ACKNOWLEDGEMENT

I express with deep sense of gratitude and indebtedness to my reverend advisor, guide and benefactor Dr. K.D. Prasad, M.V.Sc., Ph.D., University Professor and Chairman, Department of Veterinary Parasitology, Ranchi Veterinary College, Ranchi for his invaluable advise, inspiration, great human gesture, incessant devotion of the time and scholarly guidance in the planning and execution of the study during entire period of Research. I also wish to express my sincere thanks for his constant encouragement and sympathetic attitude during the entire period of study.

I express my profound sense of gratitude to the members of advisory committee, Dr. A.R. Deb, University Professor, Department of Veterinary Parasitology, Dr. R.L. Prasad, University Professor and Chairman, Department of Veterinary Biochemistry and Dr. K.K. Singh, University Professor and Chairman, Department of Veterinary Pathology, Ranchi Veterinary College, Ranchi for
their co-operation, valuable suggestions and constant encouragement during entire period of study.

I feel pleasure to express my sincere thanks to Dr. A.K. Sinha, Dean, Faculty of Veterinary Science and Animal Husbandry, Ranchi and Dr. G.S. Dubey, Dean, Post Graduate Studies, Birsa Agricultural University, Ranchi for providing facilities to carry out the research work smoothly.

I am highly obliged to the Hon’ble Vice Chancellor, Dr. N.N. Singh, Birsa Agricultural University, Ranchi for providing facilities and tends to carry out the research work successfully.

I am highly indebted to Dr. S.K. Singh, University Professor and Chairman, Department of Animal Breeding and Genetics, Ranchi Veterinary College, Ranchi for his help in statistical analysis of the data collected during research work.

I am very much grateful to Dr. R.N. Singh, University Professor, Department of Animal Nutrition and Professor in-charge, R.V.C. Dairy Farm, Ranchi Veterinary College, Ranchi for their valuable co-operation, encouragement and help in research work.
I would like to express my feelings of appreciation and gratitude to reverend professors, Dr. Ashok Kumar, Associate Professor, Department of Veterinary Parasitology, Dr. J. Oraon, Associate Professor and Head, Department of Veterinary and Animal Husbandry Extension Education, Dr. Abhishek Kumar, Department of Veterinary Medicine, Ranchi Veterinary College, Ranchi for their co-operation and encouragement during entire period of this study.

I express my sincere thanks to Dr. S.M. Prasad, Registrar and Dr. K. Jha, Deputy Registrar, Birsa Agricultural University, Ranchi for their constant encouragement, valuable suggestion and kind help for providing necessary facilities for academic requirements to carry out the research work.

I express my sincere thanks to Dr. M.K. Gupta, Associate Professor and Deputy Registrar (Academic), Ranchi Veterinary College, Ranchi for his valuable suggestions, guidance and encouragement during period of study.

I can not forget to thank Dr. Pawan Kumar, Post-Graduate Student of the Department of
Veterinary Parasitology. For their kind co-operation and help during entire period of research.

I extend my sincere thanks to my Seniors Post Graduate Colleagues for their kind co-operation and valuable suggestions during research work.

I extend my sincere thanks to my all Juniors Post Graduate colleagues for their co-operation and valuable help during the period of study.

I express my genuine appreciation and perpetual affection to my father Dr. Ram Naresh Prasad Chaudhary, Mother Late. Smt. Chandrawati Devi, Father-in-law Shree Kameshwar Prasad, Mother-in-law Smt. Rita Devi, Brother-in-low Dr. Chandra Sekhar Azad, Shashi Bhushan Prasad and love to my brothers Jeetendra Kumar, Pankaj Kumar, Pappu Kumar and Upendra Kumar Seth and sister Pratima Kumari for their blessing, moral support, help and continuous encouragement which sustained me to cover through the real long and hard journey leading to the studies.

I wish to record my personal reckoning of gratitude to my heart touching wife Miss. Simmi for her love, blessing, moral support and constant
encouragement which proved a potential source of inspiration during the entire period of study.

I am also obliged to the farmers of village for their assistance in providing needful informations and co-operation in collection of faecal samples, blood and other observations to make this venture a success.

Late Md. Kudus and his son Guddu have taken great pains in careful computer typing of the manuscript of the thesis deserve my whole hearted appreciation and thanks.

I extend my sincere thanks to all the staff of Department of Veterinary Parasitology, Ranchi Veterinary College, Ranchi for their co-operation during the course of research work.

Finally, there is no word to express thanks to “God” without His blessing I could not have achieved my goal.

Place:       (Manoj Kumar) 
Date:
The major part of Indian economy is derived from agriculture and livestock activities. In the traditional agricultural system, the small and marginal farmers had to depend upon livestock to carry out their agricultural operations.

India has around 57 percent buffaloes of World’s population and 16 percent of cattle population and has become one of the largest milk producer in the world.

Majority of the Indian rural farmers are still ignorant about the health management of their animals. The health and productivity of animals are not only affected by viral, bacterial and fungal diseases but parasitic diseases have been reported to cause enormous economic losses in terms of milk production and draught power capability (Sharma, 2001 and Kumar, 2002).

Among the various parasitic infections affecting cattle and buffaloes calves, ascariasis causes very high morbidity and mortality (Bhatia and Chauhan, 1984). Heavy losses due to *Toxocara vitulorum* infection in buffalo and cow calves of 1 to 3 months have been found very common in indigenous and cross-bred animals (Patnaik and Pande, 1963 and Soulsby, 1982). Prenatal or transuterine transmission of *Toxocara*
Toxocara vitulorum in neonatal buffalo calves has also been recognised as a severe helminthic disease (Robert’s 1990).

Adult of Toxocara vitulorum exclusively harm the new born calves and prenatal and transmammary infections constitute the major sources of parasites for them. The adult cattle and buffaloes acquire larval ascarid infection without apparent clinical symptoms and these larvae get transmitted to the calves during late pregnancy.

Inspite of considerable economic impact and wide spread nature of Toxocara vitulorum infection in neonatal calves, adequate attention to control the parasite in adult pregnant animals and their young progenies have not been given so far to reduce the morbidity, mortality and production losses.

Hence, the present study has been planned to see the possibility of reducing the prenatal transmission of the parasites during pregnancy in buffaloes by chemical and herbal therapeutic management and to find out the impact of parasite control on the health and growth in growing buffalo calves according to the objectives defined as follows:

1) To know the exact nature of T. vitulorum prenatal and post-natal acquired infection in young buffalo calves.

2) To see the effect of Toxocara vitulorum larvae treatment during late pregnancy in buffaloes on the prenatal transmission in neonatal buffalo calves.
3) To assess the efficacies of some chemical/herbal anthelmintics against *Toxocara vitulorum* infection in buffalo calves.

4) To know the effect of treatment on the health and growth status of *Toxocara vitulorum* infected and treated buffalo calves.
1. **Prevalence of *Toxocara vitulorum***:

Balabekyan (1960) reported that neoascariasis was found in 19 out of 27 calves of co-operative farms in the Azerbaidzhan Republic. The incidence was more among 1-2 months old animals and less among 3-4 months aged animals. The incidence of infection was 24.9 percent in the mountains, 17.5 percent in the foot hills and 0.09 percent in the low lands. Results of treatment of 379 calves showed that piperazine adipate at a dose of 0.5 gm per kg body weight was 100 percent efficacious.

Patnaik and Pande (1963) reported the incidence of *N. vitulorum*, *Stronglyloides papillosus*, *Cooperia*, *Para cooperia nodulosa*, *Setaria* spp. In 12 buffalo calves under 5 weeks of age from Mathura, U.P. *N. vitulorum* incidence was mainly due to prenatal infection.

Selim and Tewfic (1966) reported the incidence of *Ascaris vitulorum* among Egyptian buffaloes of various ages slaughtered in cairo abattoir during the period from September, 1964 till January 1966. Male buffalo calves at the age of 40 days had very high percentage of infection.

Chauhan *et al.* (1972) reported 54.76 percent incidence of *N. vitulorum* among the buffalo calves below two months age.
Thakur and Singh (1973) carried a preliminary survey of helminthic infection in cow and buffalo calves at Ranchi, Bihar and reported an incidence of 77.7 percent helminthic infection among 178 cow calves. Single infection with *N. vitulorum*, *Trichuris* spp., *Stronglyloides* spp., *Stronglyus* spp., *Moniezia* and *Amphistome* was found to be as 33.5, 9.6, 9.1, 7.8, 2.1 and 0.8 percent, respectively. *T. vitulorum* was the most common infection in young calves.

Selim and Tewfic (1974) reported after examining faecal samples of 4329 buffalo calves in Egypt, the presence of *N. vitulorum* in 36.36 percent. The age analysis revealed the positive infection in 1488 of 2096 aged upto 2 months, 21 of 50 aged between 2 to 4 months and none of 115 aged about 4 to 12 months had the nematode infections.

Selim (1980) reported that, among 1005 buffalo calves of varying ages examined, 74.4 percent of 40 days old calves slaughtered were infected with *T. vitulorum*. The worm burden ranged from 70 to > 500 (mean 219) worms/animal and they were concentrated mostly in the 2\textsuperscript{nd}, 3\textsuperscript{rd} and 4\textsuperscript{th} meter of small intestine. Eggs were detected in the faeces of the male calf 17 days after birth (patent period 75 days) and of the female calf 28 days after birth (Patent period 88 days). Both calves showed unthrift ness, rough coat, stunted growth and the suffered from either constipation or diarrhoea.
Baruah et al. (1981) reported the prevalence of *N. vitulorum* and other helminthic infections in buffalo calves to be 52.5 percent in Hissar (India). They observed an infection rate of 77.1 percent in 46 to 53 days old calves and 35.7 percent in 81 to 90 days calves.

Srivastava and Sharma (1981) reported that 16 of 90 buffalo calves up to one year old had 500-700 *N. vitulorum* eggs in their faeces in Mathura.

Masud and Majid (1984) reported that 41.94 percent of 773 buffalo faecal samples were positive for ascariasis and 35.08 percent of cattle faecal sample were positive for ascariasis in Pakistan.

Gupta (1986) reported the prevalence of *N. vitulorum* from 31 (81.6%) of 38 buffalo calves under 3 months of age. Infection was detected in buffalo calves as young as 6 days but majority of the animals were found infected beyond 90 days of age (Maximum patency 60 days). Control of *N. vitulorum* was observed either by weaning or treating buffalo calves 2 to 3 days after birth until the animals are 2 to 3 months old.

Toparlak et al. (1989) reported after examining 1988 faecal samples of 379 cattle calves aged about one day to 1 year of age, from 16 locations near LakeVan in eastern Turkey. *T. vitulorum* eggs were found in 61 (16%) of cattle calves, all from private farms and all between 20 days to 5 months age.
Gupta and Chhabra (1990) reported that the faecal samples of intestinal parasitic infection in 340 young buffalo calves (<6 months) in Haryana had *T. vitulorum* the predominant infection (41.2%) followed by *Stronglyoides* (3.8%).

Sahoo *et al.* (1991), reported after examination of 318 buffalo calves (6 months old) faecal samples in Orissa that 228 (71.7%) animals were infected with one or the other intestinal parasites. Ascariasis was found in 129 calves and other parasites in seven. The prevalence of ascariasis was more in calves of 2-3 months.

Pradhan *et al.* (1991) reported the incidence of gastrointestinal parasites in calves in and around Ranchi, Bihar during 1989. Faecal samples from 300 calves were examined and 185 were (61.60%) found positive for parasitic infections. Of the positive samples, 84.80 percent were due to nematode infection, 3.24 percent had trematodes, 1.60 percent had cestodes and 10.20 percent had Coccidia. *N. vitulorum, Trichuris, Strongyloides* were the commonest parasites in the age groups of 0-60 days.

Hassan and Bahi (1992) reported after investigating enteric parasitic infection in field cattle and buffaloes of different ages. The prevalence of infection was higher among field animals than farm animals. *T. vitulorum* eggs were the most common in field buffalo calves (15.4%).
Starke et al. (1992) reported that the transmammary route of *T. vitulorum* transmission was shown by the presence of larval from calving to 26 days after parturition in colostrum or milk from 14 to 20 buffalo calves (70.0%) examined during 1989-90.

Chollet et al. (1994) reported that monthly faecal analysis was carried out in 17 traditionally managed herds for a period of 2 years. Toxocariasis appeared to be the most important parasitic infection in the Northern province where its prevalence reached 58 percent in calves aged 0-6 months. The sixty percent of infected calves passed large number of eggs at least once. Samples with high egg counts were more frequent in dry season.

Johal and Kaur (1995) reported that of 245 faecal sample from cattle (*Bos indicus* and *Bubalis bubalis*) collected from patiala city and its surrounding villages of Punjab, India, nematodes were found in 40 percent of sample, out of which *Strongyloides Papillosus* ova were present in 18.7 percent, Strongyles in 20.4 percent *N. vitulorum* in 6.1 percent and *Trichuris* in 1.2 percent *N. vitulorum* infection was more with EPG levels ranging from 15,000 to 18,000 in 11 calves.

Umur and Gicik (1995) reported that *T. vitulorum* eggs were found in samples from 59 (13%) of 453 calves (7 days to 6 months of age) between March 1993 and May 1994. The highest prevalence was
found in calves 1-3 month of age, eggs were found first in 21 days old calves. Faecal egg count ranged from 850-16200.

Kanyari et al. (1995) examined the faeces of calves aged less than 6 months from Kajiado district Kenya for the eggs of *T. vitulorum* and other gastrointestinal parasites. *T. vitulorum* were encountered in relatively humid areas around the Ngong Hill forest. Calves aged about 2.5 months were commonly affected with the infection with EPG upto 480000. The clinical signs of the infection were retarded growth and poor body condition.

Toparlak et al. (1996) tested faecal samples of 796 cattle in 12 locations in Thrace and examined for *T. vitulorum* eggs of 326 above 6 months of age and found that 14 (4.3%) were positive for eggs, but 470 calves over 6 months of age were negative. The egg counts in them ranged from 25-5800 per gram.

Duong et al. (1996) examined the faecal specimens of 1057 buffaloes of 1-180 days of age and 743 calves of the same range from 57 villages in 5 districts. *T. vitulorum* was found in 404 (38.0%) buffaloes and 128 (17.0%) calves. *T. vitulorum* eggs were not found in adult buffaloes.

Anwar et al. (1996) found 91 (18.2%) animals positive for *T. vitulorum* among 500 buffalo calves.
Maqbool et al. (1997) reported that the prevalence of ascariasis (*T. vitulorum*) was significantly higher (96%) among 1377 buffaloes below the age of 3 months.

Maqbool et al. (1998) reported the prevalence of *T. vitulorum* being higher (23.33%) among calves under 3 months of age.

Borthakur and Das (1998) conducted an epidemiological study in the state of Assam and found that *Toxocara*, *Strongyloides* and *Moniezia* were present only in calves. *Toxocara* and *Strongyloides* were recorded throughout the year but *Moniezia* was restricted only in winter months.

Tavassoli (1999) observed only 48 of 308 buffalo calves positive for *T. vitulorum*.

Sherif et al. (2000) reported that the highest Prevalence rate of ascariasis was in calves aged (less than or) 1 month (17.24%) and it then decreased Progressively to the lowest Prevalence (6.66%) in calves aged 5-6 months.

Altinoz et al. (2000) reported that the prevalence of *T. vitulorum* was 0.28 percent in young cattle and 0.41 percent in adult.

Tavasoly and Tadayon (2000) reported 8.07 percent prevalence of *T. vitulorum* in 1 to 6 months old native calves.

Devi (2000) studied the influence of age on prevalence of *T. vitulorum* and reported that cow calves and buffalo calves of 1-2 months
of age had maximum incidence of 57.57 and 70.40 percent, respectively and minimum of 9.75 and 16 percent in the age group of 3-4 months.

Rao et al. (2000) reported the prevalence of *T. vitulorum* was more in calves 30 days old (42.5%) followed by those 30-60 days old (33%), and those of 60-90 days old had 27.27 percent while 4.08 percent calves aged about 90 days were found infected with the round worm.

Kumari et al. (2004) evaluated the effect of season on the incidence of *Toxocara vitulorum* in cow and buffalo calves in Patna and its surrounding. The incidence in cow (38.33%) and buffalo calves (41.66%) was found to be more during monsoon.

Halmandge et al. (2006) recorded higher prevalence on *T. vitulorum* in the calves under 3 months of age (25.00, 38.60 and 10.87% in 0-1, 1-2 and 2-3 months, respectively) and low prevalence in 3-6 months of age (0.74, 0.00 and 0.70% in 3-4, 4-5 and 5-6 months, respectively) while no prevalence was observed in the calves of above 6 months of age.

2. Prenatal transmission of *T. vitulorum*:

Patnaik and Pande (1963) reported the incidence of *N. vitulorum, Strongyloides papillosus, Cooperia, Paracooperia nodulosa, Setaria* spp. in 12 buffalo calves under 5 weeks of age from Mathura, U.P. *N. vitulorum* infection was mainly due to prenatal transmission.
Mazgovoi and Shakhmatovo (1969) noted the prenatal infection of *N. vitulorum* more during the study of the life cycle of the parasite.

Mozgovoi and Slinkhov (1971) observed the prenatal infection of *T. vitulorum* in the natural and experimental cattle calves. Warren (1971) also observed the prenatal infection of *T. vitulorum* in natural and experimental calves.

Soulsby (1982) mentioned the prenatal infection of *T. vitulorum* in later part of pregnancy in cows.

Roberts (1990) while studying the egg production of *Toxocara vitulorum* in buffalo eggs found that the worm ova were first present in the faeces of calves when they were 22.316 days old. The calves treated with Pyrantel when 3 days old, the age at first patency increased by 3.5 days indicating that there was no prenatal transmission.

Barbosa *et al.* (1992), reported that *Toxocara vitulorum* eggs were the earliest to be encountered in calves faeces. During the 1st week after birth, 58.33 percent of the calves were positive and in the 4th week 100 percent calves were positive.

Roberts *et al.* (1993) reported that the number of *Toxocara vitulorum* transmitted by 12 buffalo cows at each of 3 successive calving when continuously infected from the environment, showed a significant concordance, indicating that there was a maternal host factor having
some control over the level of infection. The level of transmission was related to neither the age nor the parity of the cows when some of the cows were transferred to an uninfected environment, they continued to transmit *T. vitulorum* to their calves for up to 3 years.

3. **Efficacies of Anthelmintic control packages :**

(a) **Chemical anthelmintics :**

Swartzwelder *et al.* (1955) reported that the efficacy of Piperazine citrate syrup in eliminating light and heavy infection with *Ascaris lumbricoides* was confirmed. The egg counts were 100 percent negative in 22 out of 25 cases and by 97 percent and 98 percent in two additional cases. The dose of the ranged from 25 mg to 75 mg per 1b body weight.

Lee (1955) reported that when Piperazine adipate was administered to calves at Vom Nigeria at the rate varying from 0.1 gm to 0.3 gm per 1b weight, toxic reactions were noticed and the drug when given to calves infected with *N. vitulorum* at the rate of 0.1 gm or 0.2 gm per pond (lb), the eggs disappeared from faeces within 5 days of treatment. The critical test confirmed that the drug was 100 percent effective against immature and mature *N. vitulorum*.

Tripathy (1966) reported that a single dose of 0.5 gm per 10 lb body weight of the drug Piperazine citrate was 86.36 percent
effective against ascariasis in calves and it was easy to administer without any side effect.

Gautam et al. (1976) evaluated the efficacy of Fenbendazole @ 7.5 and 10 mg/kg body weight in 20 buffalo calves suffering from Neoascaris vitulorum infection and found that the drug with single dose of administration, was found to be 100 percent effective at both dose rates.

Hossain et al. (1980) reported that 7 days after treatment with tetramisole at 7.5 mg/kg or Piperazine at 220 mg/kg, T. vitulorum egg counts in faeces of 12 buffalo calves were reported to be reduced by 99 and 96 percent, respectively.

Yadav (1984) reported that calves infected with Toxocara vitulorum showed reduction in faecal egg count by 99.5 percent on 7th day post treatments with Nilverm (Tetramisole) administered @ 10 mg/kg body weight.

Pandey and Mishra (1985) reported that each of the 10 calves treated with piperazine adipate at the dose rate of 10-15 gm orally on 1st day with four I/m injections of Imferon F_{12}^R (4ml) given on alternate days. All the treated calves showed marked improvement in their general health conditions with clinical disappearance of symptom of anaemia after 10 days of treatment. The post treatment faecal sample examinations were negative for T. vitulorum eggs.
Akhtar et al. (1985) reported that a single oral dose of powdered *Caesalpinia crista* (4 gm/kg body weight) reduced faecal egg counts in buffalo calves naturally infected with *N. vitulorum* by 91 percent after 10 days and 100 percent after 15th day. However, 3 gm/kg of the seed reduced faecal egg count by 74 percent after 10 days and 88 percent after 15 days.

Prasad (1985) reported that 10 buffalo calves and eight *Bos Taurus* calves (1.5–4 months of age) naturally infected with *N. vitulorum* infection (1350-1550 EPG faeces) were treated with Piperazine hexahydrate (220 mg/kg body weight), Tetramisole (15 ml/kg) or Fenbendazole (10 mg/kg) and 17 days later their faecal egg counts had been reduced by 96, 98 and 100 percent, respectively.

Hossain et al. (1988) reported that 7 days after treatment with tetramisole hydrochloride @ 7.5 mg/kg body weight, Piperazine adipte @ 8 g/animal and Krimose @ 1.25 mg/kg body weight, *T. vitulorum* egg counts in faeces of 20 buffalo calves were reduced by 95.70, 98.25 and 71.25 percent, respectively.

Euswas et al. (1989) reported that the doses of 54, 27 and 18 mg of ground ripe seed per 1 kg body weight of Sakaenoa (*Cambratum quadragularae*, Kurz) decreased the number of *N. vitulorum* eggs in the faeces to zero within 1, 2 and 3 weeks, respectively after a single oral administration.
Roberts (1989) reported that the treatment of buffalo claves at different times had demonstrated the transmission of *T. vitulorum* from the cow to the calf via milk occurs in all claves during the first 2 days after birth, decreased to 53 percent by 6 days, 10 percent by 8-9 days and 2 percent from 10 days onwards. Against immature parasites, the efficacies of Pyrantel (250 mg/kg) and Levamisole (7.5 mg/kg) was 97 percent and piperazine (200 mg/kg) 42 percent percent. Against mature parasites, the efficacy of Pyrantel was 100 percent Levamisole 83 percent, and Piperazine 57% percent.

Shastri (1989) treated cattle calves naturally infected with *Toxocara vitulorum* by Ivermectin @ 200 µg/kg body weight and observed 90.36 to 97.26 percent effective against the infection.

Hasanain and Degheidy (1990) studied the efficacy of Ivomec (Ivermectin) and Rintal (Febental) against *T. vitulorum* infection in buffalo calves. Rintal was highly efficacious when given @ of 5 mg/kg body weight in two successive doses at 24 hours interval but Ivomec was not found to be effective when given @ of 500 mg/kg body weight, S/C.

Gupta and Chhabra (1990) reported that 46 calves over 6 months of age having *T. vitulorum* and *strongyloides* spp. infection were treated with Febantel at 7.5 mg/kg body weight in single oral dose, Febantel was found very effective (100%) against both *Toxocara*
vitulorum and *strongyloides* spp. and Piperazine was effective only against *T. vitulorum* infection.

Waghmare *et al.* (1991) evaluated the comparative efficacies of Ivermectin and Albendazole given @ 200 µg/kg (1% W/V) and 7.5 mg/kg body weight in *N. vitulorum* and 5 *strongyloides papillosus* infected buffalo calves and found that Ivermectin was more effective than Albendazole. These results were based on the faecal egg counts at 5, 7 and 15 days post treatment intervals.

Anwar *et al.* (1996) evaluated therapeutic efficacies of three anthelmintics Albendazole (Valbazen) at 5 ml/100 kg, Levamisole (Nilverm) at 50 ml/100 kg and Mebendazole (Chanazole) at 4 ml/200 kg against *T. vitulorum* infected 80 buffalo calves. Albendazole had the highest efficacy (88.8 to 97.6%), followed by Levamisole (81 to 95.7%) and Mebendazole (70.4 to 90.5%).

Le-Hai-Duong *et al.* (1997) treated of *T. vitulorum* with Tetramisole, Mebendazole or Enhenl 750 and found effective in young buffalo calves.

Maqbool *et al.* (1997) carried out an anthelmintic trial using Tetramisole, Fenbendazole and Ivermectin in *T. vitulorum* naturally infected buffalo calves and found high efficacy of Tetramisole (90%), followed by Ivermectin (82%) and Fenbendazole (92%).
Joshi et al. (1997) reported that a study was conducted to verify the effectiveness of strategic drenching with Pyrantel pamoate and Piperazine against ascariasis in cattle calves in the hills of Nepal between July, 1994 and June 1995. Piperazine drenching at the dose rate of 200 mg/kg at 15, 45 and 75 days has loss effective, whereas drenching with Pyrantel pamoate (250 mg/kg) at 15 days of age was found to be 100 percent effective.

Maqbool et al. (1998) demonstrated very high efficacy (90.19%) of Ivermectin as Ivotek @ 0.2 mg/kg body weight, S/c as compared to Fenbendazole (84.99%) as Ranaceine at the dose rate of 5 mg/kg body weight per OS against ascariasis in buffalo calves under farming conditions.

Shankar et al., (1998) treated buffalo and cow calves naturally infected with T. vitulorum by a new anthelmintic, CDRI compound 81/470 @ 15 and 20 mg/kg body weight and observed the compound cent percent effective in reducing the EPG at both the dose rates. Additionally, the compound was found safe and faster in action @ 20 mg/kg body weight.

Devi (1999) observed 94.50 percent efficacy of Pieperazine citrate given @ 200 mg/kg body weight against T. vitulorum infection in cow and buffalo calves.
Kasaralikar et al. (1999) reported that Levamisole hydrochloride powder given (at the dose rate of 7.5 mg/kg body weight orally) to *Toxocara vitulorum* infected in buffalo calves, the drug was found 97 percent effective. They also suggested to prefer the drug for routine deworming in buffalo calves.

Rao et al. (2000) observed 100 percent efficacies of Piperazine, Ivermectin and Levamisole on 21\textsuperscript{st}, 14\textsuperscript{th}, 7\textsuperscript{th} DPT, respectively against ascariasis in buffalo calves as determined by faecal egg counts.

Devi et al. (2000) screened a herbal anthelmintic and compared it with that of Piperazine citrate against natural infection of *T. vitulorum* in cow and buffalo calves and found that the herbal anthelmintic was less effective than Piperazine citrate.

Galdhar et al. (2003) reported that Dormectin given at the dose rate of 1 ml/50 kg body weight, S/c to buffalo calves affected with ascariasis and found the drug to be 100 percent effective after 7 days of treatment.

Kumari et al. (2004) reported a single dose of Piperazine citrate @ 250 mg/kg\textsuperscript{-1} body weight given to the animals of one group and Closantel @ 20 mg kg\textsuperscript{-1} body weight administered to the animals of another group was found 100 percent effective against *T. vitulorum* in both cow and buffalo calves.
Kumar et al. (2004) reported Tetramisole and Ivermectin control packages having the specific and supportive therapeutic agents were found highly effective in controlling natural gastrointestinal naematodiasis in cow and buffalo calves 20 DPT.

Kumar et al. (2005) reported Levamisole highly effective against ascariasis, followed by neem seed powder and B. monosperma seed powder. Higher doses of the drugs might enhance their efficacies.

Islam et al. (2005) studied the comparative efficacies of Ivermectin (200 µg/kg, S/c), Albendazole (7.5 mg/kg, orally), Piperazine citrate (200 mg/kg, orally) and Pineapple leaf extract (1g/kg, orally) against T. vitulorum in calves. Ivermectin was found to be the most effective (100%) in treating ascariasis followed by Piperazine citrate (100% at day 28 days post treatment), Albendazole (92.95%) on 28 day post treatment) and Pineapple leaf extract (51.21%) on 7th DPT.

(b) Herbal anthelmintics:

Watt (1972) observed that the expressed juice of Clerodendron infortunatum was an excellent laxative, cholagouge and anthelmintic used as on injection into rectum in case of ascarid infecting, calves.

Sharma et al. (1976) and Satyanarayana et al. (1982) reported about the promising anthelmintic efficacy of Butea frondosa
when used in the form of ether extract @ 5 ml/kg body weight for 6 days against *Ascaridia galli* infection in poultry.

Satyanarayana *et al.* (1982) experimentally infected chicks with *Ascaridia galli* and then treated them with watery extract of seeds of *Carica papaya*, alcoholic extract of seeds of *Butea frondosa*, alcoholic extract of leaves of *Aristolochia bracteata* and Piperazine hexahydrate and found the efficacies of the above drugs against the infection were 41.7, 71.2, 70.8 and 99 percent, respective after 40 days of treatment.

Akhtar *et al.* (1985) reported that a single oral dose of powdered *Caesalpinia crista* (4 gm/kg body weight) reduced faecal egg counts in buffalo calves naturally infected with *N. vitulorum* by 91 percent after 10 days and 100 percent after 15 days. However, 3 gm/kg of the seeds reduced faecal egg counts by 74 percent after 10 days and 88 percent after 15 days.

Jain and Nagi (1986) reported that Palas (*Butea monosperma*) seeds powder given orally was highly effective against round worms and thread worms infestation but it was ineffective against tape worms.

Ambasta (1986) advocated the administration of fresh leaf juice of *Clerodendron infortunatum* per rectum for removal of ascarids infection. It was further mentioned that the leaves could be used as bitter tonic, vermifuge and Cholagogue.
Euswas et al. (1989) reported that 54, 27 and 18 mg doses of ground ripe seed per kg body weight of Sakaenoa (*Cambratum quadrangularae* Kurz) decreased the number of *N. vitulorum* eggs in the faeces to zero within 1, 2 and 3 weeks, respectively after a single oral administration.

Pradhan et al. (1992) reported the therapeutic efficacy of root of *Punica granatum* @ 8-10 gm/kg body weight and seed of *Cucurbita maxima* @ 10-15 gm/kg body weight and found their efficacies to be 78.2 and 40.6 percent, respectively against clinical cases of nematodiasis in calves.

Yadav et al. (1992) reported about the anthelmintic activity of fresh tuber of *Flemingia vestita* against *Ascaris summ* in pigs by in vitro testing of the plant.

Satrija et al. (1994) studied the effect of Papaya latex (*Carica papaya*) against *Ascaris summ* in infected pigs and found encouraging anthelmintic effect.

Kirtikar and Basu (1996) reported that *Clerodendron viscosum* or *C. infortunatum* plant had a bitter pungent taste, tonic antipyretic and anthelmintic. The fresh juice employed as vermifuge in human children suffering from ascariasis.

Singh and Nagaich (1999) used aqueous extract of seeds of *Carica papaya* against common poultry round worms *Ascaridia galli* and
*Hetrakis gallinarum* to see its anthelmintic effect against the parasites. The findings of the trial indicated encouraging efficacies of the herbal drugs.

Bakshi *et al.* (1999) described the traditional use of plant leaf of *Clerodendron infortunatum* (Syn. *C. viscosum*) for helminthiasis, ascarids, abscesses, leprosy, tumour, bronchitis and cough in human subjects.

Devi (1999) evaluated the efficacy of Kriminth (a herbal preparation) against *T. vitulorum* given @ 50 ml/calf, in two repeat doses at an interval of 15 days, resulted in 77.60 percent reduction in faecal egg counts in cow and buffalo calves on day 21 post treatment.

Dama and Kirdak (2002) screened the effect of Vidhang seeds (*Embelia ribes* L.) extract against *A. galli* in naturally infected fowls (*Gallus domesticus*) @ 0.1, 0.2 and 0.3 gm/day/kg body weight orally, 9 days and found efficacies 21.51%, 69.51% and 100%, respectively.

Raje1 *et al.* (2003) used the mixture of powdered *Azadirachta indica* (bark), *Butea frondosa* (Seeds), *Nigella sativa* (Seeds) and *Piper longum* (Fruits) in equal proportions for evaluation of anthelmintic activity in vivo in cow calves infected with *Haemonchus contortus, Oesophagostomum columbianum* and *Paramphistomum cervi* selected on the basis of their egg per gram of faeces. The formulated mixture was administered to cow calves in two doses of 15 and 30 g once
a day, for three consecutive days. It was observed that the formulated mixture significantly reduced the EPG.

Islam et al. (2005) reported pineapple leaves 200 mg/kg orally to be 51.21 percent effective against *T. vitulorum* infection in calves on day 7 post treatment.

Kumar et al. (2005) compared the efficacy of Levamisole hydrochloride (7.5 mg/kg body weight) with neem seed (*Azadirchta indica*) powder Jaggery, Palas seed powder (*Butea monosperma*) in three doses of 0.25, 0.40 and 0.50 g/kg body weight along with Jaggery, against *T. vitulorum* infection in buffalo calves and the results obtained indicated that the drug Levamisole hydrochloride was highly effective against ascariasis while neem seed and *Butea monosperma* powder showed encouraging results for the nematode infection in buffalo calves.

4. **Haematobiochemical changes during *Toxocara vitulorum* infection and treatment**:

Coles (1967) reported hypoalbuminaemia, decrease in total serum protein, A/G ratio and albumin percentage in parasitised animals which was attributed due to loss of protein from the gut through damaged mucosa caused by *T. vitulorum* infection in cow calves.
Gupta *et al.* (1976) estimated bilirubin (total conjugated and free) in blood during clinical ascariasis in buffaloes and scour in zebu buffalo calves and found it to be increased.

Clayton (1978) reported a depression of albumin synthesis in foals infected with *Parascaris equorum*. Unthriftiness was the effect of the worms in the intestine and not a consequence of hepatic or pulmonary damage caused by larval migration. In gastrointestinal nematodiasis, there was hypoproteinaemia, Plasma iron trun over as infected animals lost large quantities of serum protein into gut.

Baruah *et al.* (1979) reported that animals infested with *N. vitulorum* had suboptimal level of blood glucose, total protein, albumin, iron and vitamin A which could be due to helminth infections on the metabolism causing reduction in these values.

Yadav (1984) studied the haematological variations in buffalo calves infected with *T. vitulorum* and subsequently treated with Nilverm (Tetramisole) and observed significant improvement in Hb values.

Lau and Singh (1985) reported a significantly reduced number of erythrocytes, decreased haemoglobin and cell volume, leucocytosis, lymphocytosis and eosinophilia in suckling buffalo calves infected with neoascariasis. However, non- significant differences were observed in MCH, MCV, monocytes, basophils and neutrophil counts.
Pandey and Mishra (1985) in their studies on clinico-biochemical studies on anaemia associated with neoascariasis in calves observed that there was low packed cell volume (20-40%), haemoglobin level (6.8 – 7.4 gm/dl) and TEC (4.01±4.52 x 10^6/ml). No significant difference in pre and post treatment values of mean corpuscular haemoglobin concentration (MCHC), total and differential leucocyte counts, reticulocyte counts and osmotic fragility of erythrocytes were observed.

Pandey and Mishra (1985) reported that sera samples collected twice on 0 day and 10 day post treatment from 10 infected cow calves below 2 months of age, total serum protein of all affected calves decreased (4.99±0.05) as compared to healthy control values (6.3±0.15) but the value reached about normal after treatment (6.38±0.10). The A/G ratio of affected calves decreased to 0.519±0.006 as compared to the healthy control (0.796±0.005).

Uysal (1989) reported that 20 calves given Ivermectin S/C at 2-6 months @ 0.2 mg/kg body weight showed reduced faecal egg counts by 99.50 percent in Toxocara (Neoascaris) vitulorum eggs and 99.86 percent in those of other gastrointestinal nematodes infected cattle calves. Two weeks later, when sera samples analysed, showed reduced microhaematocrit and alanine amino-transferase values. The other blood
values measured in respect of haemoglobin, aspartate amino-transferase, total protein, albumin and globulin showed no significant changes.

Waghmare et al. (1993) reported that the buffalo calves having mixed infections (>1500 EPG) with *Neoascaris vitulorum* and *Strongyloides papillosus* the levels of blood glucose, total protein, albumin, iron, vitamin A and beta carotene were all reduced as compared to uninfected control. After 15 days post treatment, the infection was completely eliminated and most of the biochemical profiles had improved towards normal ranges.

Rao and Suryanarayan (1995) recorded decreased values of Hb, PCV, TEC and lymphocytes and increased values of TLC and neutrophils in *Toxocara* affected dogs which returned gradually to normal levels after treatment with Ivermectin, Helmonilc and Piperazine hexahydrate.

Rao and Suryanarayan (1995) found decreased blood glucose, total serum protein and serum albumin levels and increased serum globulin and alanine amino transferase levels in *Toxocara* affected dogs and then returned gradually to the normal levels after treatment with Ivermectin Helmonil – C and Piperazine hexahydrate. All the tests were performed by using the diagnostic kit supplied by span diagnostic Pvt. Ltd. India.
Banerjee et al. (1997) studied the haemograms of buffalo calves infected with *Toxocara vitulorum* and observed significantly decreased TEC, PCV and Hb values.

Devi et al. (2000) reported significantly reduced haematological values in respect of Hb, PCV and TEC which returned back at about the normal ranges on 21 day post treatment in calves treated with Piperazine citrate (200 mg/kg body weight given twice at 15 days interval). However, the post treatment haematological values of calves treated with criminth given orally twice at a 15 day interval 50 ml, also showed a little elevated values but not at the normal levels.

Neves et al. (2004) observed non-significant haematological changes except eosinophils in buffalo calves infected with *T. vitulorum*.

Islam et al. (2005) reported significantly (P<0.05) decreased haematological values that is TEC, Hb and PCV and these were found increased after treatment of *T. vitulorum* in calves.

Halmandge et al. (2005) reported that the haematobiochemical values in respect of PCV, SGPT, SGOT, Plasma total proteins, Serum, Calcium, Inorganic phosphorus and Plasma Tryglycerides were significantly increased in ascariasis affected buffalo calves.
5. **Economic impact:**  

Hutchinsen *et al.* (1980) reported that the calves treated at 3 weeks interval with 1.9 mg/kg or 7.5 mg/kg Levamisole, S/C gained upto 37 and 59 kg more than untreated calves in the same pastures. Further, they pointed out that nematodes held responsible for reduced weight gain were *Haemonchus placei*, *Oesophagostomum radiatum*, *Cooperia pectinata* and *Cooperia punctata*.

Myers and Todd (1980) reported increased weight gain following systematic deworming with Fenbendazole. Treatment at every 60 days interval did not control the sub clinical nematode parasitism but did increased average daily weight gain by 0.05 kg. They found that treatment at every 30 days controlled the parasitism and had weight gain of 0.09 kg on an average.

Smith and Gibbs (1981) reported an average gain of 2.2 kg/week as compared to 1.0 kg/week in treated group. While the parasitized untreated group lost 0-2 kg/week. They noted an overall gain of 26.8 kg by the control groups in 12 weeks period which was significantly different from an 11.4 kg gain by the parasitized treated group and a loss of 2.3 kg for parasitized untreated group.

Durga *et al.* (1981) treated the sheep infected with *Trichostrongylus* spp, *Strongyloides papillosus*, *Dictyocaulus filaria*, *cestodes* and coccidia by Copper Sulphate plus Nilverm, Cambendazole or
Panacur and observed weight gain of 4.15 – 6 kg as against 3.69 kg in untreated controls after 45 days of treatment.

Borgasteeede and Oostendorp (1982) reported after studying the effects of alternate grazing on faecal egg output and on the growth of calves and lambs that the annual weight gain of calves was the same in each year, but lambs grazed alternately showed higher weight gain than lambs not alternately grazed.

Average daily weight gain was the greatest in uninfected calves and lowest in those heavily parasitized calves (Ismail, 1983).

Sharma et al. (1984) noted a significant adverse effect of parasitic infections on growth rate of young calves and milk yield of adult Murrah buffaloes. A 12.75 percent increase in milk production and 5.7 percent increase in body weight was attributed due to treatment of the infection.

Chauhan et al. (1984) observed an average gain in body weight of treated calves to be higher than that control group (27.06%) as compared to 20.26%). In other trial, they recorded body weight monthly for 12 months and found an average gain in treated calves being 34.75 kg more than that of controls.

Sharma et al. (1984) recorded an average gain of 479 gm and 533 gm in the first and 2nd fortnight after treatment with
Parbendazole @ 0.75 gm/kg single oral dose. This was noted to be similar to healthy animals.

Hoverka and Corba (1984) reported improved body weight gain and 16.5 percent improved milk production when the milch cows infected with G.I. and Pulmonary nematodes were treated with a single dose of Thiabendazole (88 mg/kg body weight). They also observed that sheep aged 3 months and infected with G.I. nematodes when treated with Fenbendazole twice @ 7.5 mg/kg but showed 80-100 percent effective and useful in increasing growth.

Chauhan et al. (1985) treated the crossbred calves by suitable anthelmintic, amprolium Hcl and Carbaryl dust against helminthic, Coccidian, and Lice, Ticks infections, respectively and after 12 months, they observed that the body weight gain was higher by 34.75 kg per animal.

Gadbois et al. (1985) noted a reduction of 87 percent faecal egg counts and increased weight gain of 67.3 kg in one year after treatment with Morantel long acting device in contrast to the result obtained among healthy controls.

Kuchin (1985) studied the effect of combined use of Fenbendazole, trace elements and vitamins on parasitic infection on sheep and observed that live weight gain (in 95 days) were higher in treated groups receiving supplements (11.7 kg gain in weight) than in
those given the an-helminthic alone (8.2 kg) in comparison to lambs
given the supplements alone gained 7.0 kg and the untreated lambs
gained only 3-6 kg.

Weight gain of animals receiving regular anthelmintic were
compared with control group treated once at weaning. Monthly
deworming proved the most effective method with daily weight gain of
between 294 and 318 gm during the 11 months trial. The average
maximum weight gain after administration of Albendazole, Levamisole or
Febantel were 97, 99 and 105 kg, respectively (Mollar and Sosa, 1985).

Bumgarner et al. (1986) observed that the calves and cow
treated with 10 percent Fenbendazole @ 10 mg/kg body weight at
optimum time showed a significant weight gain as compared to
unmediated cows and calves.

Bendenkova (1986) treated 20 calves (aged 1-5 months)
infected with G.I. nematodes by Panacur (Fenbendazole) @ 10 mg/kg
body weight in September and October and after 5 months he observed
that the treated calves were 9.6 kg heavier than untreated controls.

Malczweski and Nowosad (1986) noted weight gain of 19.7
kg (6.92%) more than untreated calves after nine months by single dose
treatment in May. The calves treated in June showed a significant weight
gain of 17.2 kg (5.7%) after one year and calves treated in September
gained 15.2 kg (5.4%) more than controls after nine months.
The Hareford weaner calves treated every 3 to 6 weeks showed significantly greater weight gains than untreated steers but those treated every 12 weeks did not. Similarly, Brahman cross weaners showed increased weight gain with 3 weeks schedule but not in 6 or 12 weeks schedule (Winks et al., 1987).

Sharma et al. (1987) reported that the treatment was found to be effective and resulted in weight gains when Parbendazole was given @ 0.75 gm/kg body weight and sulfaguanidine 0.2 gm/kg on day one and 0.1 gm/kg for subsequent 5 days of treatment given orally to 15 young buffaloes naturally infected with nematodes and coccidia.

Rossanigo and Avila (1988) reported significantly more weight gain in groups GTS (664 gm/day) and GTE (638 gm per day) when receiving the Fenbendazole @ 5 mg/kg body weight every 30 days intervals and dewormed once only in April to May, respectively as compared to untreated control GST (538 gm/day). Greater weight gain in the treated animals was observed.

Kunkel and Murphy (1988) studied the average daily weight gain and faecal parasitic egg counts among sixty 7-15 months old Holstein heifers by giving suspension of Fenbendazole @ 5 mg/kg body weight orally on 21 days and 49 days and after 148 days they reported that the treated had fewer parasitic ova and abomasal larvae. Mean total weight gain and mean daily rate of gain in Fenbendazole dosed heifers
increased by 17.3 and 0.12 kg/day, respectively as compared to those of non treated heifers.

Stuedmann (1989) evaluated the effect of treatment with Fenbendazole and its effect on the performance of beef cow and calves and found average daily gain (ADG) in treated calves was 0.04 kg greater (P<0.05) than control calves (0.82 Vs 0.78 kg) during the period of 168 days and the average daily gain in treated cow was 0.09 kg greater (P<0.05) than untreated cows (0.40 Vs 0.31). Moreover, pregnancy rate and calving rate tend to be higher in treated cow by 98 and 90 percent than for untreated control cows being 75 and 68 percent, respectively.

Zinsstag et al. (1997) reported that the *N. Dama* cattle receiving one annual Fenbendazole (Panacur) treatment did not show significant effect on live weight, but two annual treatments significantly increased live weights of the animals of the age groups 12-24 and 24-36 months by 9.4 and 17.5 percent, respectively. Animals less than 12 months old had 6.3 percent higher live weights after two treatments. The difference was statistically non-significant (P<0.06). The average weight of 3 and 4 years old cattle, when treated twice were observed to be 13.1 and 8.2 percent higher, respectively. The effect of anthelmintic treatment on live weights was not found in 5 year old and older animals.

Islam et al. (2003) studied the effect of Ivermectin on body weight of calves infected with G.I. nematodes and ectoparasites. They
observed significant (P<0.05) gain in body weight (6.663 percent) in treated calves whereas, the infected control gained 5.385 percent less in mean body weight during the period of experiment.

Islam et al. (2005) reported that the body weight of *T. vitulorum* treated calves significantly (P<0.05) increased as compared to infected untreated control calves.
MATERIALS AND METHODS

I. Prevalence of prenatal *Toxocara vitulorum* transmission:

For knowing the prevalence of prenatal transmission of *Toxocara vitulorum* in buffalo calves, 100 new born buffalo calves rectal stool specimens were examined from 0 day to 30\(^{th}\) day after birth. The calves found positive for *T. vitulorum* from birth to 28\(^{th}\) day post birth was considered to have acquired prenatal infection of the nematode. Percent prenatal transmission was estimated by the formula:

\[
\text{No. of buffalo calves born and found positive for } T. \text{ vitulorum during 0-28}^{\text{th}} \text{ day post birth} \\
\text{Total no. of calves examined for } T. \text{ vitulorum infection during the same period} \\
\]

\[
\text{% prenatal transmission} = \frac{\text{No. of buffalo calves born and found positive for } T. \text{ vitulorum during 0-28}^{\text{th}} \text{ day post birth}}{\text{Total no. of calves examined for } T. \text{ vitulorum infection during the same period}} \times 100
\]

II. Control of *Toxocara vitulorum* natural infection in pregnant buffaloes and young buffalo calves.

Twenty 8-9 months pregnant indigenous buffaloes maintained at the owners houses were selected for the control of *T. vitulorum* tissue stage larvae infection. Of these, 10 were treated with Fenbendazole + Praziquantel once while 10 others were kept as
untreated control. Eighteen buffalo calves aged about a month having naturally acquired *T. vitulorum* patent infection between 10-28\(^{th}\) day post birth were selected for the control of the nematode. Six such calves were treated with Piperazine hexahydrate and supportive drugs. Another six young calves were treated with herbal anthelmintic mixture with supportive drugs. The rest six infected buffalo calves were kept as untreated control. They were maintained at the owner’s houses with better feeding and management. Any other erroneous infections were therapeutically managed immediately. The detail schedule of the experiments have been mentioned in the Table No.-1.
<table>
<thead>
<tr>
<th>Group</th>
<th>Status of animals</th>
<th>Nature of infection</th>
<th>Drugs, doses and route of administration</th>
<th>Period of observation</th>
<th>Period of treatment</th>
<th>Status of animals</th>
<th>N° of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (10)</td>
<td>8-9 months pregnant buffaloes</td>
<td>T. vitulorum larvae</td>
<td>Fenbendazole + Praziquantel (Fentas plus) 6.6 mg/kg body weight orally</td>
<td>0 day</td>
<td>0-60 days</td>
<td>Infected, untreated control</td>
<td>(9) III</td>
</tr>
<tr>
<td>II (10)</td>
<td>8-9 months pregnant buffaloes</td>
<td>Infected untreated control</td>
<td>Piperazine hexahydrate 220 mg/kg b.wt. once orally + Supportive drugs</td>
<td>0 day</td>
<td>0-8 months</td>
<td></td>
<td>(9) II</td>
</tr>
<tr>
<td>III (6)</td>
<td>Buffalo calves (10-25 days)</td>
<td>T. vitulorum natural infection</td>
<td>Herbal anthelmintic: Pure mercury, pure sulphur, Ajmod seed powder, Bayavindung seed powder, Pure nigella, Pure suphur, Pure eeds</td>
<td>0 day</td>
<td>0-8 months</td>
<td>Infected, untreated control</td>
<td>(9) I</td>
</tr>
</tbody>
</table>

Table 1: Schedule for the control of T. vitulorum anthelmintic infection in pregnant buffaloes and young buffalo calves by chemical and herbal packages.
Observations recorded:

1. Prenatal transmission in parasite freed pregnant buffalo cows born buffalo calves by faecal EPG examination twice weekly upto 28 days after birth.
2. Mortality in buffalo calves due to *Toxocara vitulorum* infection.
3. EPG twice weekly in *Toxocara vitulorum* infected and treated buffalo calves of group 1st, IIInd and IIIrd upto 15 days.
4. Health status of infected and treated buffalo calves twice weekly upto 20 days and then at monthly intervals upto the end of observation by measuring:
   (a) Hb, PCV and TEC
   (b) Glucose, ALT, AST and Fe
5. Birth weight of buffalo calves born from the pregnant buffaloes.
6. Growth rate at fortnightly intervals in group Ist to IIIrd.

Detail Technical Procedures:

1. **Prenatal transmission of *T. vitulorum* in buffalo calves born from treated pregnant buffaloes:**

   The prenatal transmission of the parasite was seen in buffalo calves born from treated pregnant buffaloes by faecal examination from 0 day upto 28 days. Percent prenatal
transmission of *T. vitulorum* was estimated by the formula mentioned earlier.

2. **Mortality due to *Toxocara vitulorum* infection in buffalo calves:**

   The mortality rate in buffalo calves infected with *Toxocara vitulorum* was estimated by noting the number of animals died of the infection and number of calves recovered naturally from the infection. The percent mortality was calculated by the formula:

   \[
   \text{Percent mortality} = \frac{\text{No. of calves died of } T. \ vitulorum \ \text{infection}}{\text{No. of calves positive for } T. \ vitulorum \ \text{infection}} \times 100
   \]

3. **Faecal (EPG) examination for the assessment of drug efficacy.**

   The EPG of all naturally infected buffalo calves were done on zero day before treatment and twice weekly in animals of group I-III up to 15-25 days as per the method of Stoll (1930).
The percent efficacies of the drugs were calculated by the formula:

\[
\text{Percent efficacy} = \frac{\text{Pre treatment mean EPG} - \text{Post treatment mean EPG}}{\text{Pre treatment mean EPG}} \times 100
\]

4. **Drugs used:**
   **For* T. vitulorum* infection**
   **Specific drugs:**

   (a) **Piperazine hexahydrate**
   220 mg/kg body wt., once orally, manufactured by TTK Health Care Ltd. 5, Old Trunk Road, Chennai, India.

   (b) **Fenbendazole** 150 mg + Praziquantel 50 mg (Fentas plus)
   manufactured by Intas Pharmaceuticals Ltd., Ahmedabad, India.

   (C) **Herbal Preparation Consisting of**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure mercury</td>
<td>100 mg</td>
</tr>
<tr>
<td>Pure sulphur</td>
<td>200 mg</td>
</tr>
<tr>
<td>Ajmod (<em>Trachyspermum roxburghianum</em>) seed powder</td>
<td>300 mg</td>
</tr>
<tr>
<td>Bayavidanga (<em>Embelia ribes</em>) seed powder</td>
<td>400 mg</td>
</tr>
<tr>
<td>Pure Nux-vomica (<em>Strychnos nux-vomica</em>) seed powder</td>
<td>400 mg</td>
</tr>
<tr>
<td>Palas (<em>Butea monosperma</em>) seed powder</td>
<td>600 mg</td>
</tr>
<tr>
<td>Pumpkin (<em>Cucurbita maxima</em>) seed powder</td>
<td>3000 mg</td>
</tr>
<tr>
<td>Cumin (<em>Cuminum cyminum</em>) seed powder</td>
<td>4000 mg</td>
</tr>
<tr>
<td>Arecaanut (<em>Areca catechu</em>) powder</td>
<td>3000 mg</td>
</tr>
<tr>
<td>Black til (<em>Sesamum indicum</em>) seed powder</td>
<td>3000 mg</td>
</tr>
</tbody>
</table>

**Total** 15g
The above herbal ingredients were procured from the local market and dried in sun light. Then all the ingredients were ground up in mixer grinder separately to make fine powder and were mixed in the proportions indicated above.

Supportive drugs:

All the *T. vitulorum* infected animals treated with the specific drugs, were also given supportive drugs like liver stimulants, antidiarrhoeal, appetizers, minerals, vitamins, antibiotics as and when required.

5. **Estimation of haematological parameters:**

(i) **Collection of blood:**

For assessing the changes in different haematological parameters, the blood samples were collected from the experimental animals Jugular vein in sterile vials having the anticoagulant EDTA @ 1-1.5 mg/ml of blood. Then the haematological parameters were examined within few hours of blood collection.
(ii) **Estimation of haemoglobin (Hb g%)**:

Haemoglobin content of each blood sample of *Toxocara vitulorum* affected and treated animals was estimated in an Automated Haematology Analyzer (Transasia, Japan).

(iii) **Estimation of TEC (x10⁶/cumm) and PCV (%):**

The TEC and PCV of all the blood samples were estimated with the help of Neubauer counting chamber as per the method of Schalm *et al.* (1976) and microhaematocrit centrifuge as per the method of Jain (1986), respectively or both these parameters were estimated in an Automated Haematology Analyzer (Transasia, Japan).

6. **Estimation of biochemical parameters** :

Blood samples were collected from Jugular vein in sterile test tubes without anti coagulant. The collected blood samples were slanted on spot for clotting. Serum was separated and cleared by centrifugation at 1000 rpm for 5 minutes. Then all the sera samples were used for estimating different biochemical parameters as per the procedure detailed below:
(I) Estimation of Glucose (mg/dl) :

**Method:** Enzymatic, GOD – POD

**Principle:**

Glucose is oxidized by Glucose Oxidase to Gluconic acid and hydrogen peroxide. In a subsequent proxidase catalyzed reaction, the oxygen liberated is accepted by the Chromogen System to give a red coloured quinoneimine compound. The red colour so developed is measured at 505 nm and is directly proportional to glucose concentration.

**Reagents used :**

<table>
<thead>
<tr>
<th>Reagent</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reagent 1</td>
<td>Glucose Reagent</td>
</tr>
<tr>
<td>Reagent 2</td>
<td>Glucose Diluent</td>
</tr>
<tr>
<td>Reagent 3</td>
<td>Glucose Standard</td>
</tr>
<tr>
<td>Reagent 4</td>
<td>Glucose standard 400 mg/dl Dextrose</td>
</tr>
</tbody>
</table>

**Specimen :**

Serum should be separated within 30 minutes of blood collection of samples.
**Procedure:**

The serum sample and the reagents were mixed in cleaned test tube labelled as Blank (B), Standard (S) and Test (T) in the proportions given below:

<table>
<thead>
<tr>
<th>Pipetted into tubes marked</th>
<th>Blank (B)</th>
<th>Standard (S)</th>
<th>Test (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>-</td>
<td>-</td>
<td>10 µl</td>
</tr>
<tr>
<td>Glucose standard</td>
<td>-</td>
<td>10 µl</td>
<td>-</td>
</tr>
<tr>
<td>Working Glucose Reagent</td>
<td>1000 µl</td>
<td>1000 µl</td>
<td>1000 µl</td>
</tr>
</tbody>
</table>

The contents of all the test tubes were mixed well by shaking and incubated at 37ºC for 10 minutes or at room temperature for 30 minutes.

**Calculation:**

\[
\text{Glucose (mg/dl) = } \frac{\text{Absorbance of Test}}{\text{Absorbance of standard}} \times 100
\]

**(II) Estimation of Serum Glutamate Pyruvate Transaminase (SGPT)/Alanine Transaminase (ALT) (Unit/ml):**

**Method:** 2, 4-DNPH Method

**Principle:**

SGPT (ALT) catalyses the following reaction:

\[
\alpha - \text{Ketoglutartate} + \text{L–Alanine} \rightleftharpoons \text{L-Glutamate} + \text{Pyruvate}
\]
Pyruvate so formed is coupled with 2, 4-Dinitrophenyl hydrazine (2, 4-DNPH) to give the corresponding hydrazone, which gives brown colour in alkaline medium and this can be measured colorimetrically.

**Reagents:**

- **Reagent 1**: Buffered Alanine α-KG substrate, pH 7.4
- **Reagent 2**: DNPH colour Reagent
- **Reagent 3**: Sodium Hydroxide, 4 N
- **Reagent 4**: Working pyruvate standard 2 mM

**Preparation of working solutions:**

**Solution 1:**

1 ml of Reagent was diluted to 3 to 10 ml with purified water.

Reagents 1, 2 and 4 were kept ready for use.

**Procedure:**

**Standard curve:**

The standard graph of Enzyme activity (in unit/ml) on x-axis vs O.D. on y-axis was not a linear one, which showed that O.D. increased with increased enzyme activity at a decreasing rate.
It was not necessary to plot standard curve every time the test performed. It was plotted initially when the first test was performed subsequently periodic checking was done by running only a couple of tubes viz. tubes 1 and 3 of the following table and their O.D. were compared with the original curve.

<table>
<thead>
<tr>
<th>Tube No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enzyme activity (Units/ml)</td>
<td>0</td>
<td>28</td>
<td>57</td>
<td>97</td>
<td>150</td>
</tr>
<tr>
<td>Reagent 1 : Buffered Alanine pH 7.4</td>
<td>ml</td>
<td>0.5</td>
<td>0.45</td>
<td>0.4</td>
<td>0.35</td>
</tr>
<tr>
<td>Reagent 4: Working Pyruvate Standard, 2 mM</td>
<td>ml</td>
<td>-</td>
<td>0.05</td>
<td>0.1</td>
<td>0.15</td>
</tr>
<tr>
<td>Purified water</td>
<td>ml</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Reagent 2. DNPH Color Reagent Mixed well and allowed to stand at room temperature for 20 minutes</td>
<td>ml</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Solution I</td>
<td>ml</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Mixed well by inversion. Allowed to stand at room temperature for 10 minutes and measured the O.D. of all the five tubes against purified water on a colorimeter with a green filter or on photometer at 505 nm.

<table>
<thead>
<tr>
<th>Test :</th>
<th>Test (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reagent 1 : Buffered Alanine, pH 7.4 incubated at 37°C for 5 minutes</td>
<td>0.25 ml</td>
</tr>
<tr>
<td>Serum Mixed well and incubated at 37°C for 30 minutes</td>
<td>0.05 ml</td>
</tr>
<tr>
<td>Reagent 2 : DNPH color Reagent</td>
<td>0.25 ml</td>
</tr>
<tr>
<td>Mixed well and allowed to stand at room temperature for 20 minutes</td>
<td>2.5 ml</td>
</tr>
<tr>
<td>Solution I</td>
<td></td>
</tr>
</tbody>
</table>
Mixed well and allowed to stand at room temperature for 10 minutes and read the O.D. against purified water on a colorimeter using a green filter or on photometer at 505 nm.

Calculations:

The O.D. of test marked on the y-axis of the standard curve and extrapolated it to the corresponding enzyme activity on x-axis.

III) Estimation of Serum Glutamate Oxaloacetate Transaminase (SGOT) Aspartate Transaminase (AST) unit/ml:

Method: 2,4-DNPH

Principle:

GOT (AST) catalyses the following reaction:

$$\alpha$$-ketoglutarate + L-Aspartate $\rightarrow$ L-Glutamate

Oxaloacetate so formed is coupled with 2,4-Dini trophenyl hydrazine (2,4-DNPH) to give the corresponding hydrazone, which gives Brown colour in alkaline medium and this can be measured colorimetrically.
Reagents:

Reagent 1 : Buffered Aspartate α-KG substrate, pH 7.4
Reagent 2 : DNPH colour Reagent
Reagent 3 : Sodium Hydroxide, 4 N
Reagent 4 : Working pyruvate standard 2 mM

Working solution:

Dilute 1 ml of Reagent 3 (Sodium Hydroxide, 4 N) to 10 ml with purified water.

Procedure:

Standard Curve:

As the reaction proceeded with time, more amount of products were formed and since the end products inhibited the enzyme, there was more of inhibition. The standard graph of Enzyme activity (in Units/ml) on x-axis vs O.D. on y-axis was not a linear one, which showed that O.D. increased with increased enzyme activity at a decreasing rate. The following table and their O.D. were compared with the original curve.
<table>
<thead>
<tr>
<th>Tube No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enzyme activity (Units/ml)</td>
<td>0</td>
<td>24</td>
<td>61</td>
<td>114</td>
<td>190</td>
</tr>
<tr>
<td><strong>Reagent 1</strong>: Buffered Alanine pH 7.4</td>
<td>ml</td>
<td>0.5</td>
<td>0.45</td>
<td>0.4</td>
<td>0.35</td>
</tr>
<tr>
<td><strong>Reagent 4</strong>: Working Pyruvate Standard, 2 mM</td>
<td>ml</td>
<td>-</td>
<td>0.05</td>
<td>0.1</td>
<td>0.15</td>
</tr>
<tr>
<td>Purified water</td>
<td>ml</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Reagent 2</strong>: DNPH Color Reagent</td>
<td>ml</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Solution I</td>
<td>ml</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Mixed well by inversion. Allowed to stand at room temperature for 10 minutes and measured the O.D. of all the five tubes against purified water on a colorimeter with a green filter or on photometer at 505 nm, plotted a standard graph by taking enzyme activity on x-axis and O.D. on y-axis.

<table>
<thead>
<tr>
<th>Test</th>
<th>Test (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reagent 1</strong>: Buffered Aspartate, pH 7.4 incubated at 37°C for 5 minutes</td>
<td>0.25 ml</td>
</tr>
<tr>
<td><strong>Serum</strong>: Mixed well and incubated at 37°C for 60 minutes</td>
<td>0.05 ml (50 µl)</td>
</tr>
<tr>
<td><strong>Reagent 2</strong>: DNPH color Reagent Mixed well and allowed to stand at room temperature for 20 minutes</td>
<td>0.25 ml</td>
</tr>
<tr>
<td>Solution I</td>
<td>2.5 ml</td>
</tr>
</tbody>
</table>
Mixed well and allowed to stand at room temperature for 10 minutes and then read the O.D. against purified water in a Calorimeter using a green filter or on photometer at 505 nm.

**Calculation:**

Marked the O.D. of Test (T) on the Y-axis of the standard curve and extrapolated it to the corresponding enzyme activity on X-axis.

**(IV) Estimation of Fe (µg/dl):**

Iron molecules are absorbed in the small intestine and get bound to a globulin in the plasma, called transferrin and transported to the bone marrow for the formation of haemoglobin.

**Principle:**

Iron bound to transferrin is released in an acidic medium and the ferric ions are reduced to ferrous ions. The Fe (II) ions reacts with Ferrozine to form a violet coloured complex. Intensity of the complex formed is directly proportional to the amount of iron present in the sample.
Procedure:

Clean and dry test-tubes were labelled as ‘BLANK’, ‘STANDARD’, ‘SAMPLE BLANK’ and ‘TEST’.

Iron assay:

<table>
<thead>
<tr>
<th>Addition sequence</th>
<th>Blank</th>
<th>Standard</th>
<th>Sample Blank</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron buffer reagent (L₁)</td>
<td>1.0</td>
<td>1.0</td>
<td>1.05</td>
<td>1.0</td>
</tr>
<tr>
<td>Distilled water</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Iron standard(s)</td>
<td>-</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sample</td>
<td>-</td>
<td>-</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Iron colour reagent (L₂)</td>
<td>0.05</td>
<td>0.05</td>
<td>-</td>
<td>0.05</td>
</tr>
</tbody>
</table>

All the contents were mixed well and incubated at room temperature for 5 min. The absorbance of the Blank (Abs. B), standard (Abs. S), sample Blank (Abs. S.B.) and Test sample (Abs. T) were taken against distilled water at 570 nm wave length by u.v. spectrophotometer (chemito).

\[
\text{Abs. T} - (\text{Abs. SB} + \text{Abs. B})
\]
\[
\text{Calculation} = \frac{\text{Abs. T} - (\text{Abs. SB} + \text{Abs. B})}{\text{Abs. S} - \text{Abs. B}} \times 100
\]
7. **Birth weight:**

The birth weight of the buffalo calves born of parasite freed pregnant buffaloes were taken one hour after birth using 100 kg weighing spring balance.

8. **Growth rate/Weight gain:**

The weight gain or loss in growing buffalo calves during the infection and simultaneous treatment in group 1\textsuperscript{st}, 2\textsuperscript{nd} and 3\textsuperscript{rd} was recorded at fortnightly intervals up to the end of observation. For taking the live weight the buffalo-calves, body length was measured from the point of buttock (Pin bone) to the shoulder with the help of measuring tape and was stated in terms of inches and the measurement was also taken behind the shoulder with the help of tape measure and stated in terms of inches.

Aggrawala’s modified Scheffer’s formula was used for calculating body weight of Indian Cattle i.e.

\[
\text{Live weight in seers} = \frac{\text{Length} \times \text{Girth}}{Y}
\]
Where,

\[ Y = 9, \text{ if girth measurement of the animal is } 60” \text{ to } 70” \]

\[ Y = 8.5, \text{ if girth measurement of the animal is } 71” \text{ to } 80” \]

\[ Y = 8, \text{ if girth measurement of the animal is } 81” \text{ to } 90” \ (1 \text{ Seer} = 0.93 \text{ kg}) \]

**Statistical Analysis :**

All the data collected during the study of different parameters were analyzed by using standard formulae and methods described by Snedecor and Cochran (1968).
I. Prevalence of prenatal *Toxocara vitulorum* transmission:

(a) Prevalence of *Toxocara vitulorum* prenatal and acquired infection in buffalo calves.

Out of 100 animals, 26 Calves (26%) were found Positive for *Toxocara vitulorum* upto 28\textsuperscript{th} day post birth which indicated prenatal transmission of the nematode while 30 Calves (30%) were found positive for *T. vitulorum* on/after 29\textsuperscript{th} day post birth that indicated acquired infection of the nematode and the detail data have been presented in Table-2.

(b) Detection of *Toxocara vitulorum* prenatal transmission in fenbendazole+Praziquantel treated pregnant buffaloes born calves.

The transmission of prenatal and acquired infection of *Toxocara vitulorum* were found to be 10 and 30 percent, respectively in fenbendazole + praziquantel treated pregnant buffaloes of group 1\textsuperscript{st}. But the prenatal and acquired infection of *Toxocara vitulorum* were found to be 20 and 30 percent, respectively in untreated infected pregnant buffaloes of Group-IIInd. The detail data have been shown to Table-3.
Table 2: Prevalence of *Toxocara vitulorum* prenatal and acquired infection in buffalo calves.

| No. of animals examined | Post natal detection of *T. vitulorum* infection on day (%)* | 0 | 3 | 5 | 10 | 15 | 20 | 25 | 30 | (28) | (30) | (33) | (36) | (39) |
|------------------------|-------------------------------------------------------------|---|---|---|----|----|----|----|----|-----|------|------|------|------|------|
| 0 | 100 | 30 | 28 | 25 | 20 | 15 | 10 | 5  | 3  | 0 (26) | 0 (24) | 0 (28) | 0 (30) | 0 (33) |

Prenatal transmission: 26.0%  
Acquired infection: 30.0%

DPB = Day Post Birth
Table 3: Detection of *T. vitulorum* prenatal transmission in Fenbendazole + Praziquantel treated pregnant buffaloes born calves.

| Species | Group | Groups (No. of animals) | Drug used | Positive animals (%) | Dose and route of &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbs...
II. Mortality in buffalo calves due to *Toxocara vitulorum* infection:

All together 56 percent *Toxocara vitulorum* infected animals were considered for mortality study and the data presented in Table-4 indicated that 14.3 percent buffalo calves died of natural *Toxocara vitulorum* infection under field condition.
Table 4: Percent mortality due to Toxocara vitulorum natural infection in buffalo calves.

<table>
<thead>
<tr>
<th>No. of calves with T. vitulorum infection</th>
<th>No. of calves died of T. vitulorum infection</th>
<th>Percent mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>8</td>
<td>14.3</td>
</tr>
</tbody>
</table>
III. Therapeutic efficacies of Piperazine hexahydrate and herbal anthelmintic parasite control packages against *Toxocara vitulorum* infection in buffalo calves.

The therapeutic efficacies of Piperazine hexahydrate and herbal anthelmintic against *Toxocara vitulorum* in buffalo calves were estimated as per the design of experiment and the results obtained have been presented in Tables (5 & 6) and figures (1, 2).

The buffalo calves of Group-I naturally infected with the nematode were treated with Piperazine hexahydrate @ 220 mg/kg body weight once, orally along with supportive drugs. The post treatment EPG observations and percent efficacy of the drug calculated on 3rd, 7th, 10th and 15th days post treatment DPT indicated that the percent efficacy of the drug was 64.75 percent on 3rd DPT and it was found to be 100 percent effective on 15th DPT. The buffalo calves of Group-IIInd were treated with herbal anthelmintic @ 500 mg/kg body weight and the percent efficacy of the drug was found to be 35.98 and 93.74 percent on 3rd and 15th DPT, respectively. The infected untreated control calves of Group-IIIrd continued to pass the eggs of *T. vitulorum* till the end of observations.
Table 5: Efficacies of piperazine hexahydrate and Herbal anthelmintic parasite control packages against T. vitulorum infection in buffalo calves.

<table>
<thead>
<tr>
<th>Groups (No. of infected buffalo calves)</th>
<th>Drug used</th>
<th>Doses and route of admn.</th>
<th>Average Pre-treatment EPG</th>
<th>Average post-treatment EPG and efficacies</th>
<th>CD Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (6)</td>
<td>Piperazine hexahydrate + Supportive drugs</td>
<td>220 mg/kg body weight once orally</td>
<td>1633.33 ±102.19</td>
<td>575.66 ±33.74 (a) 575.66 ±33.74 (a)</td>
<td>115.47</td>
</tr>
<tr>
<td>II (6)</td>
<td>Herbal anthelmintic + Supportive drugs</td>
<td>Body weight daily for 5 days</td>
<td>1583.33 ±101.37</td>
<td>1013.5 ±56.99 (b) 1013.5 ±56.99 (b)</td>
<td>113.33</td>
</tr>
<tr>
<td>III (6)</td>
<td>No treatment</td>
<td>-</td>
<td>1600 ±115.47</td>
<td>1700 ±85.63 (c) 1700 ±85.63 (c)</td>
<td>188.36</td>
</tr>
</tbody>
</table>

* Supportive drugs: Liver stimulants, anti-diarrhoeal, appetizer, vitamins, mineral, antibiotics were used as and when needed.

Figures having different superscripts differ significantly (P<0.01).

Group-I: Piperazine hexahydrate treated
Group-II: Herbal anthelmintic treated
Group-III: Infected untreated control

5 E. vitulorum infection in buffalo calves.

Table 5: Efficacies of piperazine hexahydrate and Herbal anthelmintic parasite control packages against T. vitulorum infection in buffalo calves.
Table 6: Analysis of variance (ANOVA) of EPG in buffalo calves infected with *T. vitulorum* and its treatment with Piperazine hexahydrate and herbal anthelmintic.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Observation period (days)</th>
<th>F-Value (2)</th>
<th>Error d.f. (15)</th>
<th>Between groups d.f. (2)</th>
<th>MS</th>
<th>EPG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05 NS</td>
<td>3888.88</td>
<td>6811.11</td>
<td>88</td>
<td>3894.09</td>
<td>7</td>
<td>266.82**</td>
</tr>
<tr>
<td>82.21**</td>
<td>1927105.72</td>
<td>23440.98</td>
<td>7</td>
<td>638862.39</td>
<td>10</td>
<td>377.45**</td>
</tr>
<tr>
<td>243.94**</td>
<td>658886.2</td>
<td>26189.96</td>
<td>3</td>
<td>26189.96</td>
<td>15</td>
<td>377.45**</td>
</tr>
<tr>
<td>377.45**</td>
<td>10908257.55</td>
<td>15</td>
<td>15</td>
<td>10908257.55</td>
<td>15</td>
<td>377.45**</td>
</tr>
</tbody>
</table>

*NS = Non-Significant, ** = P<0.01*
Fig. No.-1: Showing average EPG of piperazine hexahydrate and herbal anthelmintic parasite control packages treatment of *T. vitulorum* infection in buffalo calves.

Fig. No.-2: Showing efficacies of Piperazine hexahydrate and herbal anthelmintic parasite control packages against *T. vitulorum* infection in buffalo calves.
IV. Estimation of haematobiochemical alterations during *Toxocara vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintics.

(a) Haematological observations:

The results of haematological observations during *Toxocara vitulorum* infection and their treatment with Piperazine hexahydrate and herbal anthelmintics have been presented in Tables (7, 8) and figure 3.

The mean haemoglobin (g%) content of the buffalo calves of Group-I and Group-II on 0 day before treatment were 10.68±0.43 and 10.14±0.38, respectively. When the same was estimated on 20\(^{th}\) DPT, the values were found significantly (P<0.01) improved at about normal ranges i.e. 13.79±0.09 and 12.67±0.03, respectively. But the haemoglobin value of the control buffalo calves of Group-III on 20\(^{th}\) day decreased from 10.10±0.29 to 7.66±0.26 and remained at about normal ranges i.e. 12.02±0.03. Also, the average haemoglobin values were observed significantly increased in Piperazine hexahydrate (14.72±0.06) and Herbal anthelmintic treated buffalo calves (14.49±0.03), respectively on 240\(^{th}\) DPT.

The average PCV values of Piperazine hexahydrate treated calves of Group-I on 20\(^{th}\) DPT and 240\(^{th}\) DPT were found to be 42.64±0.06 and 45.47±0.03, respectively which were observed to be significantly (P<0.01) higher than the PCV value (38.24±0.53) before treatment. Similarly, the average
PCV values of herbal anthelmintic treated buffalo calves (Group-II) on 20\textsuperscript{th} DPT and 240\textsuperscript{th} DPT were 41.22±0.04 and 44.01±0.03, respectively which were observed to be significantly (P<0.01) higher than the PCV value (38.15±0.49) before treatment but the infected untreated control animals of Group-III had slightly decreased average PCV value from 37.49±0.84 to 31.76±0.01 which was found at normal ranges i.e. 37.05±0.05 on 240\textsuperscript{th} day of observation.

The mean TEC values of \textit{Toxocara vitulorum} infected and Piperazine hexahydrate treated buffalo calves (Group-Ist) were also found improved significantly (P<0.01) from 4.49±0.13 to 6.12±0.02 on 20\textsuperscript{th} DPT and 7.02±0.02 on 240\textsuperscript{th} DPT, respectively.

The herbal anthelmintic treated (Group-IIInd) buffalo calves had their average TEC values increased significantly (P<0.01) from 4.75±0.05 to 5.65±0.06 on 20\textsuperscript{th} DPT and 6.55±0.09 on 240\textsuperscript{th} DPT, respectively but the infected treated control buffalo calves of Group-IIIrd had slightly decreased average TEC from 4.77±0.19 to 4.44±0.02 on 20\textsuperscript{th} day of observation which was found at about normal ranges on 240\textsuperscript{th} day of observation.
Table 7: Haematological profiles of buffalo calves during *T. vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Observation period (days)</th>
<th>Group I (6) Piperazine hexahydrate treated</th>
<th>Group II (6) Herbal anthelmintic treated</th>
<th>Group III (6) Infected untreated control</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD-Value</td>
<td>0.19</td>
<td>5.73±0.01c</td>
<td>6.55±0.09p</td>
<td>7.02±0.02e</td>
</tr>
<tr>
<td></td>
<td>0.13</td>
<td>4.44±0.02c</td>
<td>5.65±0.06p</td>
<td>6.12±0.02e</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.77±0.19</td>
<td>4.75±0.05</td>
<td>4.49±0.13</td>
</tr>
<tr>
<td>TEC (10⁶/cumm)</td>
<td>0.10</td>
<td>37.05±0.05c</td>
<td>44.01±0.03p</td>
<td>4.47±0.039</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37.49±0.84</td>
<td>41.22±0.02p</td>
<td>31.76±0.01c</td>
</tr>
<tr>
<td>PCV (%)</td>
<td>0.13</td>
<td>37.49±0.84</td>
<td>38.15±0.53</td>
<td>38.24±0.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td>38.45±0.94</td>
<td>38.15±0.53</td>
<td>38.45±0.94</td>
</tr>
<tr>
<td></td>
<td>0.13</td>
<td>12.02±0.03c</td>
<td>14.97±0.03c</td>
<td>12.02±0.03c</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14.72±0.06c</td>
<td>14.72±0.06c</td>
<td>14.72±0.06c</td>
</tr>
<tr>
<td></td>
<td>0.39</td>
<td>7.66±0.26c</td>
<td>12.67±0.03p</td>
<td>13.79±0.039</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.14±0.28</td>
<td>10.68±0.43</td>
<td>10.14±0.28</td>
</tr>
<tr>
<td>Hb (g%)</td>
<td>0.19</td>
<td>4.47±0.039</td>
<td>5.65±0.06p</td>
<td>6.12±0.02e</td>
</tr>
<tr>
<td></td>
<td>0.13</td>
<td>31.76±0.01c</td>
<td>41.22±0.02p</td>
<td>38.24±0.039</td>
</tr>
<tr>
<td></td>
<td>0.13</td>
<td>12.02±0.03c</td>
<td>14.97±0.03c</td>
<td>38.45±0.94</td>
</tr>
<tr>
<td></td>
<td>0.39</td>
<td>7.66±0.26c</td>
<td>12.67±0.03p</td>
<td>13.79±0.039</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.14±0.28</td>
<td>10.68±0.43</td>
<td>10.14±0.28</td>
</tr>
</tbody>
</table>

Figures having different superscripts differ significantly (p<0.01).
Table 8: Analysis of variance (ANOVA) of haematological profiles during *T. vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Observation period (days)</th>
<th>Degree of freedom</th>
<th>MS</th>
<th>F-Value</th>
<th>Error MS</th>
<th>F-Value</th>
<th>Error MS</th>
<th>F-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb (g%)</td>
<td>0</td>
<td>2 &amp; 15</td>
<td></td>
<td>0.62</td>
<td>0.83</td>
<td>0.74</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>2 &amp; 13</td>
<td></td>
<td>48.36</td>
<td>0.08</td>
<td>604.5**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>2 &amp; 13</td>
<td></td>
<td>9.99</td>
<td>0.01</td>
<td>999**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>PCV (%)</td>
<td>0</td>
<td>2 &amp; 13</td>
<td></td>
<td>1.01</td>
<td>2.46</td>
<td>0.41</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>2 &amp; 13</td>
<td></td>
<td>158.23</td>
<td>0.01</td>
<td>15823.5**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>2 &amp; 13</td>
<td></td>
<td>92.02</td>
<td>0.006</td>
<td>15336.6**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>TEC (10^6/cumm)</td>
<td>0</td>
<td>2 &amp; 15</td>
<td></td>
<td>0.14</td>
<td>0.11</td>
<td>1.27</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>2 &amp; 13</td>
<td></td>
<td>3.47</td>
<td>0.01</td>
<td>347**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>2 &amp; 13</td>
<td></td>
<td>2.01</td>
<td>0.02</td>
<td>100.5**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>HB (g%)</td>
<td>0.41 NS</td>
<td>2.46</td>
<td></td>
<td>1.01</td>
<td>2.815</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2 &amp; 13</td>
<td></td>
<td>9.99</td>
<td>2.813</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>2 &amp; 13</td>
<td></td>
<td>48.36</td>
<td>2.813</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>604.5**</td>
<td>2.813</td>
<td></td>
<td>0.83</td>
<td>2.815</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2 &amp; 13</td>
<td></td>
<td>0.62</td>
<td>2.815</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NS** = Non-Significant; **(P<0.01)**.
Fig. No.-3 : Showing haematological profiles of buffalo calves during *T. vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.
(b) Biochemical observations:

The blood biochemical constituents of buffalo calves during *Toxocara vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic control packages have been detailed in Tables (9, 10) and figure 4.

**Glucose (mg/dl):**

The average serum glucose value of *Toxocara vitulorum* infected buffalo calves (Group-Ist) on 0 day before treatment was 46.32±1.48 and then it was found significantly (P<0.01) improved after respective treatment to 54.12±0.23 on 20th DPT and 56.32±0.26 on 240th DPT, respectively and the value in Group-IInd animal on 0 day before treatment was 46.36±1.27 and the same was found significantly (P<0.01) improved to 52.50±0.07 on 20th DPT and 55.35±0.07 on 240th DPT, respectively but the infected untreated buffalo calves of Group-IIInd had decreased value (44.26±0.09) on 20th day of observation which was observed again at about normal range i.e. 52.46±0.14 on 240th day of observation.

**ALT (SGPT) Unit/ml:**

The mean ALT (unit/ml) value on 0 day before treatment in Group-Ist buffalo calves was found increased i.e. 28.94±0.55 and the same got
significantly (P<0.01) returned at about normal ranges i.e. 26.18±0.07 on 20\textsuperscript{th} DPT and 18.65±0.13 on 240\textsuperscript{th} DPT. The serum ALT content in Group-IIInd buffalo calves being higher (29.63±0.57) on 0 day before treatment which got significantly returned to at about normal range 26.35±0.19 on 20\textsuperscript{th} DPT and 19.32±0.16 on 240\textsuperscript{th} DPT, respectively. But the untreated control calves (Group-IIIrd) had increased value (29.22±0.57) on 0 day before treatment and the same was found elevated to 32.05±0.04 on 20\textsuperscript{th} day and 35.89±0.11 on 240\textsuperscript{th} day of observations.

**AST (SGOT) Unit/ml**

The mean AST (unit/ml) estimated on 0 day before treatment in Group-Ist buffalo calves was found increased to 44.05±0.78 and the same got significantly (P<0.01) returned towards normal ranges i.e. 38.07±0.12 on 20\textsuperscript{th} DPT and 27.53±0.10 on 240\textsuperscript{th} DPT. The serum AST content in Group-IIInd buffalo calves being higher (45.51±1.31) on 0 day before treatment which was found significantly at about normal ranges i.e. 43.31±0.12 on 20\textsuperscript{th} DPT and 29.18±0.07 on 240\textsuperscript{th} DPT, respectively. But the untreated control calves (Group-IIIrd) had increased value (42.46±0.75) on 0 day before treatment and the same was found elevated to 44.37±0.21 on 20\textsuperscript{th} day and 34.31±0.08 on 240\textsuperscript{th} day of observations.
**Fe (µg/dl):**

The mean value of Fe (µg/dl) in Piperazine hexahydrate treated buffalo calves (Group-Ist) evaluated on 0 day (104.59±1.56) was found to have significantly (P<0.01) improved to 116.01±0.07 on 20th DPT and 132.7±0.03 on 240th DPT, respectively.

The mean value of serum Fe in herbal anthelmintic treated buffalo calves of Group-IIInd was found at 102.67±1.75 on 0 day before treatment and it got elevated significantly (P<0.01) to 108.00±0.08 on 20th DPT and 130.28±0.27 on 240th DPT. But the mean value of iron in infected untreated control animals of Group-IIIrd was 106.68±0.17 and the same got decreased to 92.85±0.09 on 20th day and it was observed again at about normal range (123.64±0.45) on 240th day of observation.
Table 9: Biochemical profiles of buffalo calves during *T. vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>CD</th>
<th>Glucose (mg/dl)</th>
<th>AL (SGPT) (unit/ml)</th>
<th>AST (SGOT) (unit/ml)</th>
<th>Fe (µg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I (6)</td>
<td>Group II (6)</td>
<td>Group III (6)</td>
<td>Group I (6)</td>
<td>Group II (6)</td>
<td></td>
</tr>
<tr>
<td>Observation period (days)</td>
<td>Observation period (days)</td>
<td>Observation period (days)</td>
<td>Observation period (days)</td>
<td>Observation period (days)</td>
<td></td>
</tr>
<tr>
<td>0.83</td>
<td>12.3±0.4</td>
<td>13.0±0.2</td>
<td>13.2±0.3</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>0.24</td>
<td>9.2±0.8</td>
<td>10.8±0.0</td>
<td>11.6±0.1</td>
<td>0.32</td>
<td></td>
</tr>
<tr>
<td>0.27</td>
<td>3.4±1.0</td>
<td>2.9±0.3</td>
<td>2.7±0.0</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>0.46</td>
<td>4.4±1.6</td>
<td>4.3±1.0</td>
<td>4.3±1.0</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>0.48</td>
<td>3.5±0.9</td>
<td>1.9±0.6</td>
<td>1.8±0.5</td>
<td>0.48</td>
<td></td>
</tr>
<tr>
<td>0.44</td>
<td>3.2±0.5</td>
<td>2.6±0.3</td>
<td>2.6±0.8</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>0.60</td>
<td>2.9±0.2</td>
<td>2.5±0.5</td>
<td>2.6±0.2</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>0.54</td>
<td>4.1±0.6</td>
<td>5.2±0.0</td>
<td>5.1±0.2</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>0.34</td>
<td>4.0±1.3</td>
<td>4.6±1.4</td>
<td>4.3±1.2</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

Figures having different superscripts differ significantly (P<0.01). Figures having same superscripts did not differ significantly.
Table-10 : Analysis of variance (ANOVA) of biochemical profiles during T. vitulorum infection and its treatment with Piperazine hexahydrate and herbal anthelmintic.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Observation Period (days)</th>
<th>F-Value</th>
<th>Between Groups MS</th>
<th>Error MS</th>
<th>Degree of Freedom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe (µg/dl)</td>
<td>0</td>
<td>281.47 **</td>
<td>0.36</td>
<td>0.10</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>21549**</td>
<td>0.03</td>
<td>0.72</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>2.18 **</td>
<td>11.07</td>
<td>4.21</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td>ALT (SGPT)</td>
<td>0</td>
<td>1432.55 **</td>
<td>5.92</td>
<td>13.89</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>3577.91 **</td>
<td>5.96</td>
<td>13.89</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>2.18 **</td>
<td>5.86</td>
<td>2.37</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td>AST (SGOT)</td>
<td>0</td>
<td>21549**</td>
<td>0.04</td>
<td>0.36</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>1432.55 **</td>
<td>5.92</td>
<td>13.89</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>2.18 **</td>
<td>5.96</td>
<td>13.89</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td>Glucose</td>
<td>0</td>
<td>281.47 **</td>
<td>0.36</td>
<td>0.10</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>21549**</td>
<td>0.03</td>
<td>0.72</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>2.18 **</td>
<td>11.07</td>
<td>4.21</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td>2.18 **</td>
<td>0</td>
<td>281.47 **</td>
<td>0.36</td>
<td>0.10</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td>21549**</td>
<td>0</td>
<td>281.47 **</td>
<td>0.36</td>
<td>0.10</td>
<td>2 &amp; 13</td>
</tr>
<tr>
<td>2.18 **</td>
<td>0</td>
<td>281.47 **</td>
<td>0.36</td>
<td>0.10</td>
<td>2 &amp; 13</td>
</tr>
</tbody>
</table>
| NS = Non-Significant; ** (P<0.01)
Fig. No.-4 : Showing biochemical profiles of buffalo calves during *T. vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.
V. Birth weight (Kg) of buffalo calves:

The birth weight of buffalo calves born from the pregnant buffaloes treated with Fenbendazole + Praziquantel was found to be slightly higher (29.25±0.21) than infected untreated pregnant buffaloes born calves (28.51±0.27). The data have been presented in table-11.
Table-11: Birth weight (kg) of buffalo calves born from the pregnant buffaloes treated with Fenbendazole + Praziquantel.

<table>
<thead>
<tr>
<th>Group</th>
<th>Parameters</th>
<th>$t$-value</th>
<th>Difference</th>
<th>$I$ (10)</th>
<th>$II$ (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group-I: Fenbendazole + Praziquantel Treated</td>
<td>Birth weight (kg)</td>
<td>2.17$^{NS}$</td>
<td>0.74</td>
<td>28.51±0.27</td>
<td>29.25±0.21</td>
</tr>
<tr>
<td>Group-II: Infected untreated control</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NS: Non-Significant
VI. **Body weight gain (Kg) in buffalo calves:**

The pretreatment average fortnightly body weight being 28.00±0.28 in Piperazine hexahydrate treated buffalo calves, it was observed significantly increased to 125.30±0.78 on 240\textsuperscript{th} day of observation. Similarly, the body weight of herbal anthelmintic treated buffalo calves before treatment was 27.75±0.23 which reached 120.30±0.42 on 240\textsuperscript{th} day of observation but the infected untreated control buffalo calves average weight on 0 day (27.84±0.22) increased to 117.64±0.41 on 240\textsuperscript{th} day of observation as shown in tables (12 & 13) and figure-5.
Table-12: Average body weight (kg) gain in buffalo calves during *T. vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.

<table>
<thead>
<tr>
<th>Observation period (days)</th>
<th>Group I (6)</th>
<th>Group II (6)</th>
<th>Group III (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Piperazine</td>
<td>Herbal</td>
</tr>
<tr>
<td></td>
<td>Intersected</td>
<td>Hexahydrate</td>
<td>Anthelmintic</td>
</tr>
<tr>
<td>7.6</td>
<td>120.3±0.70</td>
<td>122.5±0.31</td>
<td>118.3±0.71</td>
</tr>
<tr>
<td>7.7</td>
<td>105.8±0.48</td>
<td>106.6±0.45</td>
<td>111.3±0.65</td>
</tr>
<tr>
<td>7.9</td>
<td>99.8±0.56</td>
<td>100.4±0.49</td>
<td>110.4±0.57</td>
</tr>
<tr>
<td>8.2</td>
<td>92.2±0.69</td>
<td>93.1±0.50</td>
<td>97.4±0.30</td>
</tr>
<tr>
<td>8.4</td>
<td>85.4±0.76</td>
<td>86.3±0.46</td>
<td>90.4±0.46</td>
</tr>
<tr>
<td>8.7</td>
<td>78.6±0.83</td>
<td>79.6±0.49</td>
<td>83.5±0.39</td>
</tr>
<tr>
<td>9.4</td>
<td>71.8±0.80</td>
<td>73.1±0.37</td>
<td>76.7±0.36</td>
</tr>
<tr>
<td>10.2</td>
<td>65.6±0.60</td>
<td>66.7±0.25</td>
<td>69.0±0.34</td>
</tr>
<tr>
<td>10.8</td>
<td>59.4±0.26</td>
<td>60.8±0.19</td>
<td>63.3±0.29</td>
</tr>
<tr>
<td>11.6</td>
<td>53.7±0.07</td>
<td>55.1±0.17</td>
<td>57.0±0.26</td>
</tr>
<tr>
<td>13.4</td>
<td>48.6±0.05</td>
<td>49.8±0.16</td>
<td>50.5±0.22</td>
</tr>
<tr>
<td>1.2</td>
<td>37.3±0.27</td>
<td>38.6±0.17</td>
<td>39.5±0.34</td>
</tr>
<tr>
<td>0.7</td>
<td>24.6±0.12</td>
<td>25.0±0.21</td>
<td>26.3±0.65</td>
</tr>
<tr>
<td>0.0</td>
<td>46.3±0.01</td>
<td>47.8±0.18</td>
<td>49.2±0.32</td>
</tr>
<tr>
<td>0.0</td>
<td>33.3±0.08</td>
<td>34.6±0.29</td>
<td>35.9±0.30</td>
</tr>
<tr>
<td>0.1</td>
<td>29.0±0.20</td>
<td>30.0±0.21</td>
<td>31.0±0.21</td>
</tr>
<tr>
<td>0.2</td>
<td>27.2±0.22</td>
<td>28.0±0.23</td>
<td>29.8±0.23</td>
</tr>
</tbody>
</table>

CD Value: 0.70 ± 0.01

Figures having same superscripts did not differ significantly.

Figures having different superscripts differ significantly (*=P<0.05; **=P<0.01).

Table-12: Average body weight (kg) gain in buffalo calves during *T. vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.
Table-13 : Analysis of variance (ANOVA) of body weight (kg) of buffalo calves during *T. vitulorum* infection and their treatment with Piperazine hexahydrate and herbal anthelmintic.

<table>
<thead>
<tr>
<th>Observation Period</th>
<th>Between Groups Error MS</th>
<th>F-Value</th>
<th>Degree of Freedom</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>240</td>
<td>77.71</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>225</td>
<td>55.05</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>210</td>
<td>47.47</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>195</td>
<td>43.36</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>180</td>
<td>41.50</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>165</td>
<td>38.83</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>150</td>
<td>36.24</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>135</td>
<td>32.76</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>120</td>
<td>26.97</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>105</td>
<td>20.88</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>90</td>
<td>14.90</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>75</td>
<td>9.57</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>6.75</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>45</td>
<td>6.49</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>3.60</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>2.88</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0.90</td>
<td>2.13</td>
<td>2 &amp; 13</td>
<td>0</td>
</tr>
</tbody>
</table>

NS = Non-Significant; * Significant = (P<0.05); ** Significant = (P<0.01)
Fig. No.-5: Showing average body weight (kg) gain in buffalo calves during *T. vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.
VII. Percent growth rate in buffalo calves:

The percent growth rate in Piperazine hexahydrate treated buffalo calves of Group-Ist was 10.78 on 15th DPT and 5.90 on 240th DPT. Similarly, the percent growth rate of herbal anthelmintic treated buffalo calves (Group-IIInd) was 10.48 on 15th DPT and 6.01 on 240th DPT. But the percent growth rate in infected untreated control buffalo calves of Group-IIInd was 10.09 on 15th day and 4.80 on 240th day of observation as shown in table-14 and figure-6.
Table 14: Percent growth rate in buffalo calves during *T. victulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.

<table>
<thead>
<tr>
<th>Observation period (days)</th>
<th>Group I (6) Piperazine hexahydrate treated</th>
<th>Group II (6) Herbal anthelmintic treated</th>
<th>Group III (6) Infected untreated control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>9.00</td>
<td>10.26</td>
<td>10.19</td>
</tr>
<tr>
<td>15</td>
<td>10.78</td>
<td>10.48</td>
<td>10.09</td>
</tr>
<tr>
<td>30</td>
<td>14.18</td>
<td>14.25</td>
<td>13.18</td>
</tr>
<tr>
<td>45</td>
<td>13.24</td>
<td>13.10</td>
<td>12.48</td>
</tr>
<tr>
<td>60</td>
<td>12.86</td>
<td>12.79</td>
<td>11.86</td>
</tr>
<tr>
<td>75</td>
<td>12.56</td>
<td>11.52</td>
<td>11.24</td>
</tr>
<tr>
<td>90</td>
<td>12.02</td>
<td>10.57</td>
<td>10.72</td>
</tr>
<tr>
<td>105</td>
<td>11.03</td>
<td>10.39</td>
<td>10.52</td>
</tr>
<tr>
<td>120</td>
<td>10.26</td>
<td>9.73</td>
<td>10.19</td>
</tr>
<tr>
<td>135</td>
<td>9.72</td>
<td>9.57</td>
<td>9.77</td>
</tr>
<tr>
<td>150</td>
<td>8.95</td>
<td>8.92</td>
<td>8.95</td>
</tr>
<tr>
<td>165</td>
<td>8.40</td>
<td>8.40</td>
<td>8.80</td>
</tr>
<tr>
<td>180</td>
<td>7.65</td>
<td>7.80</td>
<td>7.95</td>
</tr>
<tr>
<td>195</td>
<td>7.14</td>
<td>7.24</td>
<td>7.53</td>
</tr>
<tr>
<td>210</td>
<td>6.66</td>
<td>6.79</td>
<td>6.74</td>
</tr>
<tr>
<td>225</td>
<td>6.26</td>
<td>6.38</td>
<td>6.03</td>
</tr>
<tr>
<td>240</td>
<td>5.90</td>
<td>6.01</td>
<td>4.80</td>
</tr>
</tbody>
</table>

*Note: The table shows the percent growth rate of buffalo calves during *T. victulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic. The values represent the growth rate at various observation periods.*
Fig. No.-6: Showing growth rate in buffalo calves during *T. vitulorum* infection and treatment with Piperazine hexahydrate and herbal anthelmintic.

- **Group-I**: Piperazine hexahydrate treated
- **Group-II**: Herbal anthelmintic treated
- **Group-III**: Infected untreated control
Prevalence of *Toxocara vitulorum* infection in buffalo calves:

*Toxocara vitulorum* is one of the commonest round worms infection in new born buffalo and cattle calves. Its prevalence has been reported to be more in buffalo than cattle calves. (Singh et al., 1989; Devi et al., 2000 and Kumari et al., 2004).

In the present study the nature of *Toxocara vitulorum* infection occurring in buffalo calves has been observed. It was found that approximately 26 percent buffalo calves upto the age of 28\textsuperscript{th} day were positive for the round worm infection whereas 30 percent of the buffalo calves examined were having the eggs of *Toxocara vitulorum* in their stool after that. The observation also indicated that prenatal *Toxocara vitulorum* infection was common (26\%) in calves aged about one months and about 30 percent calves were found to acquire post natal nematode infection. *Toxocara vitulorum* infection in cattle and buffalo calves has also been reported as one of the commonest round worm infection occurring in cattle and buffalo calves from India and abroad (Toparlak et al., 1989; Singh et al., 1989; Sherif et al., 2000; Devi, 2000 and Halmandge et al., 2006). However, there is no information distinguishing about the nature of prenatal and post natal acquired infection occurring in
the animals. The result of the present finding clearly indicated that 50 percent (26/56%) of the young buffalo calves positive for *T. vitulorum* infection had acquired the infection prenatally.

The present finding would be useful in formulating the possible measures for implementing the therapeutic control of prenatal transmission of *Toxocara vitulorum* during last quarter of pregnancy. This idea was experimentally tested by treating pregnant buffalo cows during late pregnancy for observing the effect if any on the prenatal/acquired transmission of the worm in treated pregnant buffalo cows born calves.

The observation further revealed slight reduction (20%) in the transmission of prenatal nematode infection in treated pregnant buffaloes born calves.

The study appeared to be a preliminary because there was no such information available in the literature. Thus, there is need to carry out repeated trials on larger number of cattle/buffalo calves to verify the findings of the present investigation.

**Efficacies of chemical and herbal anthelmintics against *Toxocara vitulorum* infection in buffalo calves:**

A large number of chemical anthelmintics have been evaluated for their therapeutic efficacies against *Toxocara vitulorum* infection in cattle and buffalo calves (Prasad, 1985; Kasaralikar et al., 1999; Devi 1999; Rao *et al.*, 2000; Kumari *et al.*, 2004 and Islam *et al.*, 1992).
2005. The findings of many of the scientists indicated that the round worm infection occurring in young cattle and buffalo calves could be controlled effectively by chemical anthelmintics. Recent reports on the development of drug resistant parasite population in animals warranted the necessity to find out a suitable, safe and effective herbal anthelmintic. Therefore, a mixture of several anthelmintic property having plant products were prepared for testing the suitability as an effective anthelmintic for the control of *Toxocara vitulorum* infection bovine/bubaline calves. The herbal mixture was found to have a maximum of 93.74 percent effectiveness against *T. vitulorum* infection in young buffalo calves. Thus, it appeared from the present observation that the herbal mixture could be an useful alternative for the treatment of large round worm infection in calves. Some of the available reports indicated that single herbal product could be used to treat the nematode infection in animals (Akhtar et al., 1985; Euswas et al., 1989 and Islam et al., 2005) For sustainable control of parasitic infections in domestic animals, there is need to implement strategic therapeutic control management under different farming conditions. For that there should be a suitable, highly efficacious and safe anthelmintic. A combination of anthelmintic property having several herbal product could be able to solve the problem of controlling helminthic infections in animals. The common herbal anthelmintic property having several plants are available in remote
rural areas where farmers can use to control the common worm infestation of their livestock. Of course, the present herbal anthelmintic mixture need to be tested for its safety and efficacy against other round worms infecting other livestock as well.

**Haematological variations during *Toxocara vitulorum* infection and treatment:**

The observation on Haemoglobin, Packed Cell Volume and Total Erythrocytic Counts during *Toxocara vitulorum* natural infection in buffalo calves observations were taken during infection and treatment with chemical as well as herbal anthelmintics. The results obtained clearly indicated that the Hb, PCV and TEC values were found significantly reduced during infection of the nematode. The decrease in these haematological parameters have also been reported by Yadav (1984), Lau and Singh (1985), Rao and Suryanarayan (1995), Devi (2000), Islam *et al.* (2005). The reduced haematological parameters were found to return at about normal ranges after treatment of the nematode infection by both the chemical and herbal anthelmintics. The reduced haematological parameters due to *T. vitulorum* infection in cattle/buffalo calves have also been reported to get recovered towards normal ranges after treatment of the round worms by Yadav (1984), Pandey and Mishra (1985), Devi *et al.* (2000) and Islam *et al.* (2005).
There was no any information on the variations in haematological parameters during *Toxocara vitulorum* infection and its herbal anthelmintic treatment. Therefore, the herbal anthelmintic used to control *Toxocara vitulorum* infection in calves in the present study appeared to be useful in helping the infected animals to recover from the damages caused by the parasites.

**Biochemical variations during *Toxocara vitulorum* infection and treatment:**

*Toxocara vitulorum* infection in cattle and buffalo calves causes weakness, anaemia, exhaustion and toxicity. For observing the pathogenic effects produced by the parasite in infected hosts, glucose, iron and enzymes like, ALT and AST were studied. The observations noted indicated that there was significant reduction in blood glucose level during *Toxocara vitulorum* infection in calves. Likewise, the Fe level was also found to be much below the normal levels in them. But the status of liver function monitored by the estimation of AST and ALT enzymes during *Toxocara vitulorum* infection indicated significant increase in their blood levels. Uysal (1989), Waghmare *et al.* (1993) and Rao and Suryanarayan (1995) have also observed decreased levels of blood glucose and iron during *Toxocara vitulorum* infection in cattle/buffalo calves. The increased level of liver enzymes ALT and AST during *Toxocara*
vitulorum infection in calves have also been reported by Baruah et al. (1979), Halmandge et al. (2005).

The above biochemical constituents being either at decreased (Glucose, Fe) or increased (ALT, AST) levels were found to have returned at about normal ranges after treatment of the infection with chemical as well as herbal anthelmintics. Waghmare et al. (1993), Rao and Suryanarayan (1995) also found reduced level of glucose and increased ALT, AST blood levels during infection and these values were found to return towards normal ranges after treatment of Toxocara vitulorum with suitable anthelmintic. Uysal (1989), Waghmare et al. (1993) and Halmandge et al. (2005) have also supported the findings of the present study.

The harmful effects produced by the parasite origin toxic substance in animals probably got stopped after treatment and the animals recovered by suitable and timely treatment of the infection. The herbal anthelmintic preparation used to treatment the T. vitulorum infection in the present study was also found capable to help the host in recovering from the damages caused by the parasites indicating that the herbal anthelmintic could be a suitable and safe alternative anthelmintic for the control of Toxocara vitulorum infection in buffalo calves.
Birth weight of *Toxocara vitulorum* infected and uninfected buffalo calves born from treated/untreated pregnant buffaloes:

The pregnant buffaloes cows are the major source of *Toxocara vitulorum* infection in young calves. The infection has been presumed to be transmitted by the mother during late pregnancy in uterus (Prenatal) and early lactation through the milk (Post natal acquired). The prenatally infected calves were found to have slightly decreased birth weight than the calves born from the treated pregnant buffalo cows. The findings of the present study showed that treatment of pregnant buffaloes was useful in reducing the health hazards produced by the parasites upto limited extent to the calves during later part of pregnancy. There is no any similar report available in the literature for comparing the findings of the present study. However, Kumari (2001) and Das (2001) have reported that G.I. nematode parasitized pregnant sows and pregnant does born piglets and kids were having less birth weight than the treated pregnant sows and does born Piglets and kids, respectively. Thus the treatment of pregnant buffaloes with anti parasitic agents might have advantageous effect on the health of pregnant buffaloes leading to little higher birth weight of there buffalo calves.
Growth rate of *Toxocara vitulorum* infected and chemical and herbal anthelmintic treated growing buffalo calves:

The treatment of *Toxocara vitulorum* infection by suitable anthelmintic during early postnatal life of the new born buffalo calves was found to be advantageous in respect of growth rate and weight gain.

In the chemical and herbal anthelmintics treated calves the percent growth during early growing period was not significantly differing from that of untreated infected control animals but the observations upto 240 days the weight gain of the infected treated and infected untreated animals indicated that the percent growth rate as well as weight gain by the chemical/herbal anthelmintics treated growing buffalo calves were significantly higher than infected untreated control calves.

Thus, there was positive impact of treatment on the growth performance in *Toxocara vitulorum* infected and treated buffalo calves. The reduction in growth rate and body weight gain in *Toxocara vitulorum* infected cattle/buffalo calves have also be observed by Borgsteede and Oostendorp (1982), Ismail (1983), Winks *et al.* (1987) and Islam *et al.* (2003) while increased growth rate and weight gain obtained after suitable anthelmintic treatment of *Toxocara vitulorum* infection in cattle/buffalo calves were also observed by Hutchinsen *et al.* (1980), Chauhan *et al.* (1984), Mollar and Sosa (1985), Islam *et al.* (2003) and Islam *et al.* (2005). None of the available information indicated the
positive impact of herbal anthelmintic treatment on the growth performance in buffalo calves. However, the findings of the present investigation needs verification by repeated trials on large number of *Toxocara vitulorum* infected buffalo calves after using herbal anthelmintic in different farming conditions.
SUMMARY AND CONCLUSION

1. 26.0 and 30.0 percent new born buffalo calves were found to have acquired prenatal and post natal *T. vitulorum* infection.

2. The treatment of *T. vitulorum* tissue stage larvae in pregnant buffaloes resulted in reduction in prenatal *T. vitulorum* infection in new born buffalo calves.

3. The Piperazine hexahydrate cured 100 percent *T. vitulorum* infected buffalo calves whereas herbal anthelmintic treatment could eliminate about 93 percent infection of *T. vitulorum.*

4. The reduced Hb, PCV and TEC blood values in *T. vitulorum* infected buffalo calves were observed to have improved at about normal ranges on 20\(^{\text{th}}\) and 240\(^{\text{th}}\) days post treatment observation.

5. Reduced Glucose and Fe blood levels in *T. vitulorum* infected buffalo calves were seen to get improved towards normal ranges on 20\(^{\text{th}}\) and 240\(^{\text{th}}\) day post treatment observation. Significantly increased ALT and AST serum levels in *T. vitulorum* infected buffalo calves were also found to have returned at about normal ranges in treated animals on both the post treatment days of observations.
6. There was significantly higher body weight gain in buffalo calves having been treated for *T. vitulorum* infection than untreated infected animals.

7. The percentage growth rate was significantly higher in *T. vitulorum* anthelmintic treated animals than infected untreated buffalo calves.
CONCLUSION

1. Prenatal *T. vitulorum* infection in buffalo calves could be reduced upto limited degree by the treatment of pregnant buffaloes during late pregnancy. The mortality caused by the parasites in new born buffaloes calves could be reduced to limited extent by application of the present finding.

2. Detection of *T. vitulorum* pre and post natal infection in buffalo calves upto 30th days post birth and treatment with chemical and herbal anthelmintic was found to have significant effect on health and growth rate of treated animals.


Kumar, M.C.A.; Udupa, K.G.; Prakash, N. and Kumar, S.P. (2005). Comparative efficacy of Levamisole hydrochloride and
certain indigenous drugs against ascariasis in buffalo calves. *Indian Vet. J.*, **82** (3) : 342-344.


