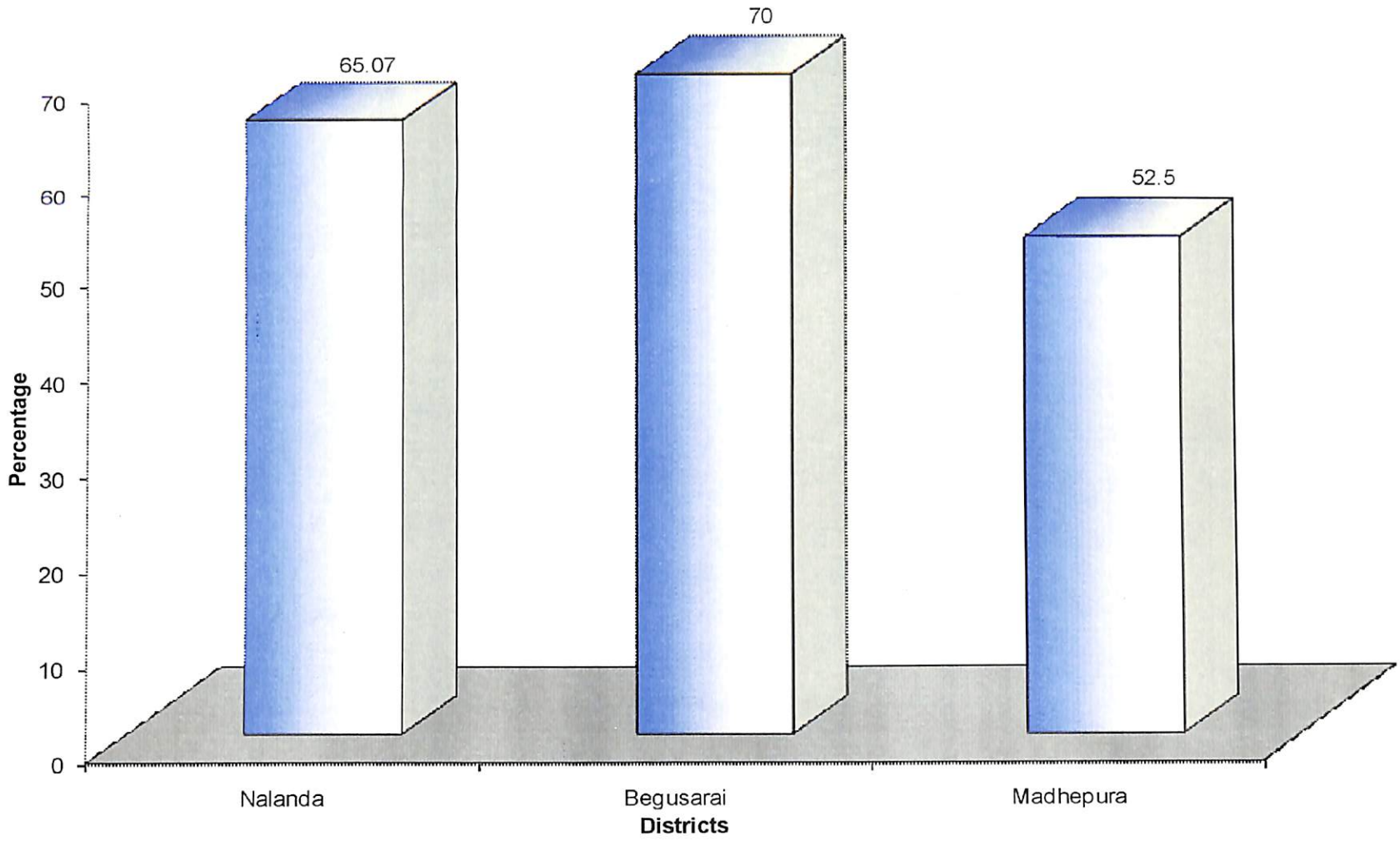


Table - 7 : Prevalence of various gastrointestinal parasites in Begusarai on intestinal content examination.

Total Examined	Positive	Name of Parasite
500	406 (81.20%)	*Ascaridia galli* – 287 *Raillietina spp.* – 350 *Heterakis gallinarum* - 31

Diagonal values indicating the number of poultry carrying individual infection and number of samples above & below the diagonal indicating mixed infection.

Species	*A. galli*	*Raillietina spp.*	*Heterakis gallinaurm*	Total
A. galli	52	224	11	-
Raillietina spp.	224	107	19	-
Heterakis gallinarum	11	19	1	-
Total	**287**	**350**	**31**	

Fig. - 7 : Bar diagram showing prevalence of *Heterakis gallinarum* in three districts of Bihar on faecal sample examination.

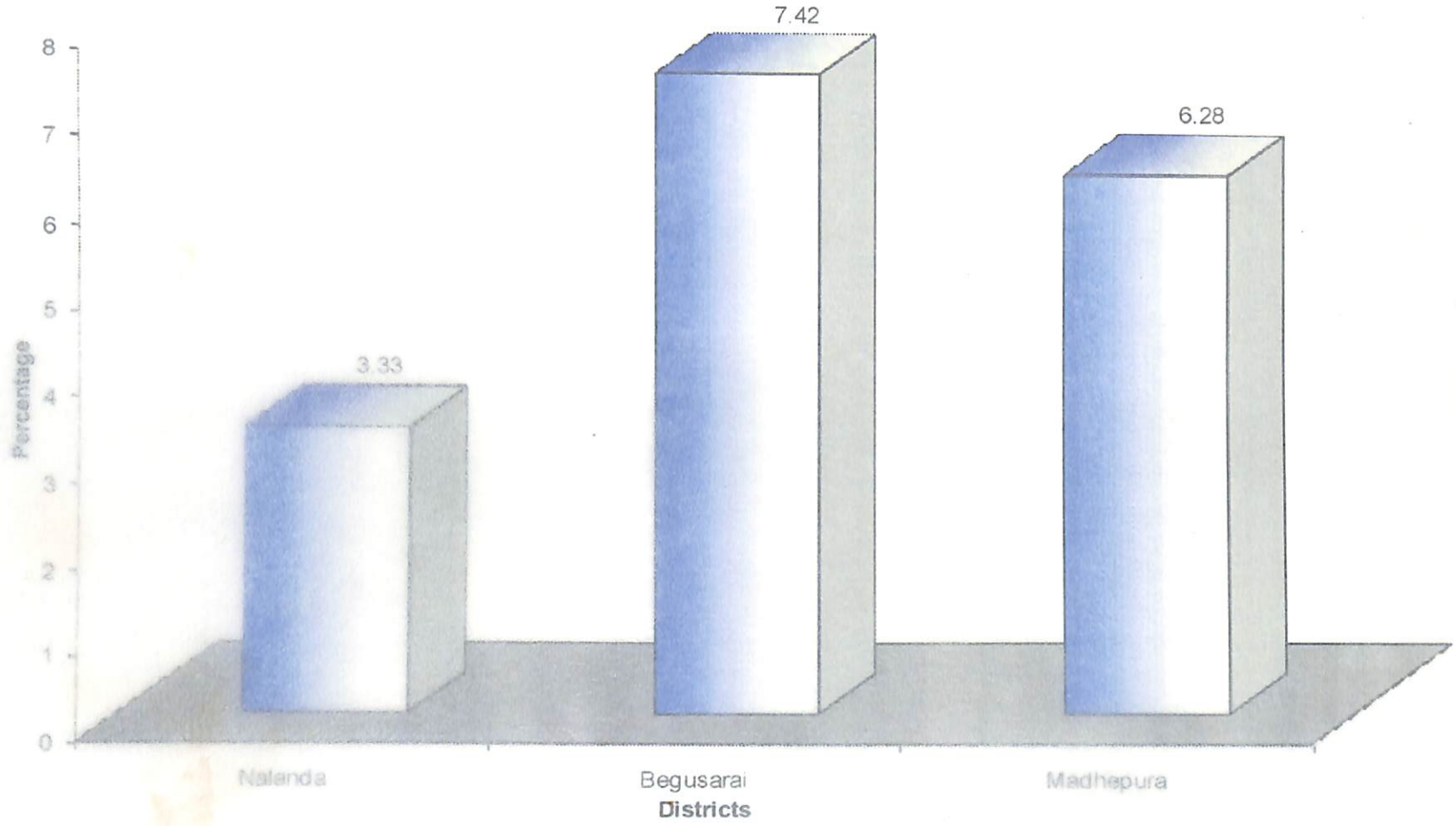


Fig. - 7 : Bar diagram showing prevalence of *Heterakis gallinarum* in three districts of Bihar on faecal sample examination.

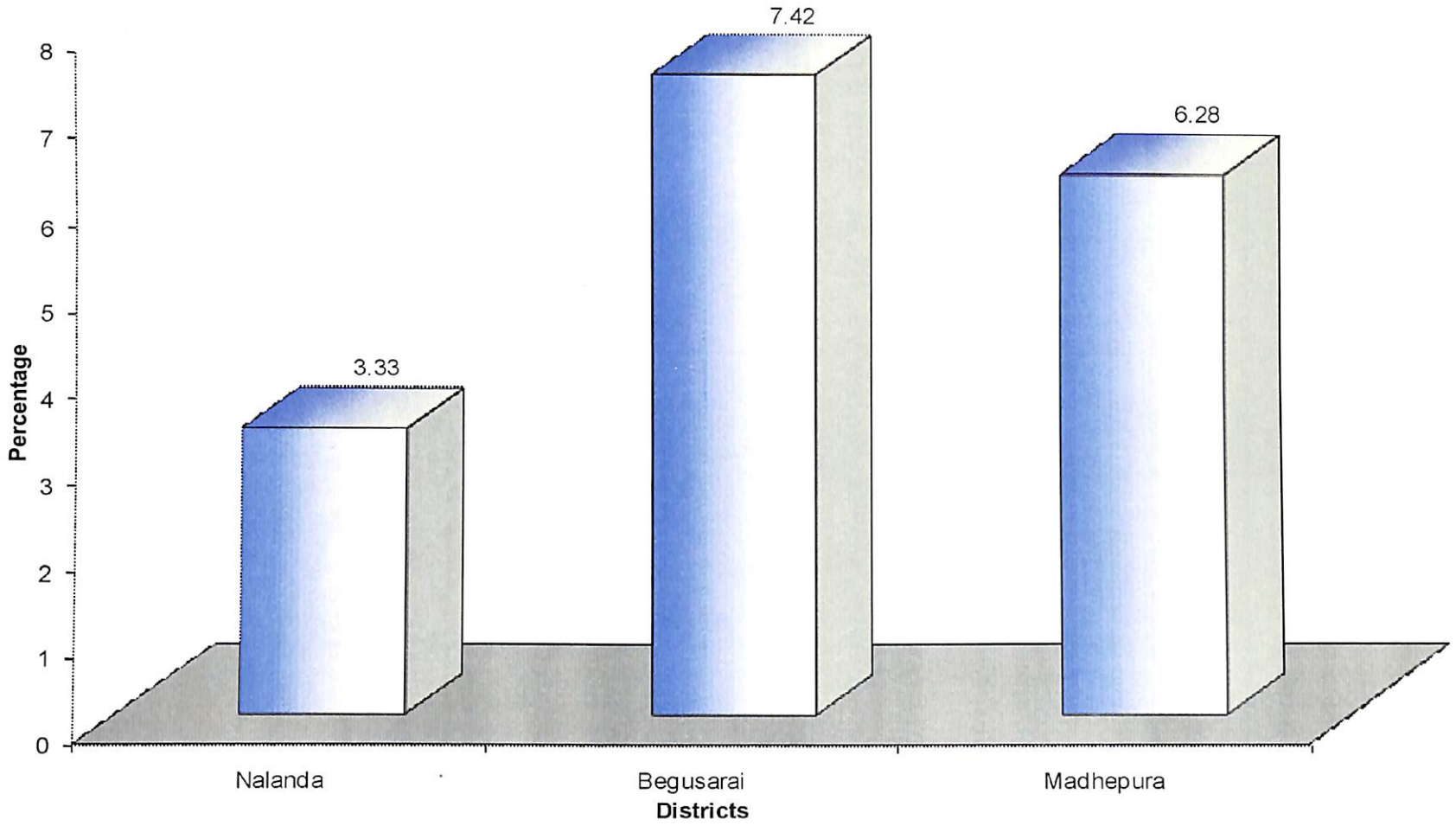


Table - 8 : Prevalence of various gastrointestinal parasites in Madhepura on intestinal content examination.

Total Examined	Positive	Name of Parasite
400	308 (77.0%)	*Ascaridia galli* – 226 *Raillietina spp.* – 210 *Heterakis gallinarum* - 51

Diagonal values indicating the number of poultry carrying individual infection and number of samples above & below the diagonal indicating mixed infection.

Species	*A. galli*	*Raillietina spp.*	*Heterakis gallinaurm*	Total
A. galli	78	140	8	226
Raillietina spp.	140	39	31	210
Heterakis gallinarum	8	31	12	51
Total	**226**	**210**	**51**	

Fig. - 8 : Bar diagram showing prevalence of *Heterakis gallinarum* in three districts of Bihar on intestinal content examination.

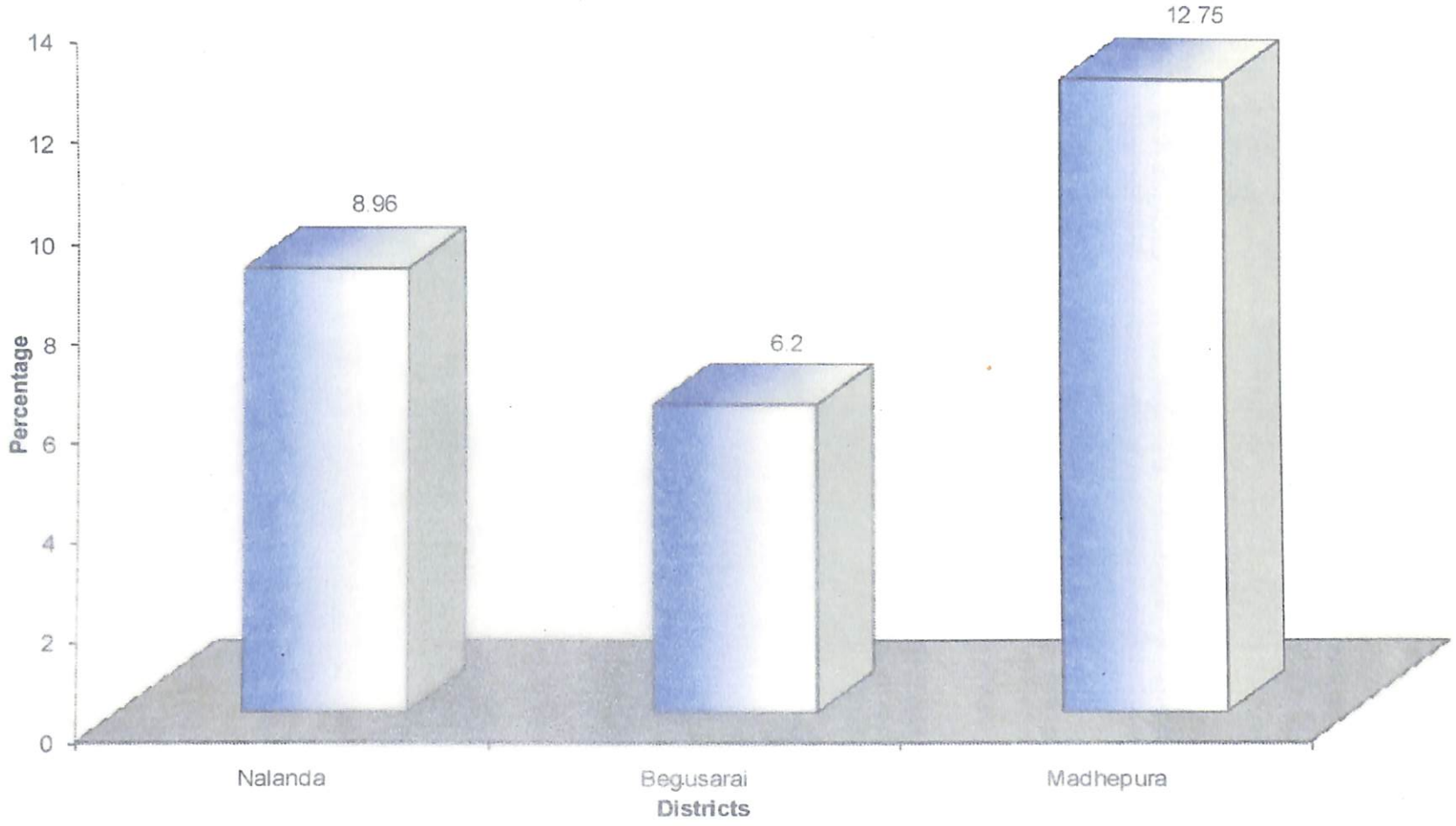


Fig. - 8 : Bar diagram showing prevalence of *Heterakis gallinarum* in three districts of Bihar on intestinal content examination.

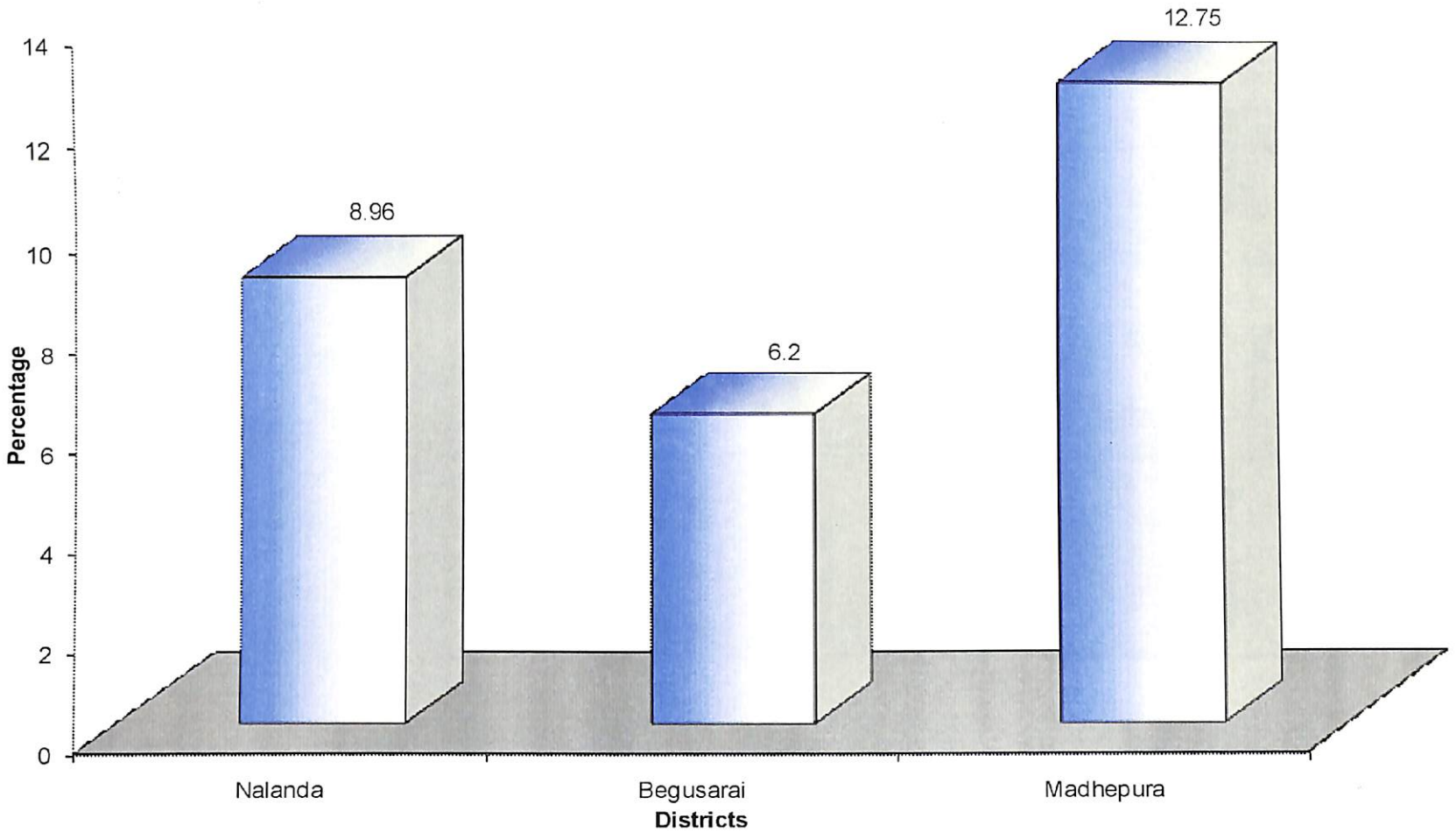


Table - 9 : Prevalence of *Ascaridia galli* on faecal sample examination in three districts of Bihar.

District	No. of samples examined	No. of Positive	Percentage	χ^2_2df
Nalanda	360	204	56.66	0.82^{NS}
Begusarai	350	205	58.57	
Madhepura	350	193	55.14	
Total	**1060**	**602**	**56.79**	

NS = Non – Significant

Fig. – 9 : Bar diagram showing age wise prevalence of different parasites in districts of Bihar on intestinal content examination.

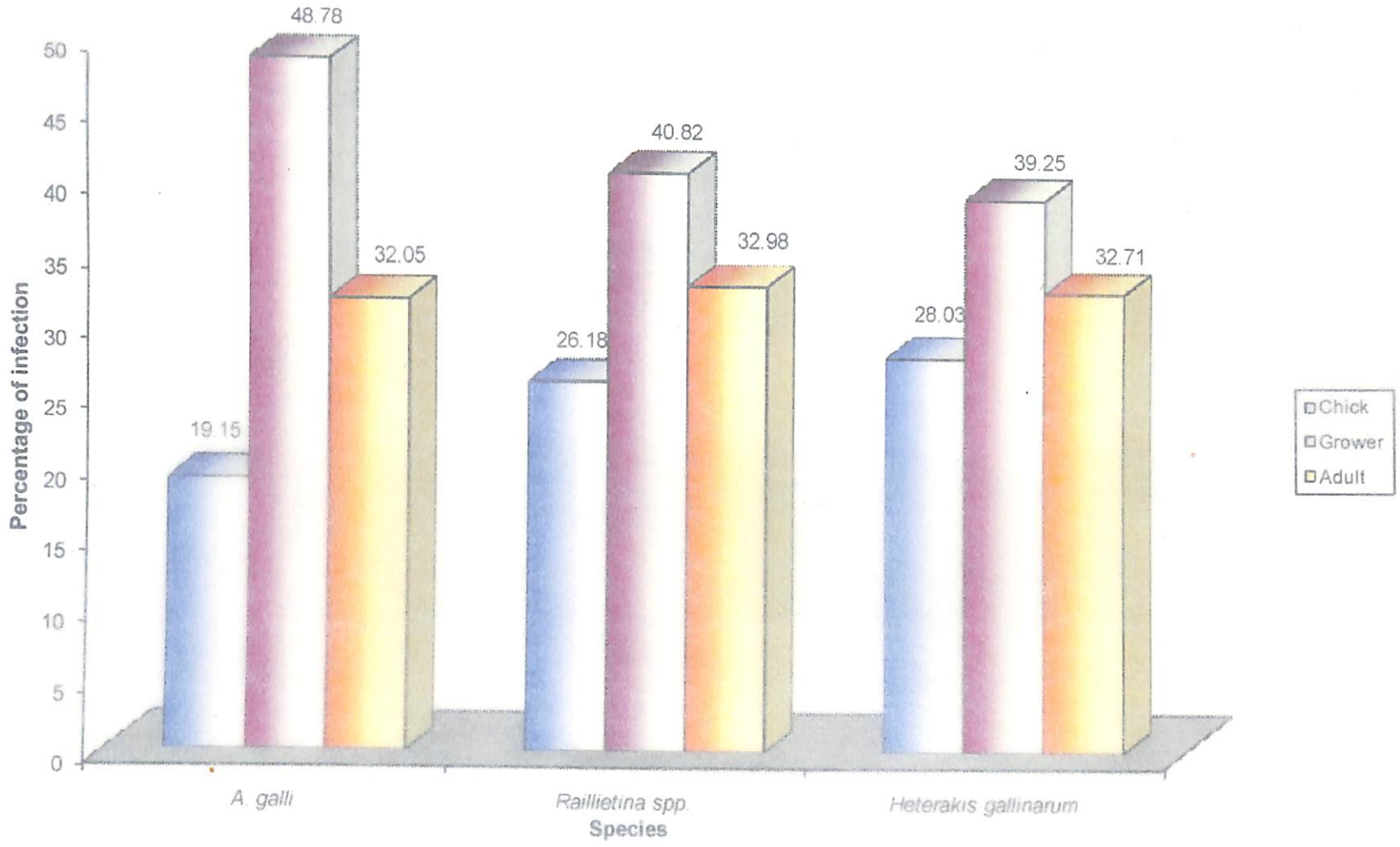


Fig. – 9 : Bar diagram showing age wise prevalence of different parasites in districts of Bihar on intestinal content examination.

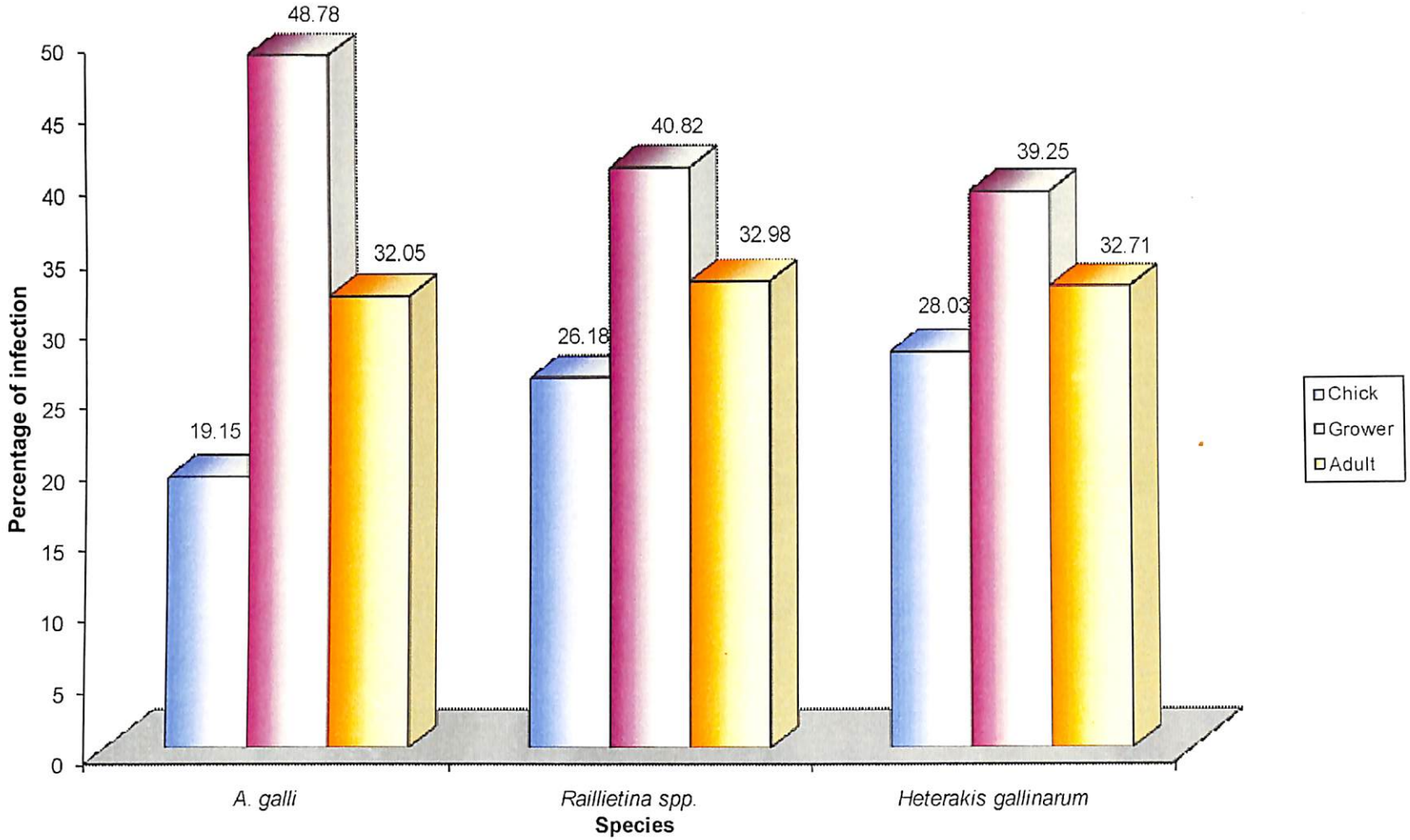


Table - 10 : Prevalence of *Ascaridia galli* on intestinal content examination.

District	No. of samples examined	No. of Positive	Percentage	χ^2_2df
Nalanda	630	303	48.09	13.011**
Begusarai	500	287	57.40	
Madhepura	400	226	56.50	
Total	**1530**	**816**	**53.33**	

** = Significant at P<0.01

Fig.-10 : Bar diagram showing age wise prevalence of different parasites in districts of Bihar on faecal sample examination.

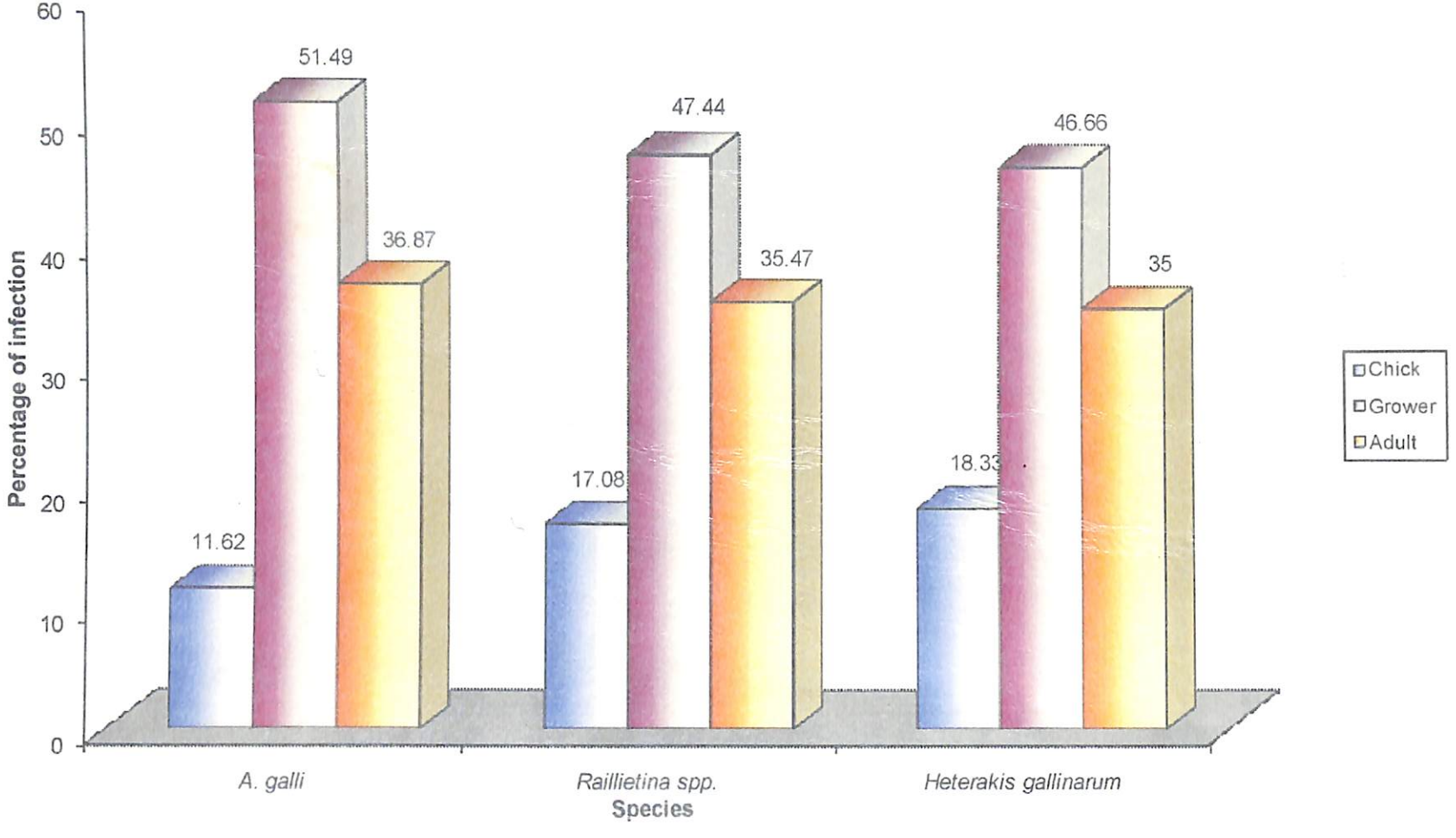


Fig.-10 : Bar diagram showing age wise prevalence of different parasites in districts of Bihar on faecal sample examination.

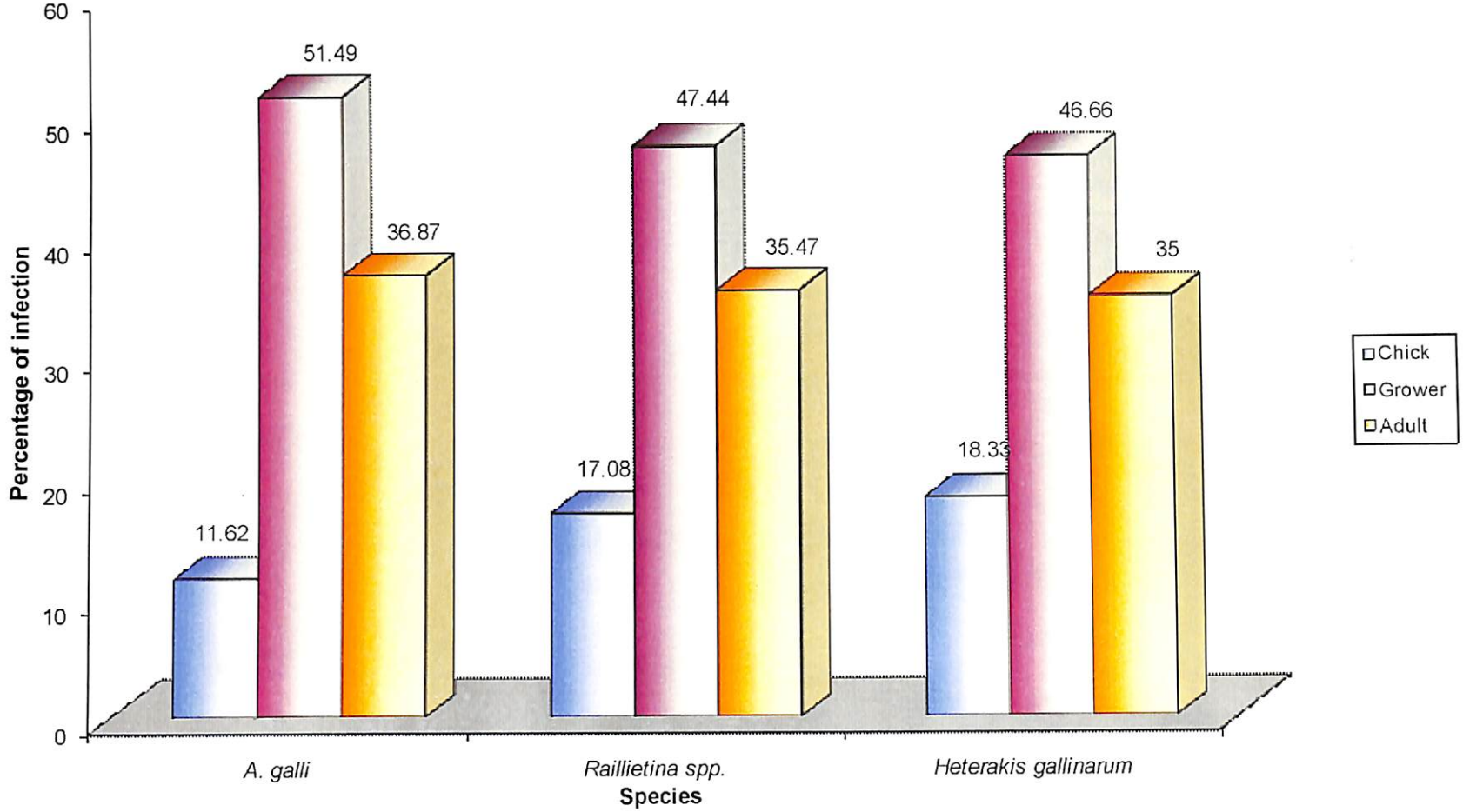


Table - 11 : Prevalence of *Raillietina spp.* on faecal sample examination.

District	No. of samples examined	No. of Positive	Percentage	χ^2_2df
Nalanda	360	232	64.44	0.04^{NS}
Begusarai	350	228	65.14	
Madhepura	350	225	64.28	
Total	**1060**	**685**	**64.62**	

NS = Non - Significant

Fig.-11 : Bar diagram showing sex wise prevalence of different parasites in districts of Bihar on intestinal content examination.

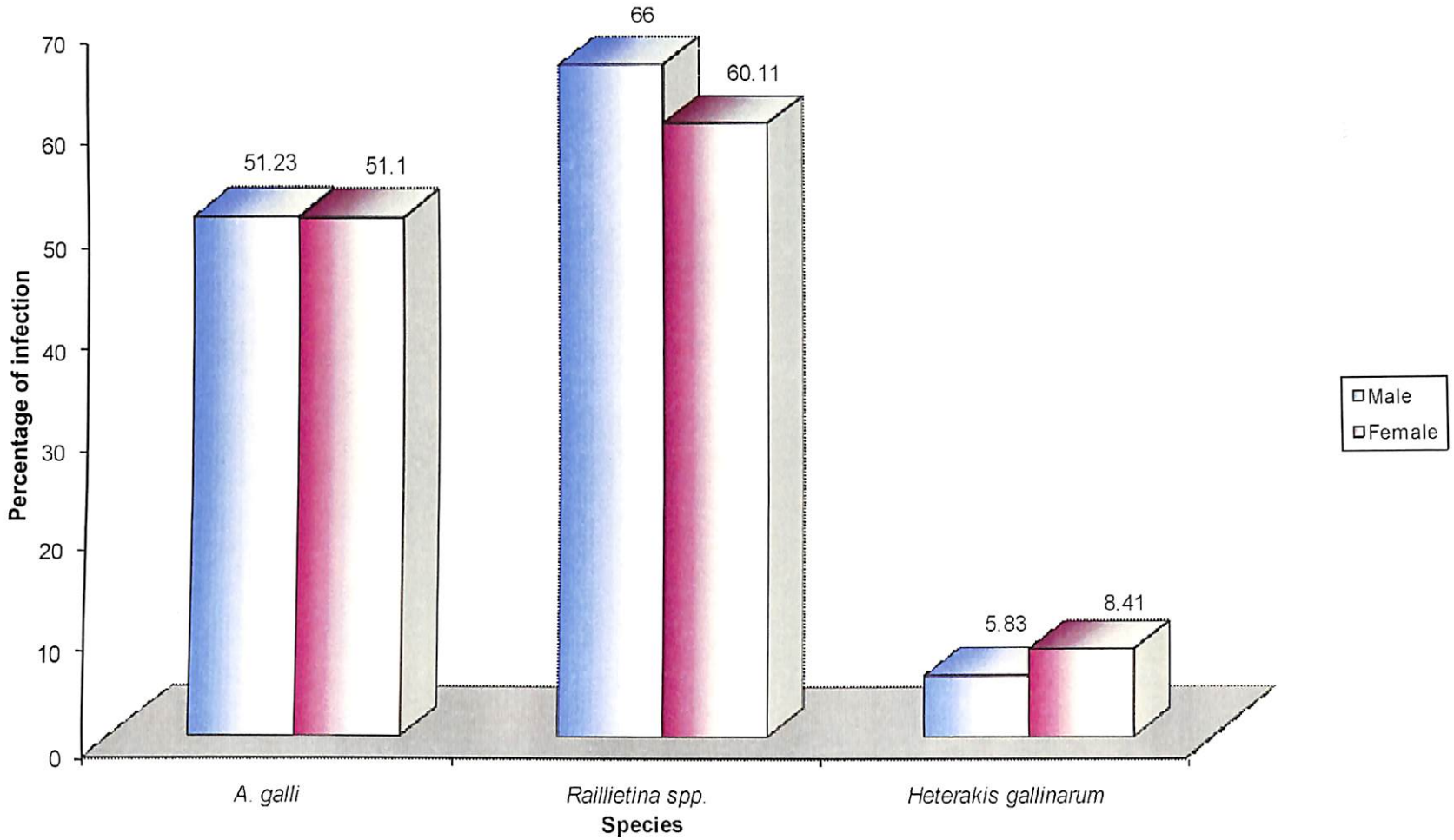


Table - 12 : Prevalence of *Raillietina spp.* in three on of Bihar on intestinal content examination.

District	No. of samples examined	No. of Positive	Percentage	χ^2_2df
Nalanda	630	410	65.07	30.61**
Begusarai	500	350	70.00	
Madhepura	400	210	52.5	
Total	**1530**	**970**	**63.39**	

** = Significant at P<0.01

Fig.-12 : Bar diagram showing sex wise prevalence of different parasites in districts of Bihar on faecal samples examination.

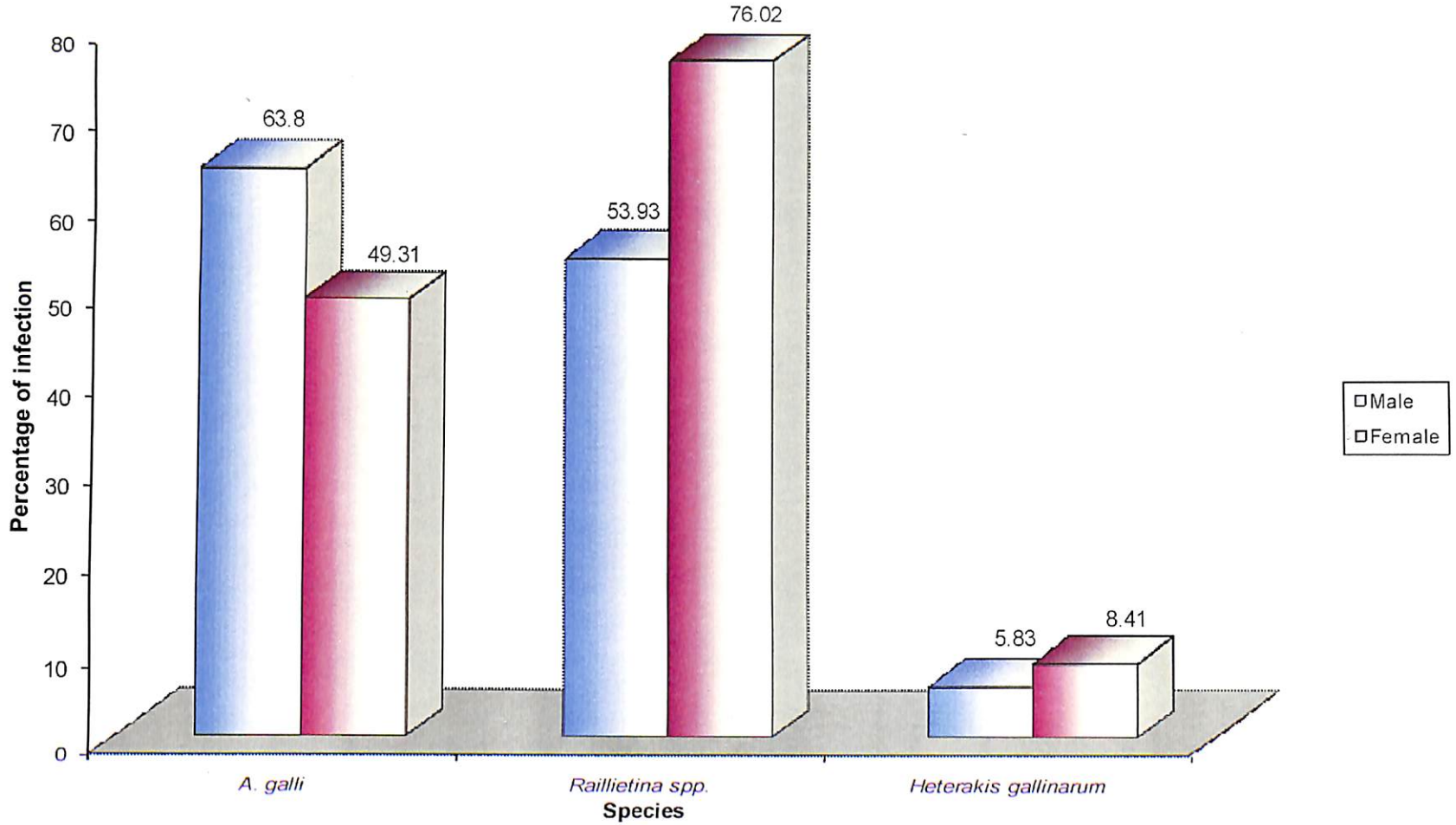


Table - 13 : Prevalence of *Heterakis gallinarum* in three districts of Bihar on faecal sample examination.

District	No. of samples examined	No. of Positive	Percentage	χ^2_2df
Nalanda	360	12	3.3	5.92^{NS}
Begusarai	350	26	7.42	
Madhepura	350	22	6.28	
Total	**1060**	**60**	**5.66**	

NS = Non-significant

Fig.-13 : Bar diagram showing season wise prevalence of various parasites in three-districts of Bihar on intestinal content examination.

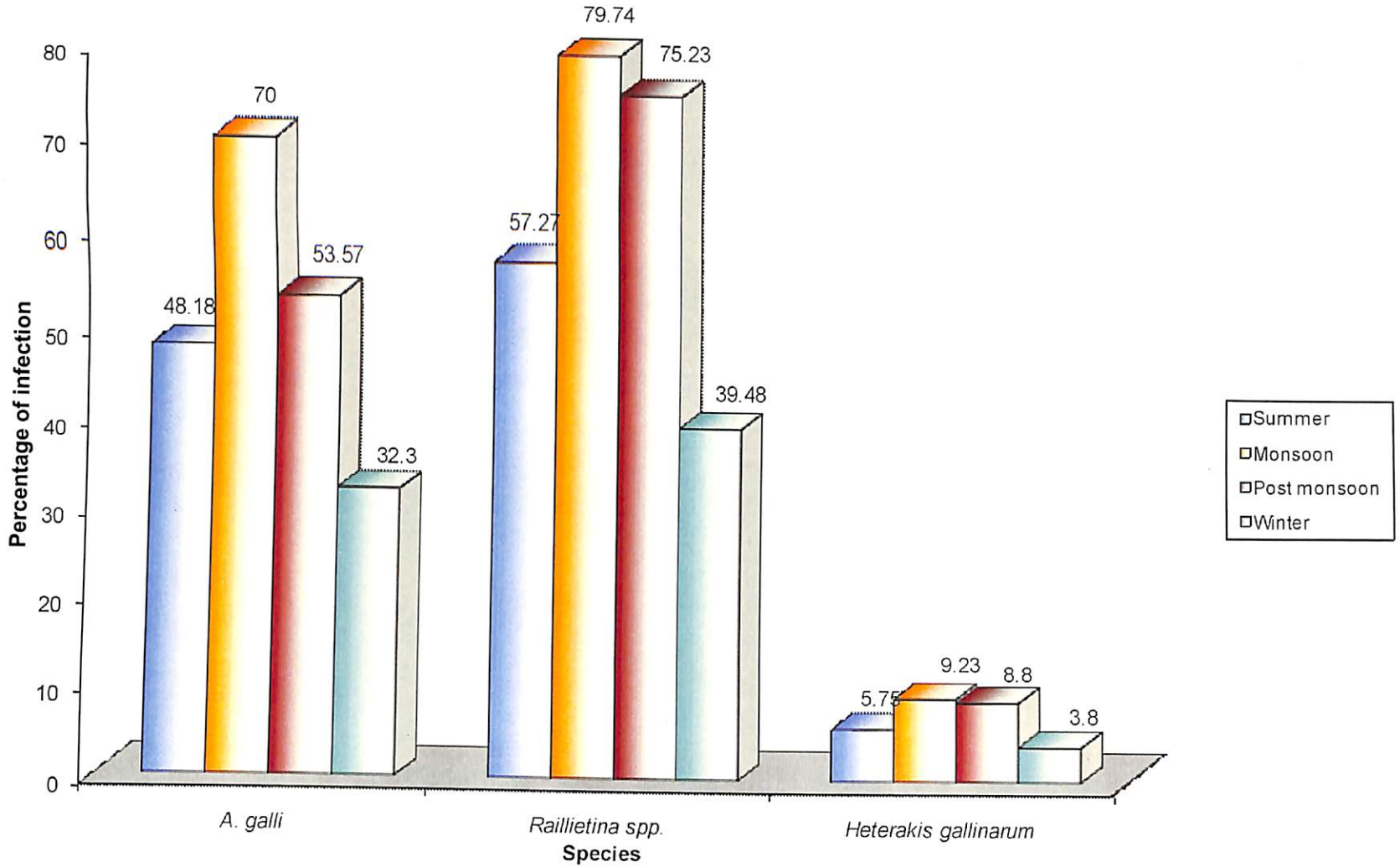


Table - 14 : Prevalence of *Heterakis gallinarum* in three districts of Bihar on intestinal content examination.

District	No. of samples examined	No. of Positive	Percentage	χ^2_2df
Nalanda	630	25	8.96	29.7**
Begusarai	500	31	6.2	
Madhepura	400	51	12.75	
Total	**1530**	**107**	**6.99**	

** = Significant at P<0.01

Fig.-14 : Bar diagram showing season wise prevalence of various parasites in three-districts of Bihar on faecal sample examination.

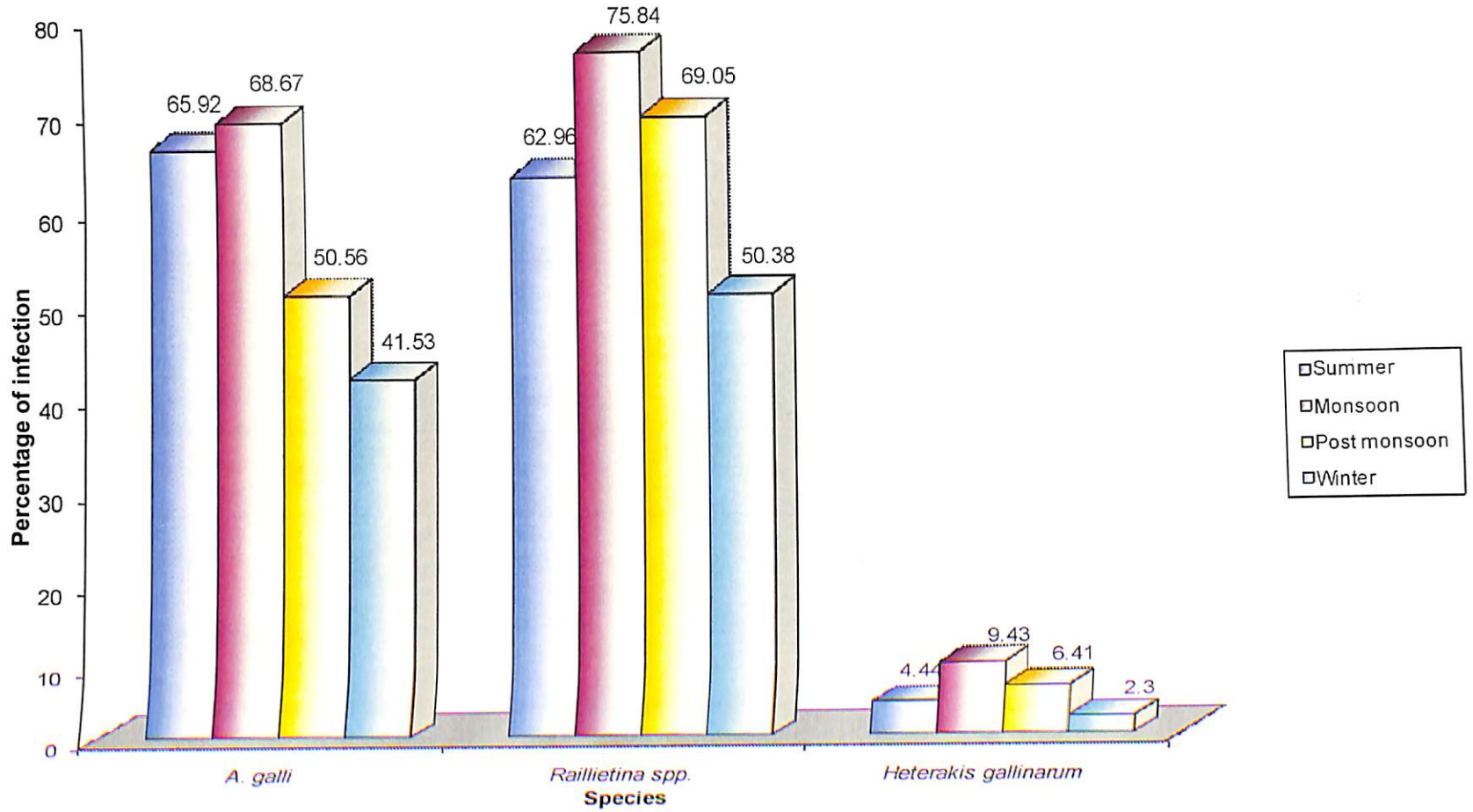


Table – 15 : Age wise prevalence of different parasites in on of Bihar on intestinal content examination.

Age	Total sample examination	*Ascaridia galli*	χ^2_3df	*Raillietina* spp.	χ^2_3df	*Heterakis gallinarum*	χ^2_3df
Chick	361	150 (19.15)	299.01**	254 (26.18)	240.49**	30 (28.03)	9.91*
Grower	448	382 (48.78)		396 (40.82)		42 (39.25)	
Adult	721	251 (32.05)		320 (32.98)		35 (32.71)	
Total	**1530**	**783**		**970**		**107**	

** = P<0.01,* = P<0.05

Figures indicated in parenthesis is percentage of respective parasite out of total sample examined.

Fig 1: Bar diagram showing comparative efficacy of various anthelmintics against natural helminthosis in desi poultry.

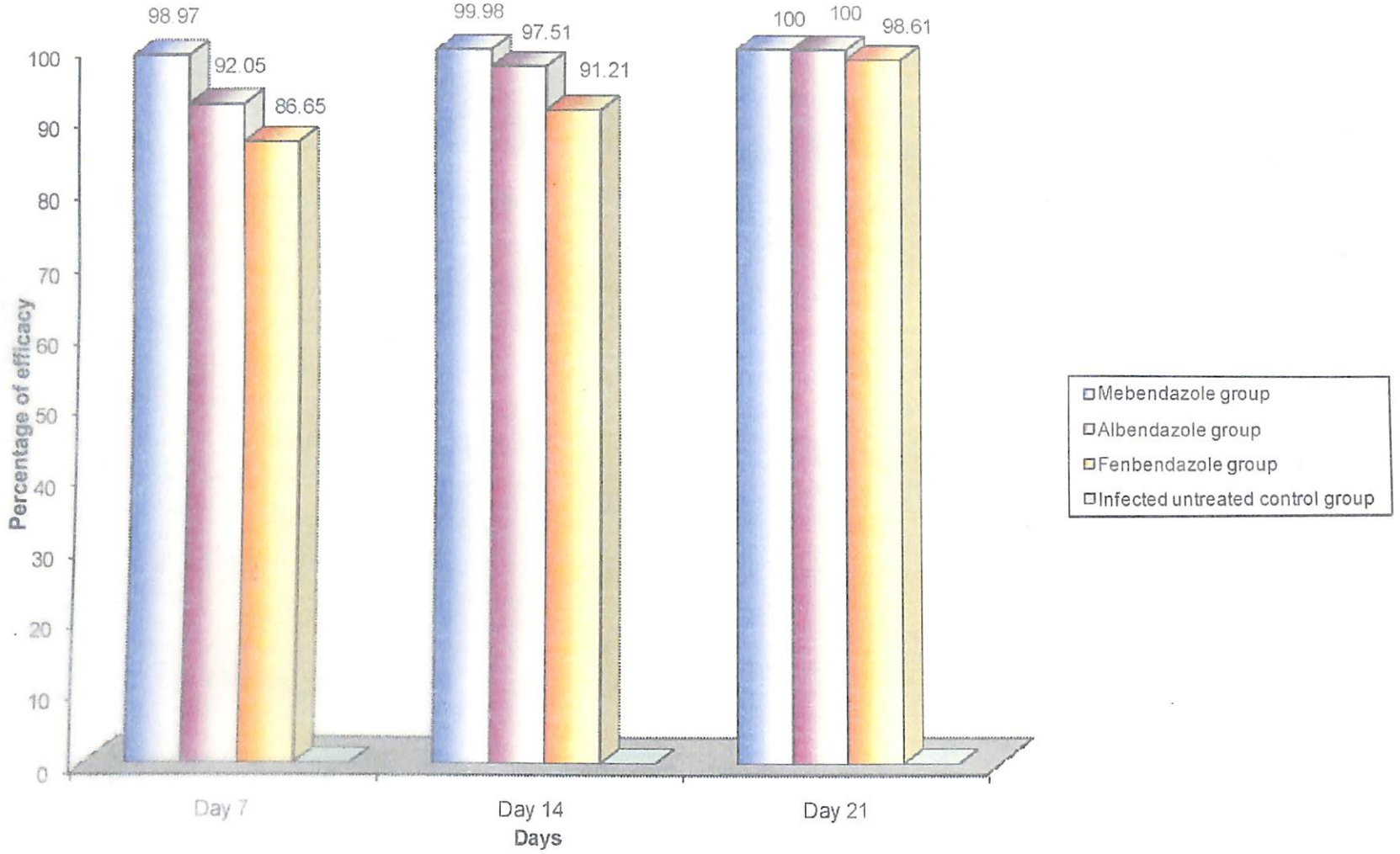


Fig.-15 : Bar diagram showing comparative efficacy of various anthelmintics against natural helminthosis in desi poultry.

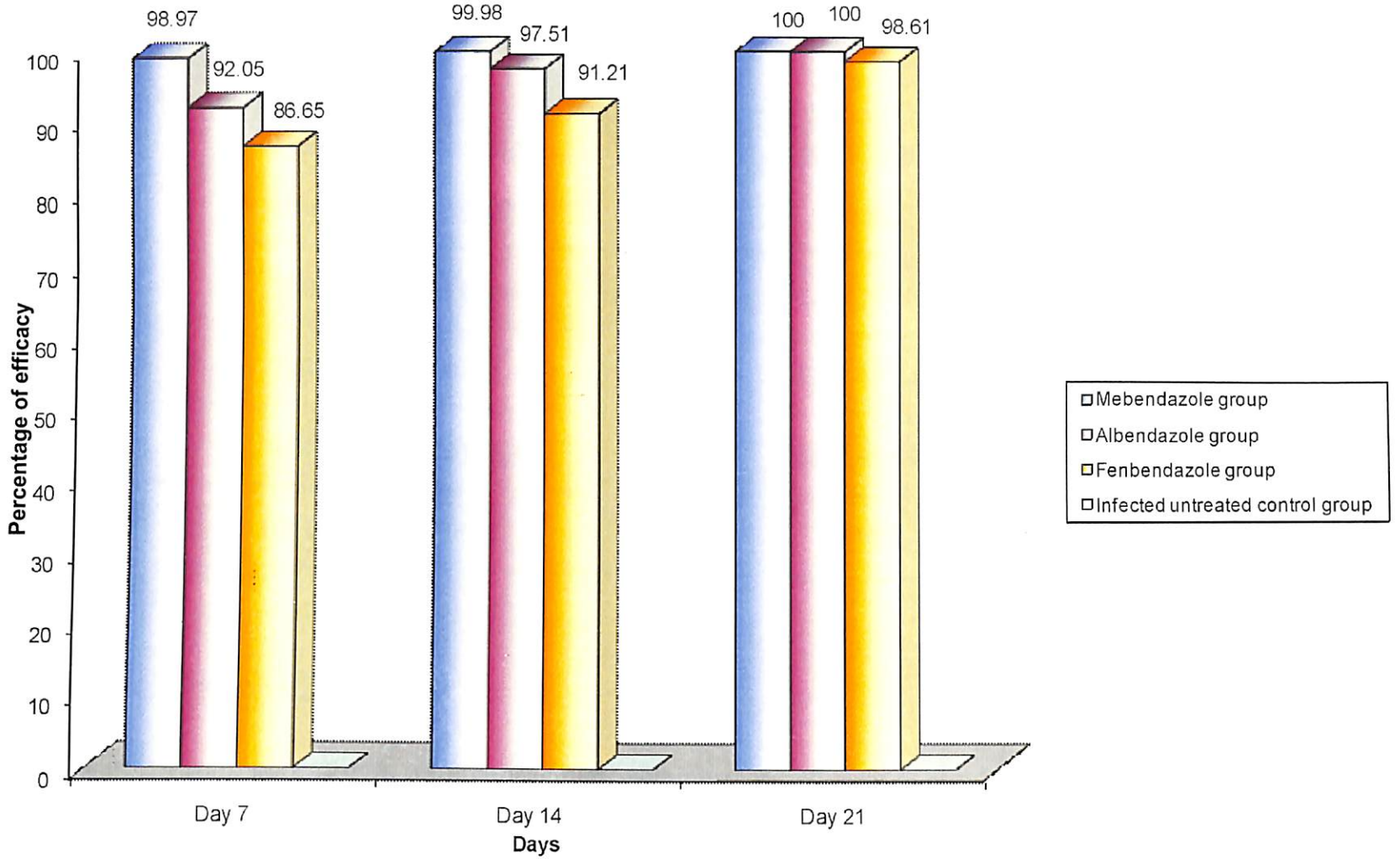


Table – 16 : Age wise prevalence of different parasites in districts of Bihar on faecal sample examination.

Age	Total sample examination	*Ascaridia galli*	χ^2_3df	*Raillietina* spp.	χ^2_3df	*Heterakis gallinarum*	χ^2_3df
Chick	260	70 (11.62)	192.30**	117 (17.08)	124.8**	11 (18.33)	3.38^{NS}
Grower	380	310 (51.49)		325 (47.44)		28 (46.66)	
Adult	420	222 (36.87)		243 (35.47)		21 (35.00)	
Total	**1060**	**602**		**970**		**60**	

**=P<0.01, NS = Non significant

Figures indicated in parenthesis is percentage of respective parasite out of total sample examined.

Fig.-16 : Line diagram showing least square means ± S.E. of Haemoglobin (Hb) percentage in poultry due to treatment at different interval of periods.

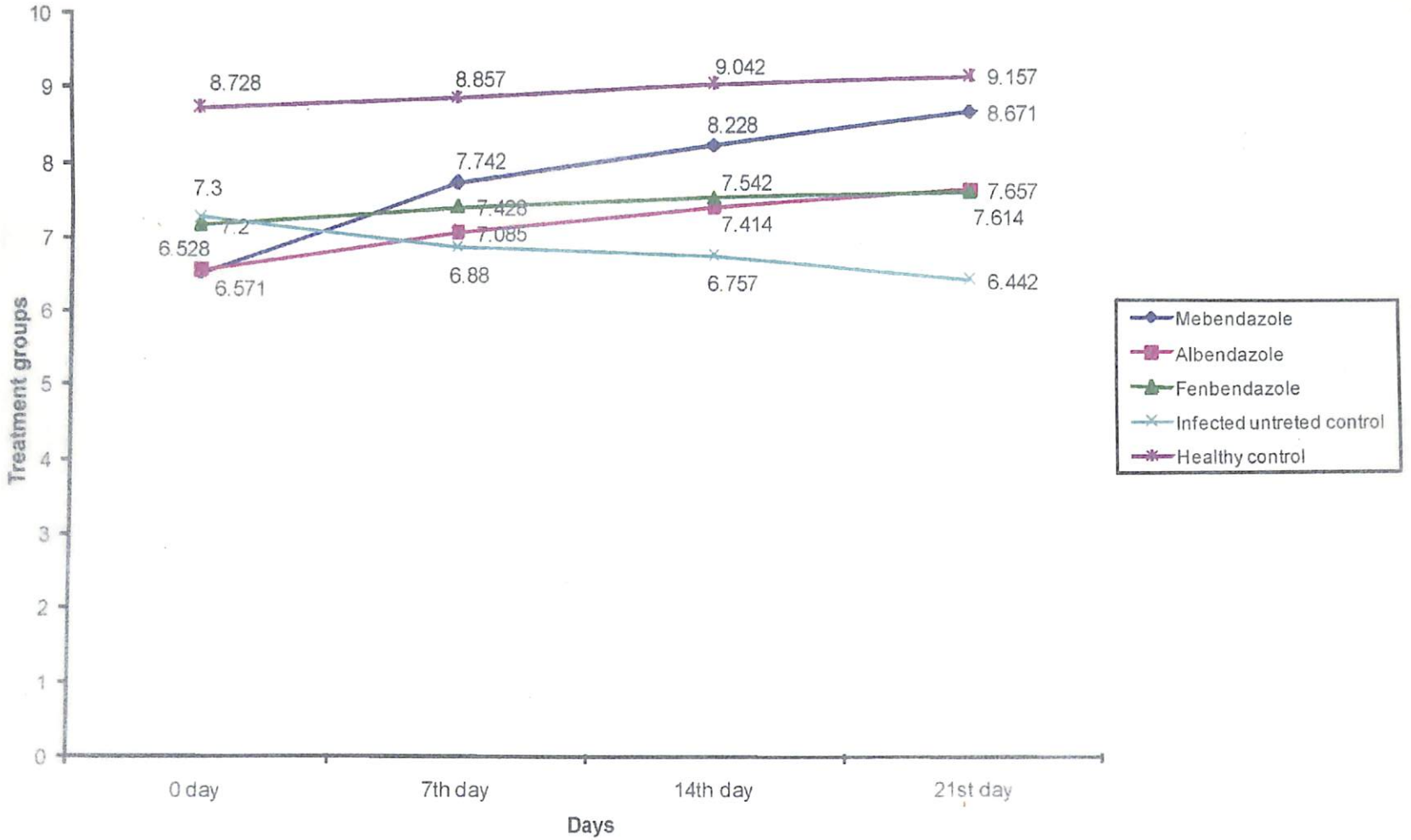


Fig.-16 : Line diagram showing least square means ± S.E. of Haemoglobin (Hb) percentage in poultry due to treatment at different interval of periods.

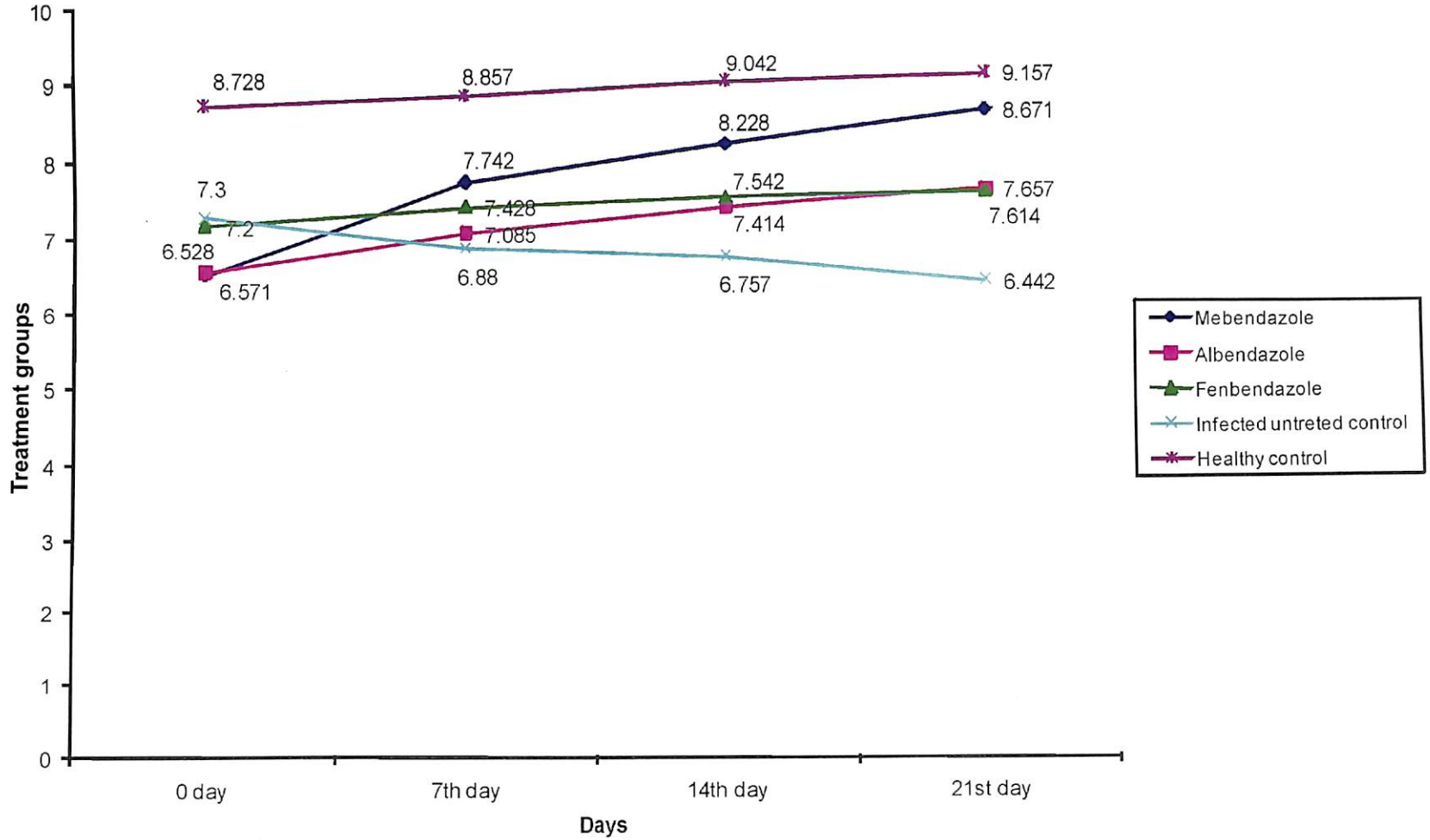


Table – 17 : Sex wise prevalence of different parasites in districts of Bihar on intestinal content examination.

Age	Total sample examination	*Ascaridia galli*	χ^2_1df	*Raillietina* spp.	χ^2_1df	*Heterakis gallinarum*	χ^2_3df
Male	853	437 (51.23)	0.00^{NS}	563 (66.00)	6.69*	50 (5.86)	3.78*
Female	677	346 (51.10)		407 (60.11)		57 (8.41)	
Total	**1530**	**602**		**970**		**107**	

* = P<0.05, NS = Non Significant

Figures indicated in parenthesis is percentage of respective parasite out of total sample examined.

Fig.-17 : Line diagram showing least square means ± S.E. of Total Erythrocyte Count (TEC-106/mm3) in poultry due to treatment at different periods of intervals.

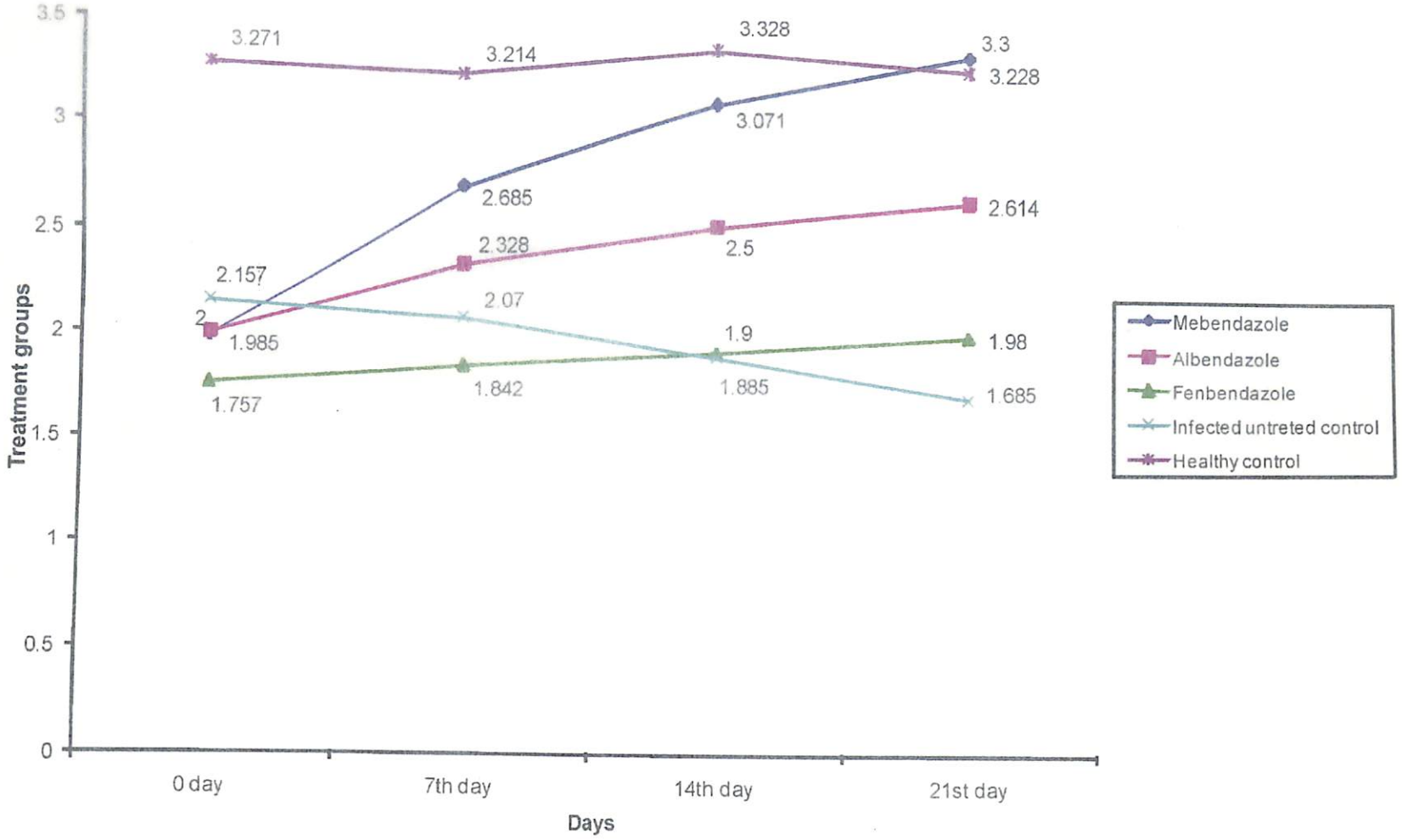


Fig.-17 : Line diagram showing least square means ± S.E. of Total Erythrocyte Count (TEC-106/mm3) in poultry due to treatment at different periods of intervals.

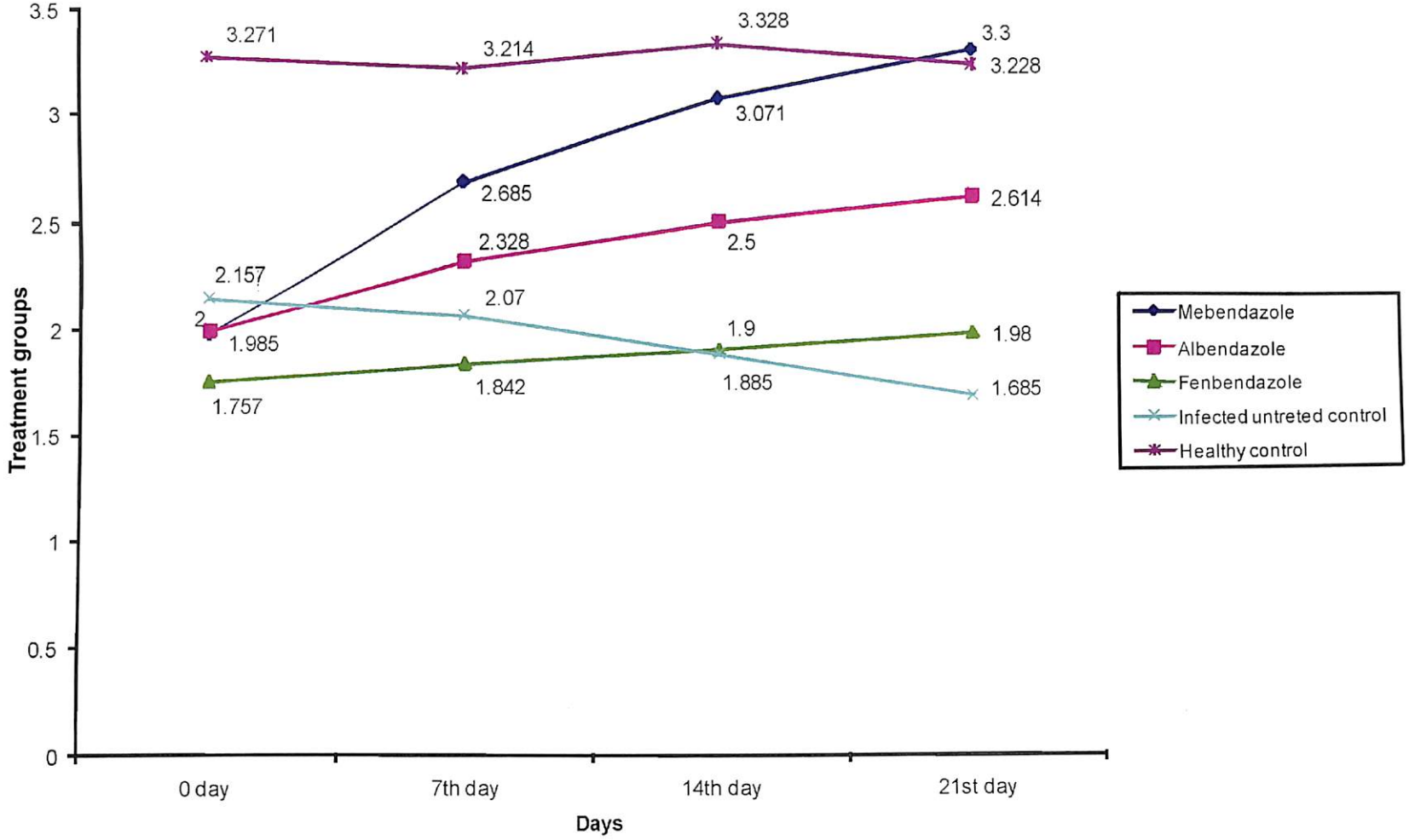


Table – 18 : Sex wise prevalence of different parasites in districts of Bihar on faecal sample examination.

Age	Total sample examination	*Ascaridia galli*	χ^2_1df	*Raillietina* spp.	χ^2_3df	*Heterakis gallinarum*	χ^2_1df
Male	547	349 (63.80)	22.61**	295 (53.93)	56.49**	39 (7.12)	4.55*
Female	513	253 (49.31)		390 (76.02)		21 (4.09)	
Total	**1060**	**602**		**685**		**60**	

** = P<0.01,* = P<0.05,

Figures indicated in parenthesis is percentage of respective parasite out of total sample examined.

Fig.-18 : Line diagram showing least square means ± S.E. of Total Leucocyte Count (TLC-103/mm3) in poultry due to treatment at different periods of intervals.

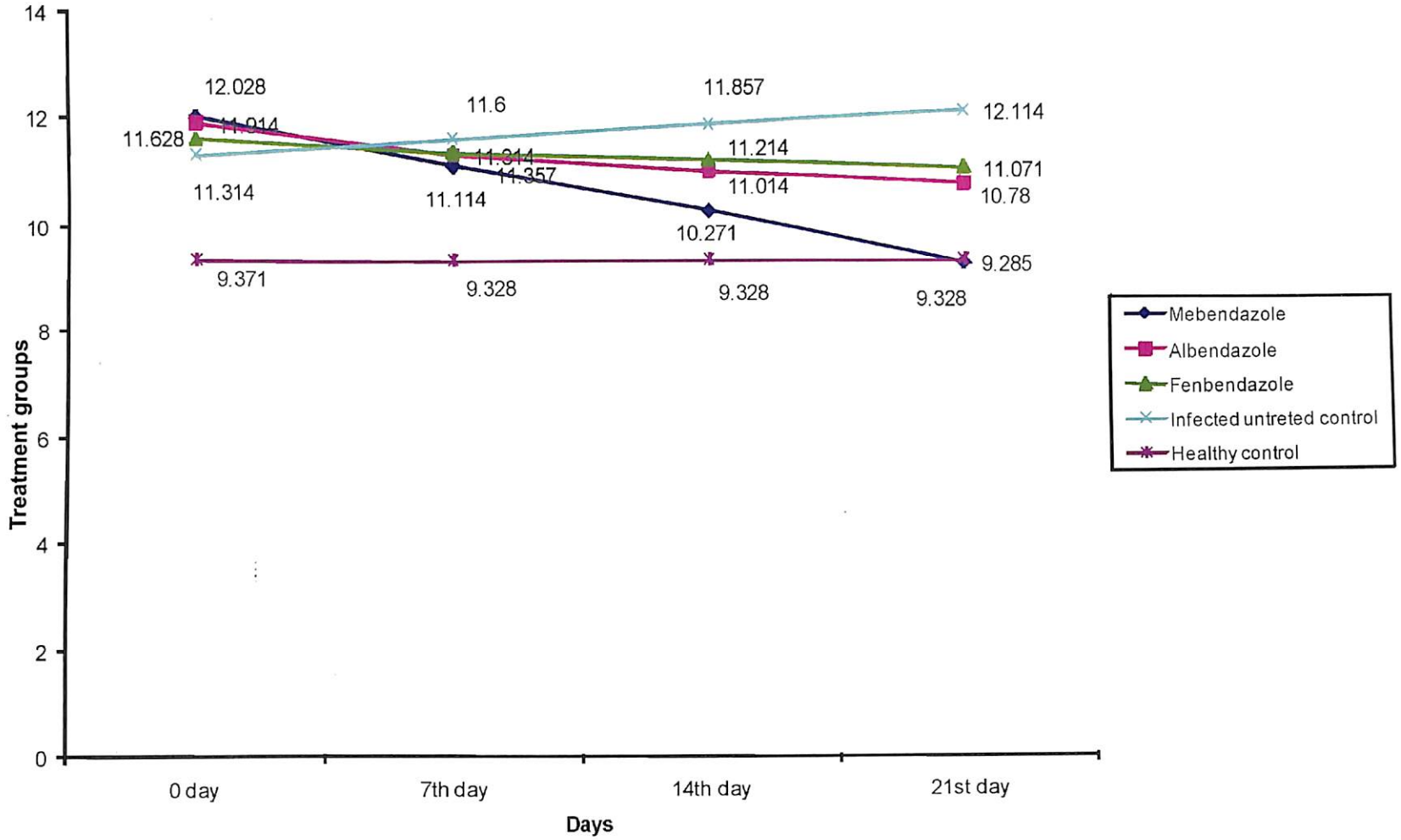


Table – 20 : Season wise prevalence of various Parasites in three-districts of Bihar on faecal sample examination.

Season	Total sample examination	*A. galli*	χ^2_3df	*Raillietina* spp.	χ^2_3df	*Heterakis gallinarum*	χ^2_3df
Summer	270	178 (65.92)	113.00**	170 (62.96)	40.47**	12 (4.44)	13.53*
Monsoon	265	182 (68.67)		201 (75.84)		25 (9.43)	
Post Monsoon	265	134 (50.56)		183 (69.05)		17 (6.41)	
Winter	260	108 (41.53)		131 (50.38)		6 (2.30)	
Total	**1060**	**602**		**685**		**60**	

** = P<0.01,* = P<0.05

Figures indicated in parenthesis is percentage of respective parasite out of total sample examined.

Table – 21: Comparative efficacy of various anthelmintics against natural helminthosis in desi poultry.

Treatment	Average EPG and percent efficacies						
	Pretreatment Epg on (0 day)	Epg on day 7 post treatment	Percent efficacy (%)	Epg on day 14 post treatment	Percent efficacy (%)	Epg on day 21 post treatment	Percent efficacy (%)
Mebendazole group	925.35^{a} ± 10.12	9.50^{b} ± 1.58	98.97	0.14^{c} ± 0.01	99.98	00 ± 00	100
Albendazole group	886.49^{a} ± 14.00	70.42^{b} ± 1.66	92.05	22.068^{c} ± 1.24	97.51	00 ± 00	100
Fenbendazole group	912.33^{a} ± 21.55	121.72^{b} ± 0.078	86.65	80.18^{c} ± 1.414	91.21	12.30^{d} ± 1.143	98.61
Infected untreated control group	890.09^{a} ± 03.29	856.22^{a} ± 27.56	--	926.54^{a} ± 12.118	--	991.80^{a} ± 13.742	--

Values with similar superscripts (columnwise) did not differ significantly.

Table – 22 : Least square means ± S.E. of Haemoglobin (Hb) percentage in poultry due to treatment at different periods of interval.

Treatment group	0 day	7th day	14th day	21st day
Mebendazole	$6.528^{aA} \pm 0.149$	$7.742^{aB} \pm 0.079$	$8.228^{aBC} \pm 0.080$	$8.671^{aC} \pm 0.126$
Albendazole	$6.571^{bA} \pm 0.170$	$7.085^{bB} \pm 0.186$	$7.414^{bBC} \pm 0.163$	$7.657^{bC} \pm 0.153$
Fenbendazole	$7.20^{cA} \pm 0.124$	$7.428^{cB} \pm 0.132$	$7.542^{cBC} \pm 0.118$	$7.614^{cC} \pm 0.124$
Infected untreated control	$7.30^{dA} \pm 0.143$	$6.88^{dB} \pm 0.121$	$6.757^{dBC} \pm 0.083$	$6.442^{dC} \pm 0.065$
Healthy control	$8.728^{cA} \pm 0.096$	$8.857^{cB} \pm 0.075$	$9.042^{cBC} \pm 0.068$	$9.157^{cC} \pm 0.063$

Values with similar superscripts (column-wise a, b, c and row-wise A, B, C) did not differ significantly.

Table – 23 : Analysis of variance for the effect of treatment on haemoglobin percentage of poultry at different interval of periods.

Source of variation	d.f.	S.S.	M.S.	F
Drugs	4	72.9943	18.2486	73.93**
Days	3	8.3469	2.7823	11.27**
Error	132	32.5806	0.2468	

** = Significant at P < 0.01.

Table – 24 : Least square means ± S.E. of Total Erythrocyte Count (TEC-10^6/mm^3) in poultry due to treatment at different periods of interval.

Treatment group	0 day	7th day	14th day	21st day
Mebendazole	$1.985^{aA} \pm 0.090$	$2.685^{aD} \pm 0.090$	$3.071^{aCD} \pm 0.063$	$3.30^{DBC} \pm 0.08$
Albendazole	$2.00^{bA} \pm 0.106$	$2.328^{bD} \pm 0.112$	$2.50^{bCD} \pm 0.117$	$2.617^{bDBC} \pm 0.118$
Fenbendazole	$1.757^{cA} \pm 0.106$	$1.842^{cD} \pm 0.102$	$1.90^{cCD} \pm 0.106$	$1.98^{cDBC} \pm 0.108$
Infected untreated	$2.157^{dcA} \pm 0.063$	$2.07^{dcD} \pm 0.049$	$1.885^{dcCD} \pm 0.060$	$1.685^{dcDBC} \pm 0.057$
Healthy control	$3.271^{eA} \pm 0.071$	$3.214^{eD} \pm 0.047$	$3.328^{eCD} \pm 0.045$	$3.228^{eDBC} \pm 0.040$

Values with similar superscripts (column-wise a, b, c and row-wise A, B, C) did not differ significantly.

Table – 25 : Analysis of variance for the effect of treatment on Total Erythrocyte Count (TEC) of poultry at different interval of periods.

Source of variation	d.f.	S.S.	M.S.	F
Drugs	4	37.5267	9.3817	88.5230**
Days	3	2.3200	0.7733	7.2970
Error	132	13.9894	0.1060	

** = Significant at P < 0.01.

Table – 26 : Least square means ± S.E. of Total Leucocyte Count (TLC-$10^3/mm^3$) in poultry due to treatment at different interval of periods.

Treatment groups	0 day	7th day	14th day	21st day
Mebendazole	$12.028^{aA} \pm$ 0.193	$11.114^{aA} \pm$ 0.107	$10.271^{aBA} \pm$ 0.084	$9.285^{aCB} \pm$ 0.075
Albendazole	$11.914^{bA} \pm$ 0.714	$11.314^{bA} \pm$ 0.079	$11.014^{bBA} \pm$ 0.095	$10.78^{bCB} \pm$ 0.090
Fenbendazole	$11.628^{cbA} \pm$ 0.275	$11.357^{cbA} \pm$ 0.249	$11.214^{cbBA} \pm$ 0.247	$11.071^{cbCB} \pm$ 0.224
Infected untreated	$11.314^{dA} \pm$ 0.115	$11.60^{dA} \pm$ 0.090	$11.857^{dBA} \pm$ 0.063	$12.114^{dCB} \pm$ 0.055
Healthy control	$9.371^{eA} \pm$ 0.074	$9.328^{eA} \pm$ 0.069	$9.328^{eBA} \pm$ 0.045	$9.328^{eCB} \pm$ 0.035

Values with similar superscripts (column-wise a, b, c and row-wise A, B, C) did not differ significantly.

Table – 27 : Analysis of variance for the effect of treatment on Total Leucocyte Count (TLC) of poultry at different interval of periods.

Source of variation	d.f.	S.S.	M.S.	F
Drugs	4	96.7734	24.1933	69.8574**
Days	3	10.2448	3.4149	9.8605
Error	132	45.7148	0.3463	

** = Significant at P<0.01.

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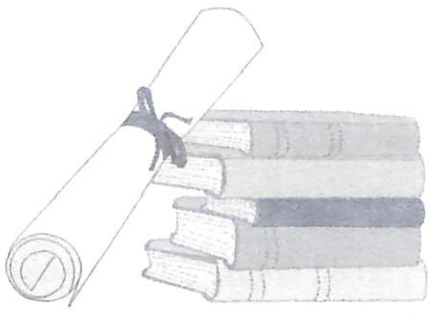
Chapter - V

DISCUSSION



Chapter - V

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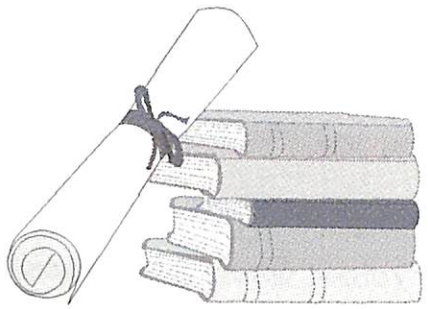

DISCUSSION

Domestic poultry keeping is a popular subsidiary occupation in rural and urban areas in all districts of Bihar, which is often comprised of 10-20 birds or little larger poultry flock that is left scavenging around the houses.

Backyard poultry or traditional poultry rearing usually adapted with desi or non-descript breeds of fowl who get feed from environment as kitchen waste, offal, insects and seeds and become prone to many diseases through contamination of soil. The enteric pathogens and worms are important sources of infection to *Gallus* chickens accounting for high morbidity and mortality, decreased production and low meat quality. Apart from coccidian, bacterial and viral diseases, helminthic diseases are common in desi fowls. Helminthic infection in indigenous poultry results in chronic infection in different internal organs viz., oesophagus, crop, proventriculus, gizzard, duodenum, small intestine, caecum, colon, rectum, liver, bileduct, gall bladder, pancreas, oviduct, kidney, respiratory tract, bursa of fabricius, mouth cavity etc and is responsible for causing varying grades of pathogenesis.

It has been observed that the survival and development of infective stages of helminth parasites in pasture is determined by climatic factors, notably temperature and rainfall. Topographical situation of Bihar provides variation in geoclimatic condition from place to place. However, information on epidemiology of gastrointestinal helminthosis in domestic poultry under backyard system is scanty for this region. The control of parasitism has two important components, first, accurate diagnosis, which to a large extent is dependent on the observation of clinical signs and detection of the parasites

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and/or its stages in the infected host or the environment, secondly, detail epidemiological assessment playing an important role in diagnosis and treatment of parasitic diseases. So, knowledge of epidemiology of helminthic infection of domestic fowl may be useful for development of practices to minimize the production losses and exposure to infection in commercial poultry or neighbouring poultry population. Therefore, the present investigation was undertaken to study the prevalence of different helminthic infections in three districts of Bihar, viz. Nalanda, Begusarai and Madhepura in different seasons, sex and age groups of desi or non descript poultry reared under backyard system of management.

To conduct study, altogether alimentary tract of 1530 locally slaughtered chickens and anal dropping of 1060 domestic chickens were collected from Nalanda, Begusarai and Madhepura districts of Bihar. Out of total 1060 faecal samples examined for parasitic infections, 360, 350 and 350 faecal samples were from Nalanda, Begusarai and Madhepura, respectively. Similarly 630, 500, 400 intestinal contents were examined in respective districts of Bihar. The study showed that prevalence of gastro intestinal helminthosis among three districts of Bihar was found highly significant. Panday and Jiang (1992) suggested that free ranged birds are in constant contact with soil which serves as an important reservoir and transmission site for external larval stages of helminths and vector insects. These factors explain the presence of wide range of helminths in domestic, free ranged chickens in traditional sectors. Helminthosis, partly responsible for low productivity of these birds, is associated with unthriftness, poor growth poor feed conversion rate, reduced egg production and fertility due to perpetual worm load. The present study revealed that rate of infection was

highest in Begusarai followed by Madhepura and Nalanda districts in free ranged birds. These findings suggest that desi poultry are highly susceptible to helminthic infection in all the districts of Bihar, due to potential of indigenous poultry as a source of food and income to people has usually remained unexplored and in free range chickens significance of parasitic infestation, often neglected despite their losses in terms of reduced growth rate and higher morbidity. Studies conducted by Yadav and Tandon (1991) in Meghalaya, Virk *et al.* (1987) in Chandigarh, Kurade *et al.* (2001) in Himanchal Pradesh, Kulkarni *et al.* (2001) in Maharashtra also demonstrated 53.20 to 90.9 percent worm load in desi fowl population. In the present study also helminthic infection ranged between 69.72 to 82 percent on screening of faeces and intestinal scrapings in three districts of Bihar. Permin *et al.* (1997) observed 100 percent prevalence of worms in scavenging village chickens. Muhairwa *et al.* (2007) reported that impact of helminthosis was 52 percent in scavenging ducks of Morogoro municipality. Eshetu *et al.* (2001) found 91.01 percent of gastrointestinal helminthic infection in scavenging chickens in Ethopia. Role of helminthic parasites of desi fowls and their prevalence from different parts of country has been well documented by Matta and Ahluwalia (1982) in Uttar Pradesh, Anandi *et al.* (1994) in Manipur, Singh *et al.* (1993) in Ranchi. Similarly, Mathur (2000) recorded 77 percent incidence of helminth parasites in the domestic fowls in Rajasthan.

However under local condition of Bihar a lot of factors hinder the development and profitable desi poultry rearing in its full capacity. These factors include poor management systems, hygiene and prophylactic schedule practiced by poor, less privileged and illiterate producers. But

indigenous or non-descript fowls are well adapted to high environmental temperature and dry condition. Richard and Narayan Kutty (2002) described that village indigenous poultry having high taste are delicious and despite their low production, improves the financial and nutritional status of poor, rural and urban families. These fowls have high degree of disease resistance, hence usually helminthic infection remains untreated due to non-appearance of significant disease symptoms.

A total of three different worm species were demonstrated in the small intestine and caccum in the present survey. Overall prevalence of *Ascaridia galli* ranged from 55.14 percent - 58.57 percent in three districts of Bihar. Another parasite which was detected in intestine was *Raillietina* spp. observed 52.5 – 70.0. Prevalence of *Heterakis gallinarum* was lowest and it ranged from 3.3 percent to 12.75 percent in cloacal dropping and caecum collected from indigenous poultry from three districts of Bihar. The study further revealed that distribution of all the three parasites was non-significant on faecal examination whereas, distribution of these worms was highly significant when recorded on intestinal content examination in all three districts. *Ascaridia galli* and *Heterakis gallinarum* are potentially pathogenic worm and were shown to have clear physical effect on the health status of the indigenous poultry. The clinical signs include diarrhoea, anaemia, unthriftness, marked emaciation and retarded growth. Along with this *Heterakis gallinarum* also play the role of carrier of The protozoan parasite, *Histomonas meleagridis*, which causes entero-hepatitis or black head disease in turkeys and fowls. The observation of Permin *et al.* (1997) revealed that body condition score of all chicken infected with these worms were below normal which was natural to any parasitic infection as they cause nutritional

imbalance in host. The present study clearly showed that *Ascaridia galli* and *Heterakis gallinarum* are the significant parasitic infection in local poultry of three districts of Bihar. *Raillietina* was also shown to be an important cestode of local backyard poultry. Although this parasite was found most prevalent in the present investigation but considered to be comparatively less harmful parasite.

However, studies on relative effect on health status, blood parameters and growth rate of poultry due to these parasites are lacking. Present study revealed that heavy worm load of these parasites could be due to their simple life cycles requiring no intermediate host in case of nematodes, whereas the cestode detected in the present study requires an insect host only. The present study also showed that mixed worm infection was frequently seen than single worm infection. Findings also indicated that local desi poultry were highly susceptible to mixed infections and were limited to only a maximum of two species of helminth parasites per bird. Several studies on the endoparasites of domestic fowl have been reported with similar findings as, Singh *et al.* (1993) reported high incidence of *A. galli* and *Raillietina* spp. in unadapted villages of Ranchi region of Bihar.They also found *Heterakis gallinarum* and *Davainea proglottina* in their study. Rina *et al.* (1999) recorded prevalence of *A. galli* (91%) and *H. gallinarum* (91%) in *Gallus gallus domesticus* in Bihar state. Finding of present study corroborates with the reports of Yadav and Tandon (1991), Virk *et al.* (1987) and Mathur (2000), who encountered *Ascaridia galli* as the most prevalent parasite along with *Raillietina* sp., *Heterakis gallinae* and other worms. Kunde *et al.* (2001) demonstrated that *A. galli* was one of the major causes of mortality in chickens. Cross -sectional prevalence study of gastrointestinal helminth in

backyard rearing conducted by Permin *et al.* (1999), Pavlovic *et al.*, 1996; Mpoame and Agbede (1995), Kanjura *et al.* (1993), Zeller (1990), Terregino (1999) depicted that *Ascaridia galli, Raillietina* spp. and *Heterakis gallinarum* were most commonly seen parasites along with other worm species. Diagonal table presented in the result of present study (Table no. – 9, 10, 11, 12, 13) indicated that mixed nematode and cestode was mostly observed than single infection in local fowls of three districts of Bihar. Findings of Poulsen *et al.* (2000), Sayyed *et al.* (2000), Mushi *et al.* (2000), Ashraf *et al.* (2002), Hayat *et al.* (2002) suggested that species of parasites isolated per chicken were positive with one or two worm species for single or mixed infection.

The seasonal variation of helminths in indigenous poultry has been studied throughout the year in four seasons viz.; summer, Monsoon, post monsoon and winter season. The overall prevalence rate of all the three parasites detected in faecal samples or intestinal contents were higher in monsoon, followed by post – monsoon months. It was less prevalent in summer season and minimum infection rate was recorded in winter season. The present finding is in general agreement with the reports of Kumari and Thakur (1999) who also noted highest prevalence of endoparasites of digestive tract of domestic fowls in rainy season which decreased to minimum in winter months. They also found a significant positive correlation between parasite population with temperature and rainfall. These two factors are conducive for propagation and transmission of infective stages of the detected parasites. Rain water and humidity also provide significant higher chances of development of infective stages. Similar to present result Magwisha *et al.* (2002) observed that the number of species of

parasites isolated per chicken increased as rainy season advanced. Mpoame and Agbede (1995) also observed that parasite prevalence or worm burden were generally higher during rainy season.

Variation due to age in the prevalence and intensity of different helminthic infections were recorded maximum in growers followed by adults and minimum in chicks in all the three districts on examination of faecal sample and intestinal contents. Trend of age wise prevalence of all the three parasites viz; *A. galli, Raillietina* spp. and *Heterakis gallinarum* was recorded similar in all the three districts of Bihar. Similar observations were also recorded by Magwisha *et al.* (2002) who encountered the prevalence and burden of helminth infections in grower and adult free – range chickens. Permin *et al.* (2002) also observed that the number of parasites was higher in young grower chickens than adults. Present observation tallied with the reports of Mpoame and Agbede (1995) who demonstrated that *Ascaridia galli* was more prevalent in grower males. However, Zeller (1990) recorded higher rate of worm burden and incidence of helminthic parasites in chickens aged 5 weeks than 9-12 weeks old fowls.

No significant difference in the predisposition of the sexes to helminthic infection was however seen, but more infection rate was encountered in male desi fowls both during faecal sample and intestinal content examination in all the three districts of Bihar and for all the three parasites. However, *Raillietina* spp. and *Heterakis gallinarum* were significantly higher in female chickens than males on intestinal content examination. Similar to the present result, Magwisha *et al.* (2002) and Mpoame and Agbede (1995) also showed no effect of sex on the worm

burden in chicken but the general observation was higher prevalence of helminths in male against females.

Comparative efficacy of various anthelmintics against natural helminthosis in desi poultry:

Twenty – eight randomly selected desi birds naturally infected with G.I. parasitic helminths were taken as experimental birds for this study. The birds were divided into four groups viz. Mebendazole treated group, Albendazole treated group, Fenbendazole treated group and infected untreated control group. Mebendazole was administered with drinking water @ 100mg/5ml w/v, 3ml/lit. of drinking water, Albendazole, @ 2.5% w/v, 35 ml/lit. of drinking water, Fenbendazole @ 2.5% w/v, 1ml/100ml. of drinking water and group IV was left as untreated control. The efficacies of drugs were estimated on the basis of declining rate of E.P.G. on 7^{th}, 14^{th} and 21^{st} days of post-treatment. It was observed that efficacy of Mebendazole, Albendazole and Fenbendazole was 98.97%, 92.05% and 86.65% on 7^{th} post-treatment day, respectively which gradually increased to 99.98%, 97.51% and 91.21% on 14^{th} day and 100%, 100% and 98.61% on 21^{st} day, respectively, after treatments (Table-21). The superiority of efficacy of Mebendazole followed by Albendazole was found on all the days of observation over Fenbendazole. Mebendazole was found to be more suitable than Albendazole and Fenbendazole against natural helminthosis in the present investigation.

Maqbool *et al.* (1995) also treated birds infected with larvae and mature worms (*Ascaridia galli*) with 7.5 mg/kg Oxfendazole, 100mg/kg Mebendazole and 200mg/kg piperazine. The drugs were found more effective against mature worms than immature worms as per worm count

and reduction in the number of eggs per gram of faeces. Ashraf *et al.* (2002) found that Oxfendazole was more effective followed by Levamisole and albendazole against natural gastro-intestinal nematodosis in pea fowl. Statescu *et al.* (1992) also conducted a drug therapy with albendazole in broiler fowls for treatment of helminthic parasites and showed complete removal of all alimentary tract helminthic parasites. Hayat *et al.* (2002) evaluated the efficacy of fenbendazole against *Ascaridia galli* and *Raillietina tetragona* infections in layers and recorded 100% reduction in egg count within 7 days of administration through feed.

Present finding also conformed with the reports of Pavlovic *et al.* (1996) as he observed total absence of eggs in faecal examination giving mebendazole in feed for 14 days at 120/kg feed. Padmaja and Sathianesan (1993) reported that albendazole was 100% effective against all stages of worms.

Haematological Studies :

In the present investigation, a drug therapy was conducted with benzimidazole derivatives in indigenous fowls for treatment of helminthic parasites and observed the effect of drugs on the haematological parameters such as Hb, TEC, TLC, to study the significant improvement on the administration of drugs. Soulsby (1972) suggested that nematodosis causes marked lesion when large number of maturing parasites penetrate into the duodenal mucosa. They cause haemorrhage and enteritis. The birds become anaemic and suffer from diarrhoea with unthriftiness and emaciation. In present investigation also, marked reduction in haemoglobin and total erythrocyte count were observed in all treatment group birds before administration of drug which is day 0 observation. Shekher *et al.* (1986) also

reported that total erythrocyte count was depleted but haematocrit was elevated because of increase in individual RBC size in cockerels and pullets infected with various species of cestodes and *Ascaridia galli*. Further, they observed that the volume index was high implying macrocytic anaemia and lowered level of haemoglobin in blood. The colour index was high suggesting hyperchromic anaemia. Soulsby (1982) also suggested that nematodiasis was very common in young and growing birds specially when excess moisture occurs. Birds are more susceptible to infection due to dietary deficiencies such as those of vitamins A, B and B_{12}, various minerals and proteins. Desi birds are always predisposed to helminthic infection because they remain in constant contact with moist soil for feeding and are never provided with any dietary supplement. Hence, anaemia due to parasitic infection is very common in these birds. In the present study significant improvement in all blood parameters were noticed with maximum change in mebendazole group followed by albendazole and fenbendazole treated groups. However, effect of treatment was non-significant between days (TEC or TLC) but significant upon various treatments against helminthic parasites.

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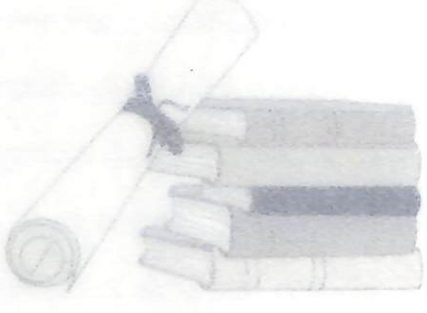
Chapter - VI

SUMMARY AND CONCLUSION



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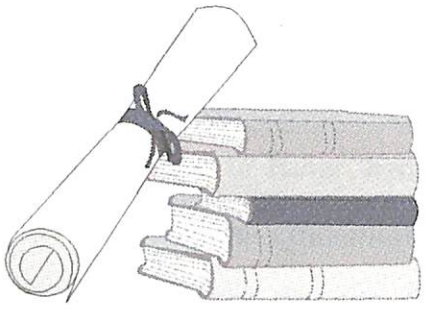

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Production of desi (indigenous or non descript) fowls under backyard system of management is an attractive profession of people residing in rural as well as semi urban areas of Bihar. It requires low capital input and the ability of poultry to thrive on native meadows and scavenging in surroundings. However, there being very limited scope for industrialization of these non-descript breeds of desi fowls in this areas due to varied activities of agriculture including its low productivity, but desi breeds of poultry under free range rearing has become a major source of income, taste delicacies and uplifting the nutritional status of poor and under privileged owners. Almost every rural household rears desi fowls, which caters to their daily needs of egg or meat etc Desi poultry are from to infection of diverse types of helminthic parasites particularly the soil and insects transmitted species because of their free range keeping.

Planning of control strategies of helminthosis requires knowledge of the epidemiological factors that influence the risk of helminth parasites in desi poultry as well as evaluation of newer chemotherapeutic drugs under local condition. To date no detailed epidemiological work has been reported on parasites of desi breeds of poultry in various districts of Bihar, hence the objective of present investigation was to estimate the epidemiological aspects of gastrointestinal helminthic parasites of desi non descript poultry reared under traditional poultry keeping methods in three districts of Bihar

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and to evaluate comparative efficacies of Benzimidazole derivatives against natural gastrointestinal helminthosis.

To conduct the study, altogether 1060 cloacal droppings and 1530 gastrointestinal contents of desi poultry were collected from Nalanda, Begusarai and Madhepura districts of Bihar. Prevalence of gastrointestinal helminthosis on faecal sample examination was found highest in Begusarai (82.00%) followed by Madhepura (78.57%) and lowest in Nalanda district (69.72%). The trend of prevalence was found same during gastrointestinal tract examination and respective rates of infection were 81.20%, 77.0% and 72.06% in three district of Bihar with significant difference.

While investigating into gastrointestinal helminthic infection of domestic fowls in three districts of Bihar three species of helmintsh were encountered as single or mixed infection, of which *Raillietina* spp. was recorded as the most prevalent (63.39 to 64.62%) parasite among local population of non descript scavenging poultry in all the three districts. *Ascaridia galli* (51.17 to 56.88%) was the most prevalent nematode spp. followed by *Heterakis gallinarum* (5.66 to 6.99%) during faecal sample and intestinal content examination. Nearly 54.19 to 58.11% samples were positive for mixed infection, maximum with 2 parasites out of total samples examined.

The prevalence of gastrointestinal helminthic infection in the present study was at the peak during monsoon followed by post monsoon, summer and lowest in winter season for all the parasites in 3 districts of Bihar. Similar trends with significant influence of seasonal variation were recorded both on faecal and intestinal content examination.

The infection rate of gastrointestinal helminthosis in different age group (chick, growers and adults) of desi poultry was also estimated in the present study. Maximum parasitic load (*A. galli, Raillietina* sp. and *Heterakis gallinarum*) was observed in growers and significantly lower rate of infection was recorded in adults followed by chicks both on faecal sample and intestinal scraping examinations in all the three districts of Bihar.

Present study revealed that susceptibility of male and female domestic chicken to infection were unequal, as significantly lower prevalence observed in male on intestinal content examination than females, whereas it was significantly higher on faecal sample examination in all the three districts of Bihar.

Efficacy of three benzimidazole compounds were evaluated against natural helminthosis in domestic chickens at the dose rate of Mebendazole, (100mg/5ml) @ 3ml/lit. of drinking water, Albendazole susp. (2.5% w/v) @ 35ml/lit. of drinking water and fenbendazole susp. (2.5% w/v) @ 100ml/lit. of drinking water on the basis of declining rates of EPG on 7^{th}, 14^{th} and 21^{st} days of observation. On the basis of faecal egg output, mebendazole was found superior to albendazole and fenbendazole on all the periods of observation.

Studies on the basis of haematological parameters such as haemoglobin content total erythrocyte count and total leucocytic count during post treatment period indicated that their effectiveness and spectrum of activity improved these parameters with advancement of days of post-treatment. Delivery of anthelmintics through drinking water was found advantageous for achieving maximum efficacy, as parasites were exposed to toxic concentration of drug for prolonged period of administration through

drinking water. However, it has been demonstrated that mebendazole treatment was most effective for combating anaemia and leucocytic counts as compared to albendazole and fenbendazole ,but all the drugs were efficacious against natural helminthosis in domestic poultry and improved the haemoglobin content, total erythrocytic count (TEC) and total leucocytic (TLC) count towards normal values.

The foregoing results and discussion clearly revealed that :

1. *Ascaridia galli, Raillietina* spp. and *Heterakis gallinarum* was the most prevalent parasites among local non-descript, domestic poultry population in Nalanda, Begusarai and Madhepura districts of Bihar.
2. Incidence of all these parasites was highest in Rainy season.
3. Younger birds were more prone to the infection, however sex of birds did not influence the incidence of gastrointestinal helminthosis.
4. Mebendazole suspension (100mg/5ml) @ 3ml. lit. of drinking was more effective than Albendazole and Fenbendazole, against gastrointestinal helminth parasites of desi birds.

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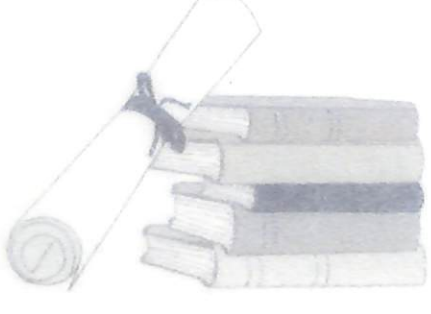
BIBLIOGRAPHY



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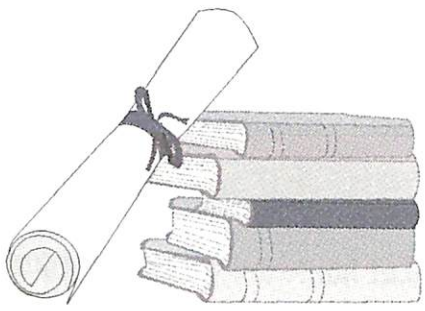

BIBLIOGRAPHY

Abdel. Wahab, M. H. (2003). Studying the efficacy of flubendazole against helminths of laying hens. *Egyptian – Poultry – Science –Journal*, **23** (4): 1021 – 1029.

Altinoz, F. (2002). The prevalence of digestive tract helminths in the modern poultry industries in Ankara and Surrounding areas. *Turkiye Parazitoloji Dergisi*, **26** (3): 320 – 324.

Anandi, Y., Bimola, Kumari, K. and Dhanachand, C. (1994). Pattern of infestation of intestinal helminth parasites of chicken in Imphal district. *Indian Journal of Hill Farming*, 7 (2): 206.

Ashraf, M., Warraich, F.N., Ahmad, I.G. and Pervez, K. (2002). Chemotherapy of gastro – intestinal nematodes in common peafowl (Pavo Cristatus). *Pakistan Veterinary Journal*, **22** (2) : 91 – 93.

Barakat, A.M., Shaalash, M.R.; Selim, M.K. and El, Tohamy, M.M. (1997). Effect of Ascaridia galli infestation on local and foreign chicken breeds, II Physio Pathological Status. *Egyption Journal of Veterinary Science*, 31 : 47-54.

Buriro, S.N., Wagan, M.P., Bhutto, M.N. and Kumbhar, M.I. (1992). Incidence of helminth parasites in poultry. *Pakistan Veterinary Journal* 12 (1): 25-27.

Carlos, S.M.F.C., and Eduardo, S.L. (2002). Notes on intestinal helminth parasites of fighting cocks. *Philippine Journal of Veterinary Medicine*, 39 (1) : 51 – 53.

BIBLIOGRAPHY

Abdel, Wahab, M.H. (2003). Studying the efficacy of flubendazole against helminths of laying hens. *Egyptian – Poultry – Science –Journal*, **23** (4) : 1021 – 1029.

Altinoz, F. (2002). The prevalence of digestive tract helminths in the modern poultry industries in Ankara and Surrounding areas. *Turkiye Parazitoloji Dergisi*, **26** (3): 320 – 324.

Anandi, Y., Binod Kumari, K. and Dhanachand, C. (1994). Pattern of infestation of intestinal helminth parasites of chicken in Imphal district. *Indian Journal of Hill Farming,* **7** (2): 206.

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Barakat, A.M., Shalash, M.R.; Selim, M.K. and El, Tohamy, M.M. (1997). Effect of Ascaridia galli infestation on local and foreign chicken breeds, II Physio Pathological Status. *Egyption Journal of Veterinary Science,* **31** : 47-54.

Buriro, S.N., Wagan, M.P., Bhutto, M.N. and Kumbhar, M.I. (1992). Incidence of helminth parasites in poultry. *Pakistan Veterinary Journal,* **12** (1): 25-27.

Carlos, S.M.E. A.S. and Eduardo, S.L. (2002). Notes on intestinal helminth parasites of fighting cocks. *Philippine Journal of Veterinary Medicine*, **39** (1) : 52 – 53.

Choudhury, S., Gogoi, A.R. and Das, M.R. (1995). Occurance of *Heterakis brevispiculum, Strongyloides avium* and *Subulura brumpti* in fowls in Assam. *Indian Veterinary Journal*, **72** (5) : 519 - 520.

Deepali, Chaddha., Agnihotri, R.K. and Rajesh, Katoch. (2005). Efficacy of albendazole and levamisole against *Ascaridia galli. Journal of Veterinary Parasitology*, **19** (1) : 35 – 37.

Dubinsky, P., Lest'an, P. and Rybos, M. (1974). Effects of invasion of *Ascaridia galli* on the components of the host's blood serum *Biologia, Bratslava, C., Vseobecna-Biologia*-1. **29**(3) : 229-236.

Dubinsky, P. and Rybos, M. (1977). Effect of *Ascaridia gallli* infection on amino-acid, protein and aminotransferase activity in chicks. *Veterinarni Medicina*, **22** (7): 433 – 439.

Eshetu, Y., Mulualem, E., Ibrahim, H., Berhanu, A. and Aberra, K. (2001). Study of gastrointestinal helminths of scavenzing chickens in four rural districts of Amhara Region, Ethiopia. *Revue Scientifique et Technique Office International des Epizooties,* **20** (3) : 791 – 796.

Fatihu, M.Y., Ogbogu, V.C., Njoku, C.O. and Saror, D.I. (1991). Comparative study of gastrointestinal helminthse of Poultry in Zaria, Nigeria. *Revue-d Elevage et de Medecine Veterinaire des Pays Tropicaux,* **44**(2) : 175-177.

Fatihu, M.Y., Ogbogu, V.C., Njoku, C.O. and Saror, D.I. (1992). Study on the pathogenicity of experimental *Ascaridia galli* infection in broiler chickens Journal.

Gundlach, J.L., Sadzikowski, A., Uchacz, S. and Tereszkiewicz, W. (1987). Mebendazole in the treatment of ascaridiosis in hens. *Wiadomosci Parazytologiczne,* **(33)** : 3, 383 – 384.

Hayat, C.S., Akhtar, M., Aziz, A., Hayat, B. and Maqbool, A. (2002). Evaluation of Fenbendazole (Panacur) against *Ascaridia galli* and *Raillietina tetragona* infestation in layers. *The Blue Cross Book,* no. 18 10 – 15.

Kaushik, R.K. (1975). A note on serum protein changes in chicks experimentally infected with *Ascaridia galli. Indian Journal of Animal Sciences*, **45** (11) : 911-912.

Khan, R.W., Khan, M.M. and Khan, S.A. (1994). Prevalence and gross pathology of helminth infection in domestic fowls of Hyderabad district. *Proceedings of Parasitology.* **No. 17**: 4-7.

Kidanemariam, A. (2001). Gastrointestinal helminths of Scavenzing fowl in and around Bahir Dar in Northwest Ethiopia. *Bulletin of Animal Health and Production in Africa,* **49** (3) : 163 – 168.

Kuczynska, E., Ziomko, I. and Cencek, T. (1994). Intestinal roundworm infection in broilers and hens. *Medycyna waterynaryjna*, **50** (1): 30 – 31.

Kulkarni, G.M., Narladkar, B.W. and Deshpande, P.D. (2001). Helminthic infections in desifowl (Gallus gallus domesticus) in Marathwada region. *Journal of Veterinary Parasitology*, **15** (2):137 – 139.

Kunjara, N.A., Ayudthaya, C. and Sangvar Anand, A. (1993). Internal parasites of alimentary tracts of adult native chickens in North-eastern

part of Thailand. *Kasetsart Journa of Natural Sciences* **27**(3): 324 – 329.

Kumari, R. and Thakur, S. (1999). Infection Pattern of nematode Ascaridia galli in Gallus gallus domesticus. *J. Ecobiology.*, **11** : 277-283.

Kurade, N.P., Jithendran, K.P. and Bhat, T.K. (2001). Occurrence and pathology of various poultry diseases in Himachal Pradesh, India. *Indian Journal of Poultry Science,* **36** (3) : 271 – 275.

Matta, S.C. and Ahluwalia, S.S. (1982). Haematological indices as influenced by *Ascaridia galli* infection in fowls. Effect on the haemoglobin concentration, packed cell volume and erythrocyte sedimentation rate. *Indian. J. Poult, Sci.,* **17**(1) : 46-51.

Magwisha, H.B., Kassuku, A.A., Kyvsgaard, N.C and Permin, A. (2002). A comparison of the prevalence and burdens of helminth infections in growers and adult free-range chickens. *Tropical Animal Health and Production*, **34** (3) : 205 – 214.

Maqbool, A., Ahmad, M. and Raza, A. (1998). Prevalence of helminth parasites of poultry under different management conditions. *Journal of the Faculty of Veterinary Medicine, University of Tehran*, **53** (1-2) : 102 – 103.

Maqbool, A., Arshed, M.J., Qaisar, S. and Hashmi, H.A. (1995). Incidence and chemotherapy of *Ascaridia galli* infection in chickens. *Indian Veterinary Journal*, **72** (11): 1145 -1147.

Mathur, A.S. (2000). Incidence of helminth parasites in the domestic fowl in Rajasthan. *Journal of Eco Physiology*, **3** (3-4): 111 – 114.

Mpoame, M. and Agbede, G. (1995). The gastro-intestinal helminth infections of domestic fowl in Dschang, Western Cameroon. *Revue d' Elevage et de medecine Veterinaire des-pays Tropicaux,* **48** (2) : 147 – 151.

Mushi, E.Z., Binta, M.G., Chabo, R.G., Ndebele, R. and Thibanyane, T. (2000). Helminth parasites of indigenous chickens in oodi, Kgatleng district, Botswana. *Journal of the South African Veterinary Association,* **71** (4) : 247 – 248.

Muhairwa, A.P., Msoffe, P.L., Ramadhani, S., Mollel, E.L., Mtambo, M.M.A. and Kassuku A.A. (2007). Prevalence of gastro-intestinal helminthes in free range ducks in Morogoro Municipality, Tanzania. *Livestock Research for rural development* **19** : 1-7.

Negesse, T. (1993). Prevalence of diseases, parasites and predators of local chickens in Leku, Southern Ethiopia. *Bulletin of Animal Health and Production in Africa,* **41** (4) : 317 – 321.

Nguyen, Thi, Kim, Thanh., do, Hong, Cuong. and Phan, Tu, Dien. (2000). Preliminary haematological study of chickens infected by roundworms and cestodes in the Hanoi region. *Khoa Hoc Ky Thuat Thu Y Veterinary Sciences and Techniques,* **7** (1) : 46 – 49.

Pandey V.S. and Jiang J. (1992). Observation of helminth parasites of domestic fowls in Zimbabwe. *Zimbabwe vet. J.* **20** : 15-17.

Padmaja, P.B. and Sathianesan, V. (1993). Comparative study on the efficacy of three newer anthelmintics with Piperazine hydrate against different developmental stages of *Ascaridia galli* in chicken. *Journal of Veterinary and Animal Sciences* **24** (2): 153 – 157.

Pavlovic, I., Rosic, G., Bajic, V., Lazarov, D. and Misic, Z. (1996). Efficacy of mebendazole in treating helminthoses of game birds and Pigeons maintained in controlled conditions. *Veterinarski Glasnik*, **50** (9-10).

Patel, P.V., patel, A.I., Sahu, R.K., Raju, Vyas. and Vyas, R. (2000). Prevalence of gastrointestinal parasites in captive birds of Gujarat Zoos. *Zoos' print,* **15** (17): 295 – 296.

Permin, A., Bisgaard, M., Frandsen, F., pearman, M., Kold, J. and Nansen, P. (1999). Prevalence of gastro – intestinal helminths in different poultry production systems. *British Poultry Science*, **40** (4) : 439 – 443.

Permin, A., Esmann, J.B., Hoj, C.H., Hove, T. and Mukaratirw, S. (2002). Ecto-endo – and haemoparasites in free range chickens in the goromonzi District in Zimbabwe. *Preventive Veterinary Medicine*, **54** (3) : 213 – 224.

Permin, A., Magwisha, H., Kassuku, A.A., Nansen, P., Bisgaard, M., Frandsen, F. and Gibbons, L. (1997). A Cross – Sectional study of helminths in rural scauenzing poultry is Tanzania in relation to season and climate. *Journal of Helminthology* ,**71** (3): 233 – 240.

Phiri, I.K., Phiri, A.M., Ziela, M., Chota, A., Masuku, M. and Monrad, J. (2007). Prevalence and distribution of gastro –intestinal helminths and their effects on weight gain in free-range chickens in central Zambia. *Tropical Animal Health and Production,* **39** (4) : 309 – 315.

Poulsen, J., Permin, A., Hindsbo, O., Yelifari, L., Nansen, P. and Bloch, P. (2000). Prevalence and distribution of gastrointestinal helminths and haemoparasites in young scavenging chickens in upper eastern region

of Ghana, West Africa. *Preventive Veterinary Medicine,* **45** (3-4): 237 – 245.

Ramadan, H.H. and Znada, N.Y.A. (1991). Some pathological and biochemical studies on experimental ascariasis in chickens. *Nahrung,* **35** (1): 71 – 84.

Raote, Y.V., Sardey, M.R. and Bhagwat, S.S. (1991). Effect of Ascaridia galli infection on plasma proteins of normal and immunosuppressed chicks. *Indian Veterinary Journal*, **68**(12) : 1117-1121.

Rina, Kumari., Sheela, Thakur., Kumari, R. and Thakur, S. (1999). Infection pattern of nematode *Ascaridia galli* in *Gallus gallus domesticus. Journal of Ecobiology,* **11** (4) : 277 – 283.

Richard Churchil, R. and Narayan Kutty, R. (2002). Indian Poultry Industry, current status and future prospects 26th year vol.3 April, 2002.

Soulsby, E.J.L. (1982). Helminths, Arthropods and Protozoa of Domesticated Animals, 7th edition. *Balliere Tindall, Lodon.*

Sayyed, R.S., Phulan, M.S., Bhatt, W.M., Pardehi, M. and Shamsher, Ali. (2000). Study of nematodes in indigenous chickens in Swat district. *Pakistan Veterinary Journal,* **20** (1): 55 – 56.

Sekhar, P.C., Mohan, U.C. and Sinha, S.S. (1986). Corpuscular haemoglobin concentration in helminth harbouring domestic fowls. *Cheiron.* **15** (2) : 67-68

Sekhar, P.C., Mohan, U.C. and Simha, S.S. (1988). Hematology of the domestic fowl infected with two different species of helminths. *Indian Veterinary Medical Journal*, **12** (1) : 63 – 66.

Sevinc, F., Guclu, F., Yaman, M. and Altinoz, F. (2000). The prevalence of gastro intestinal parasites of turkeys (*Meleagris gallopavo*). *Veteriner Bilimleri Dergisi,* **16** (2) : 15 – 19.

Sharma, R.K., Singh, K. and Saxena, K.K. (1990). Effect of cambendazole and Haloxon on the carbohydrate metabolism of *Ascaridia galli* and *Heterakis gallinae*. (Nematoda). *Angewandte Parasitologie,* **31** (2) : 101 – 105.

Shinde, L.V., Deshmukh, S.B. and Gore, G.D. (2004). Population of gastrointestinal nematode in Gallus gallus domesticus at Beed, Maharashtra. *Uttar Pradesh Journal of Zoology,* **24**(2) : 213-215.

Silva, G.S., Costa, A.J., Soares, V.E., Meireles, M.V. and Paulillo, A.C. (1999). Anthelmintic activity of albendazole and praziquantel in naturally infected chickens (*Gallus gallus domesticus*). *Ars Veterinaria*, **15** (supplement) : 18 – 22.

Srinivasa, C.S., Reddy, P.K. and Aruna, D. (1989). Incidence of Poultry diseases in Kurnool District (A.P.). *Poultry Adviser*, **22** (11) : 45-48.

Singh, R., Sahai, B.N., Ansari, M.Z. and Singh, S.K. (1993). Incidence of common helminthic infections in livestock and poultry. *Journal of Research, Birsa Agricultural University*, **5** (1): 93-95.

Statescu, C., Crivineanu, M., Paunescu, I., Cringanu, D. and Crivineanu, V. (1992). Drug therapy with an albendazole derivative in fowls with helminth infections. *Lucrari Stiintifice Universitatea de stiinte Agronomice, Bucuresti. Seria C, Medicina Veterinara*, **35**: 87-93.

Szelagiewicz, M. and Sokol, R. (1991). Poultry parasites in Suburban small holdings. *Medycyna weterynaryjna,* **47** (5) : 208-209

Terregino, C., Catelli, E., Poglayen, G., Tonelli, A. and Gadale, O.I. (1999). Preliminary study of the helminths of the chicken digestive tract in Somalia. *Revue d' Elevage et de medicine veterinaire des pays Tropicaux,* **52** (2): 107 – 112.

Tucker, C.A., Yazwinski, T.A., Reynolds, L., Johnson, Z. and keating, M. (2007). Determination of the anthelmintic efficacy of albendazole in the treatment of chickens naturally infected with gastrointestinal helminths. *Journal of Applied Poultry Research,* **16** (3): 392 – 396.

Tuli, J.S (1989). Studies on cestode parasites of poultry. **88**.

Vovchenko, N.M. (1980). Serum protein content in uninfected and Ascaridia – infected chickens. *Materialy Nauchnoi Konferentsii Vseso Yuznogo obshchestva Gel' Mintologov Nematody i nematodozy*, (**32**): 15 – 22.

Virk, K. J., Jain, M. and Prasad, R.N. (1987). Qualitative and quantitative analysis of helminth fauna in Gallus, gallus domesticus. *Zeitschrift fur Angewandte Zoologie,* 74**(3)** : 329 – 336.

Yadav, A.K. and Tandon, V. (1991), Helminth parasitism of domestic fowl (Gallus domesticus L,) in a subtropical high rainfall area of India. *Beitrage zur Tropischen Landwirtschaft und Veterinarmedizin*, **29** (1): 97 – 104.

Zeller, B. (1990). Comparative studies on the endoparasites of domestic fowls (*Gallus gallus var. domesticus L.*) in commercial and fancy breed flocks. Journal 104 pp.

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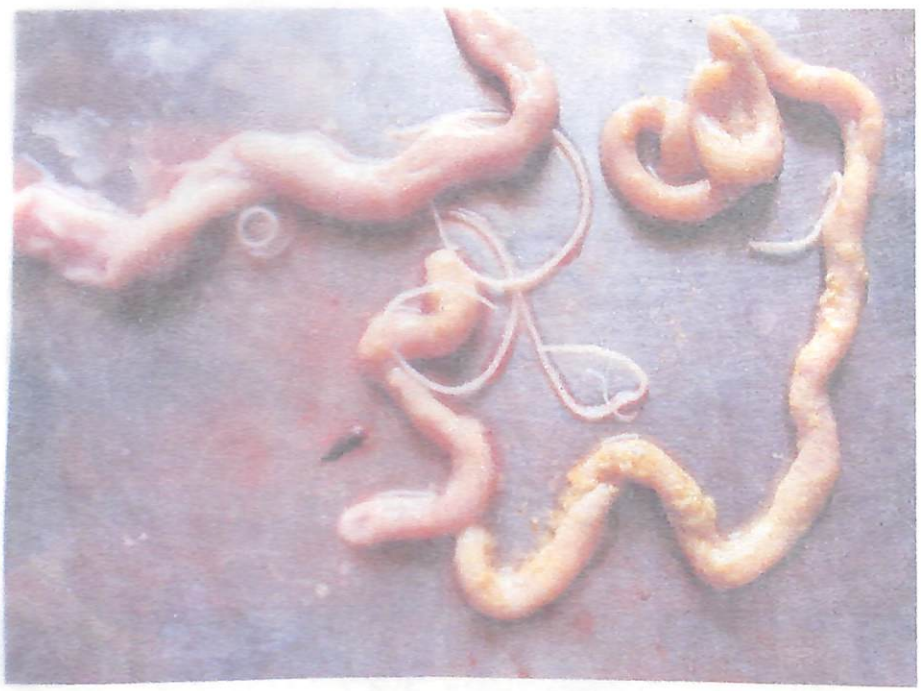
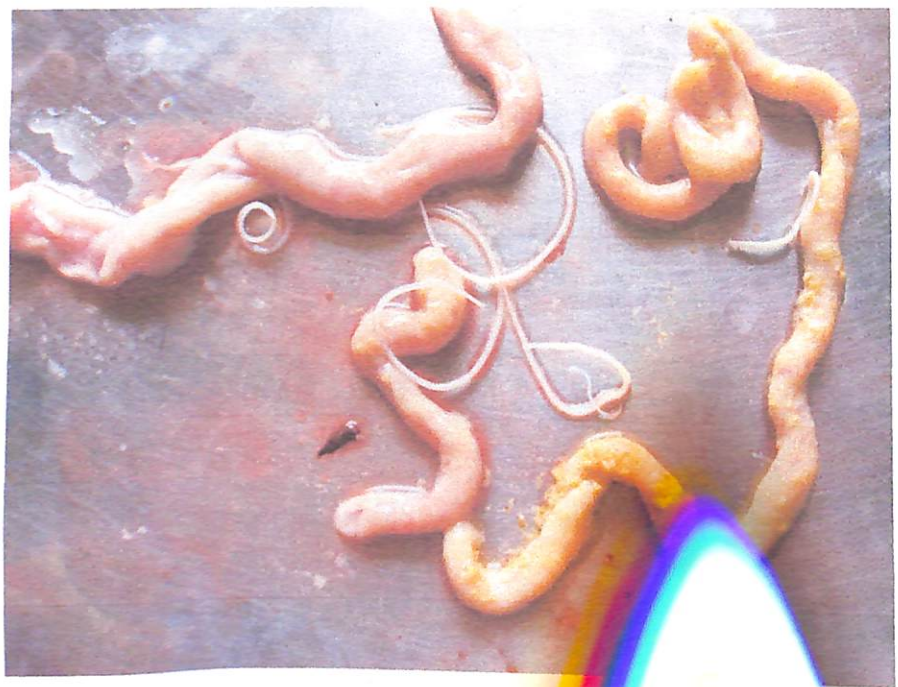
Photograph - 1. Intestine of poultry being screened.

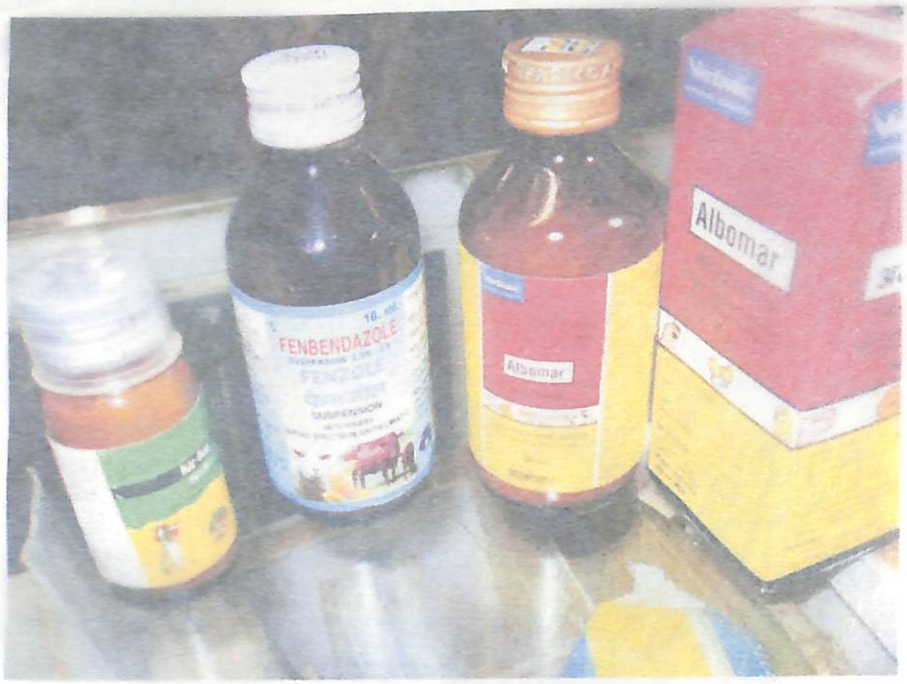


Photograph - 2. *Ascaridia galli* in the GI tract.

Photograph - 1. Intestine of poultry being screened.

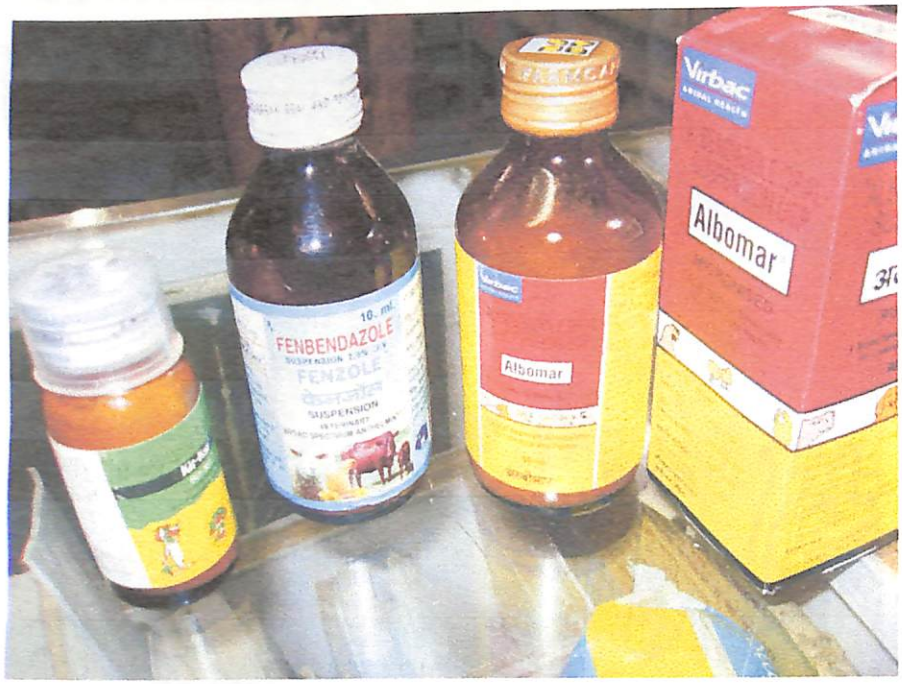


Photograph - 2. ***Ascaridia galli***



Photograph - 3. Drugs used in the trial.

Photograph - 4. Infected birds being medicated



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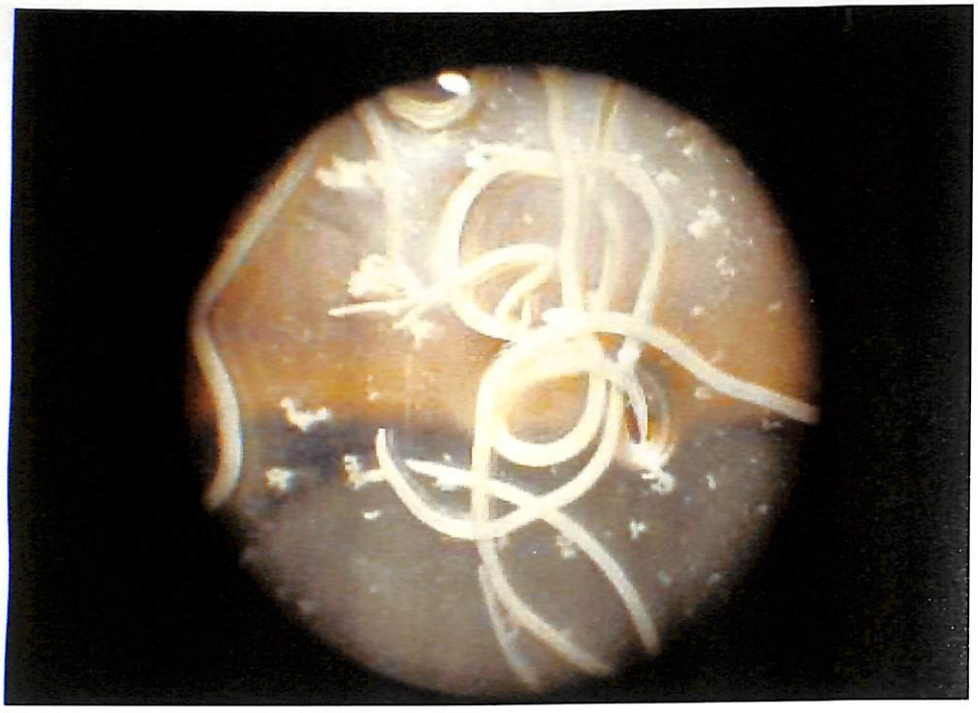
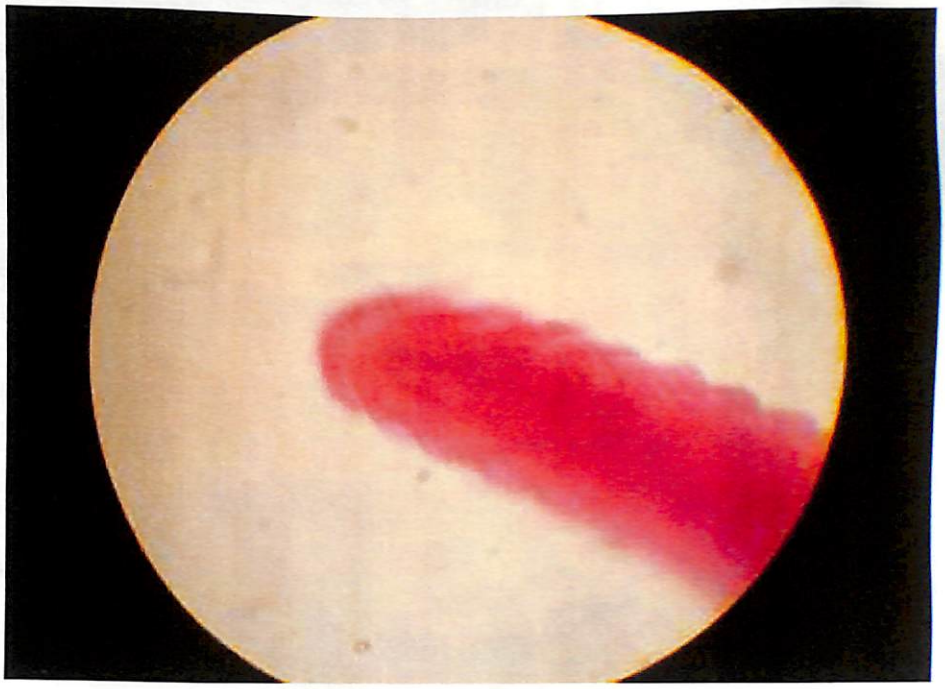
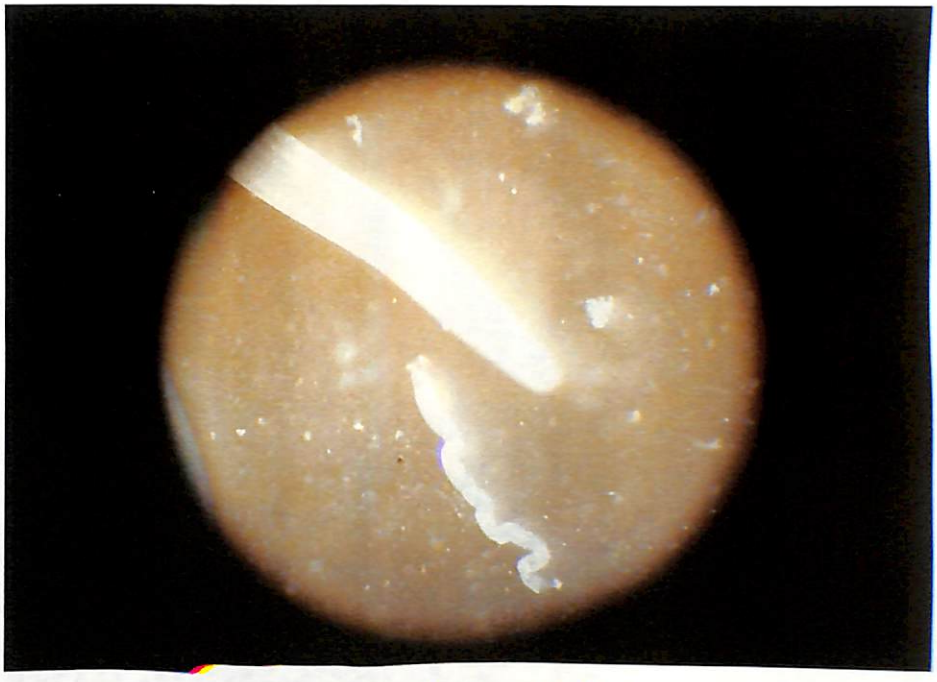


Photograph - 5. Picture of gross worms *(Ascaridia galli)* recovered from intestine of a desi poultry

Photograph - 6. Microscopic view of *Ascaridia galli*



Photograph - 7. Anterior end of *Raillietina spp.*



Photograph - 8. Anterior end of *Ascaridia galli*

Photograph - 9. Indigenous poultry population which were included in the experiment

Photograph - 10. Poultry in Backyards of farmer

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