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Role of epidemiological factors on prevalence of gastrointestinal helminthoses in buffalo of Red Laterite zone of West Bengal, India

Ruma Jas, Dhananjay Kumar, Soumitra Pandit, Surajit Baidya and Abhijit Nandi

Abstract
Effects of different epidemiological factors such as season, age, sex and manage mental practices of animals on the prevalence of gastrointestinal (GI) helminth infection were studied in buffaloes of Red Laterite Zone (RLZ) West Bengal. Monthly 120 faecal samples of buffaloes of RLZ were screened by standard parasitological techniques from April, 2016 to March, 2017. The prevalence of naturally occurring GI helminthoses was 54.17% in buffaloes. Paramphistome (34.37%) was found to be the predominant parasite followed by Strongyle (21.50%) and *Toxocara* (10.07%). Highest prevalence was recorded in monsoon (60.42%) followed by winter (54.17%) and summer (47.92%). Young buffaloes (63.93%) were more susceptible to GI helminth infection than the adult buffaloes (49.32%). The prevalence of GI helminths was higher in female animal (60.67%) than the male (49.41%). Semi-intensive system (59.17%) of rearing showed higher infection than the intensive method (41.36%). The results of the present study should be exploited to formulate control program against GI helminths infection in buffaloes of West Bengal.

Keywords: Buffalo, epidemiological factors, gastrointestinal helminths, red laterite zone, prevalence

Introduction
Buffaloes are important livestock which serve as essential component of agriculture-based Indian economy. Buffalo production is important for dairy industry as well as beef industry. Buffaloes also provide manure and drought power to the agricultural field. Though India ranks first in buffalo population but the rural Indian farmers are not able to achieve maximum returns from buffalo. Profitable production of buffalo suffers from a variety of problems, of which, disease problem is most important. Among the various diseases, gastrointestinal helminth infection is the major constraint for profitable buffalo production (Jas *et al*., 2017a). Gastrointestinal helminth infections are generally chronic and sub-clinical in nature and therefore, these infections are often overlooked by the farmers and thereby cause huge economic losses to the farmers.

Different types of gastrointestinal (GI) helminth parasites are prevalent all-round the year in India including West Bengal (Nath *et al*., 2016, Jas and Pandit, 2017) [9, 8]. Rearing practice and unawareness of the farmers about helminth infections are the major reasons for high prevalence of GI helminths (Jas *et al*., 2017b) [9]. Epidemiological factors like agroclimatic condition and host factors such as age and sex (Wadhwa *et al*., 2011, Sreedevi and Hafeez, 2014, Zaman *et al*., 2014, Deeba *et al*., 2019) [18, 15, 17, 4] and also the management practices play important role in occurrence of GI helminths (Jas *et al*., 2017b, 2020) [9]. Epidemiological knowledge is the prerequisite to control the particular infection. West Bengal has been divided into six agroclimatic zones; Hill zone, Tarai zone, Old Alluvial zone, Red Laterite zone, New Alluvial zone and Coastal zone. Information on prevalence of GI parasites in buffaloes of different agroclimatic zones of West Bengal is scattered. Therefore, in the present study the prevalence of GI helminths in buffaloes was recorded in terms of different seasons, age, sex and rearing practices in Red Laterite zone of West Bengal, India.

Materials and Methods
Study area: Red Laterite zone of West Bengal consists parts of Birbhum, Bankura, Purulia and Jhargram districts. Two villages per month from each district of Birbhum, Bankura and Purulia were selected for the present study.

Soil of this region is laterite type and, in some parts, soil is red in colour with low level of alluvial soil.

The study was continued for one year from March, 2016 to February, 2017. This study was a part of project work entitled "All India Network Programme on Gastrointestinal Parasitism" funded by the Indian Council of Agricultural Research.

Selection of animals

Buffaloes of either sex in the age group of six months to 4 years were identified for the present study. Buffaloes in those villages were maintained either by intensive system with total confinement in animal shed and sometimes tied with rope in the open area near the animal shed or by semi-intensive system where buffaloes were allowed to graze on common pasture for few hours during the day time and then confined in animal shed during the night time. Routine deworming for buffaloes was not practiced in those villages before and during the study period.

Collection and examination of faecal samples

A total of 120 faecal samples of buffaloes were collected in each month from six villages (20 samples / village) under the three above mentioned districts. Per-rectal or freshly voided faecal samples (3 gms) without dust contamination were collected in vials containing 10% formalin (@ 10 ml). Faecal samples were brought to the laboratory maintaining cold chain for further processing of samples.

Faecal samples were examined by standard sedimentation and floatation technique (Soulsby, 1982) [14]. After discarding the formalin, faecal sample was homogenized in pestle and mortar adding little amount of tap-water. Again, some amount of water was added to make faecal suspension. Faecal suspension was then strained through an ordinary tea-strainer in a clean vial and kept undisturbed for 15 minutes, after which the supernatant was discarded without disturbing the sediment. Then the vial was filled with tap-water and allowed to settle for 15 minutes after which the supernatant was discarded as previous and a drop from the sediment was put on a glass-slide and after mixing with water, it was examined under low power magnification.

After discarding the supernatant for the second time, saturated salt solution was added up to the brim of the vial and then it was covered with a glass-slide and kept undisturbed for 15 minutes. Then the slide was taken out with a hanging drop on which a cover-slip was put and examined under low power magnification.

Statistical Analysis

The data on prevalence in terms of percentage for different parasites and for seasons were compared (Analyze-Compare Means). Then the data were analyzed separately i.e. between parasites and between seasons by Duncan method (One-way-ANOVA). The data were also compared between adult and calf and between male and female buffalo by One-way-ANOVA and the significance (P-value) was recorded at 95% ($p<0.05$) level. The complete statistical analyses were done with the help of Statistical Package for Social Scientist (SPSS), Windows Version 15.0.

Results and Discussion

Overall prevalence of gastrointestinal helminths

Gastrointestinal helminths were found to be prevalent in buffaloes all-round the year during the study period. The prevalence of GI helminths varied non-significantly ($p>0.05$) in different months with an overall prevalence of 54.17% (Table-1). A moderate level of prevalence of GI helminths was recorded in buffalo of Red Laterite zone of West Bengal, India. All the three types of helminths; trematode (*Fasciola* and Paramphistomes), nematode (Strongyle, *Strongyloides*, *Trichuris* and *Toxocara*) and cestode (*Moniezia*) were recorded.

Gastrointestinal helminthic infection is generally chronic and sub-clinical and thereby causes huge economic losses to the farmer. Therefore, proper control strategy should be adopted to prevent economic losses due to GI helminthoses. Data on epidemiology of GI helminthoses is an essential component of control programme strategies. Gastrointestinal helminthoses occurred throughout the year in buffalo of Red Laterite zone. In the present study the prevalence of GI helminth infection in buffaloes was 54.17%, which was in agreement with earlier reports (Nath *et al*., 2016, Shit *et al*., 2017) [9, 12]. Moderate level of prevalence of GI helminths might be due to hot and humid climatic condition of Red Laterite zone. Earlier the authors also reported higher prevalence of GI helminths in sheep of Red Laterite zone. In comparison to our study, Wadhwa *et al*. (2011) [17] and Das *et al*. (2018) [3] reported 13% prevalence of GI helminths in buffalo of Bikaner region of Rajasthan and Jabalpur district of Madhya Pradesh, respectively. The difference in prevalence of GI helminths might be due to variation in agroclimatic condition between West Bengal and Madhya Pradesh or Rajasthan and also due to difference in rearing practices between the study areas and the number of animals included in the study.

Table 1: Prevalence of different types of GI helminths in buffalo of Red Laterite Zone of West Bengal

Months	Total examined	Total Positive	Strongyle	*Strongyloides*	*Trichuris*	*Toxocara*	*Fasciola*	Paramphistome	*Moniezia*
March	120	41.67	10.00	2.50	3.33	6.67	5.00	25.00	4.16
April	120	48.33	10.00	4.17	5.00	7.50	3.33	28.33	5.00
May	120	43.33	8.33	2.5	5.00	6.67	2.50	28.33	4.17
June	120	58.33	13.33	4.16	3.33	12.50	5.83	35.00	4.17
July	120	60.00	14.16	3.33	3.33	8.33	4.16	37.50	4.16
August	120	58.33	14.16	4.16	3.33	8.33	5.00	38.33	5.00
September	120	62.50	12.50	3.33	3.33	10.00	5.83	43.33	3.33
October	120	60.83	17.50	5.83	3.33	10.83	5.00	39.16	4.17
November	120	66.67	14.16	4.17	2.50	12.50	6.67	40.00	2.50
December	120	58.33	14.16	3.33	4.16	14.16	5.00	3.33	1.67
January	120	50.00	10.83	3.53	2.5	15.00	5.83	33.33	4.16
February	120	41.67	10.83	5.00	3.33	8.33	4.16	30.83	4.16
Overall	1440	54.17	12.50	4.00	3.54	10.07	4.86	34.37	3.89

The prevalence of Paramphistomes (34.37±1.6%) was found maximum in buffaloes of study area. Strongyle group of nematodes were the second highest (21.50±0.74%) recorded helminth followed by *Toxocara* (10.07±0.84%), *Fasciola* (4.86±0.34%), *Strongyloides* (4±0.31%), *Moniezia* (3.89± 0.28%) and *Trichuris* (3.54±0.23%). Among the different types of helminth parasites Paramphistomes was found to be the predominant parasite in buffaloes followed by Strongyle group of nematodes. Higher prevalence of Paramphistomes had also been observed earlier (Singh *et al*., 2012, Sreedevi and Hafeez, 2014) [13, 15] in large ruminants of India including West Bengal (Jas and Pandit, 2017, Shit *et al*., 2017) [8, 12]. The environmental condition of Red Laterite zone and the grazing behaviour of buffalo over swampy and water-logging areas benefit the survival and transmission of infective stages of Paramphistomes and Strongyle nematodes and thus resulting into comparatively higher prevalence.

Seasonal prevalence of gastrointestinal helminths

All the three seasons were covered during the study period. Monsoon was found to be most favourable season for GI helminth with the highest prevalence (60.42±0.87%)of GI helminths followed by winter (54.17±5.38%) and least in summer (47.92±3.75%). The prevalence of GI helminths did not differ significantly ($p>0.05$) among the different seasons of the year whereas the prevalence of Paramphistomes and Strongyle group of nematodes were significantly ($p<0.05$) higher in monsoon compared to summer (Fig. 1). No significant ($p>0.05$) difference in prevalence of Paramphistome and Strongyle was recorded between monsoon and winter season and also between winter and summer season. The prevalence of *Toxocara* sp. was significantly ($p<0.05$) higher in winter season compared to the other two seasons. The prevalence of *Fasciola*, *Moniezia*, *Strongyloides* and *Trichuris* did not differ significantly ($p>0.05$) during the different seasons of study period (Fig. 1).

Season influences the occurrence of GI helminthoses in livestock all over world (Regassa *et al*., 2006, Biswas *et al*., 2014, Zaman *et al*., 2014, Jas and Pandit, 2017, Jas *et al*., 2017b) [11, 2, 18, 8, 9]. The prevalence of GI helminths infection was highest during monsoon in buffaloes of Red Laterite zone of West Bengal and this was in agreement with our earlier finding in buffalo of Coastal zone. The environmental condition especially temperature, rainfall, humidity and availability of ample green grasses during monsoon are favourable for survival of infective stages of Strongyle nematodes and also for breeding of snail intermediate host of Paramphistomes (Jas *et al*., 2017b) [9]. Monsoon season has also been reported to be the most favourable period for occurrence of GI helminths by many authors from the different parts of the country (Das *et al*., 2018, Thakre *et al*., 2019, Singh *et al*., 2012, Sreedevi and Hafeez, 2014) [3, 16, 13 15]. High temperature and low relative humidity during the summer season are not favourable for survival and development of free-living stages of nematodes and snail intermediate host of trematodes resulting into lowest prevalence of GI helminths during summer (Thakre *et al*., 2019, Jas *et al*., 2017b, 2020) [16, 9].

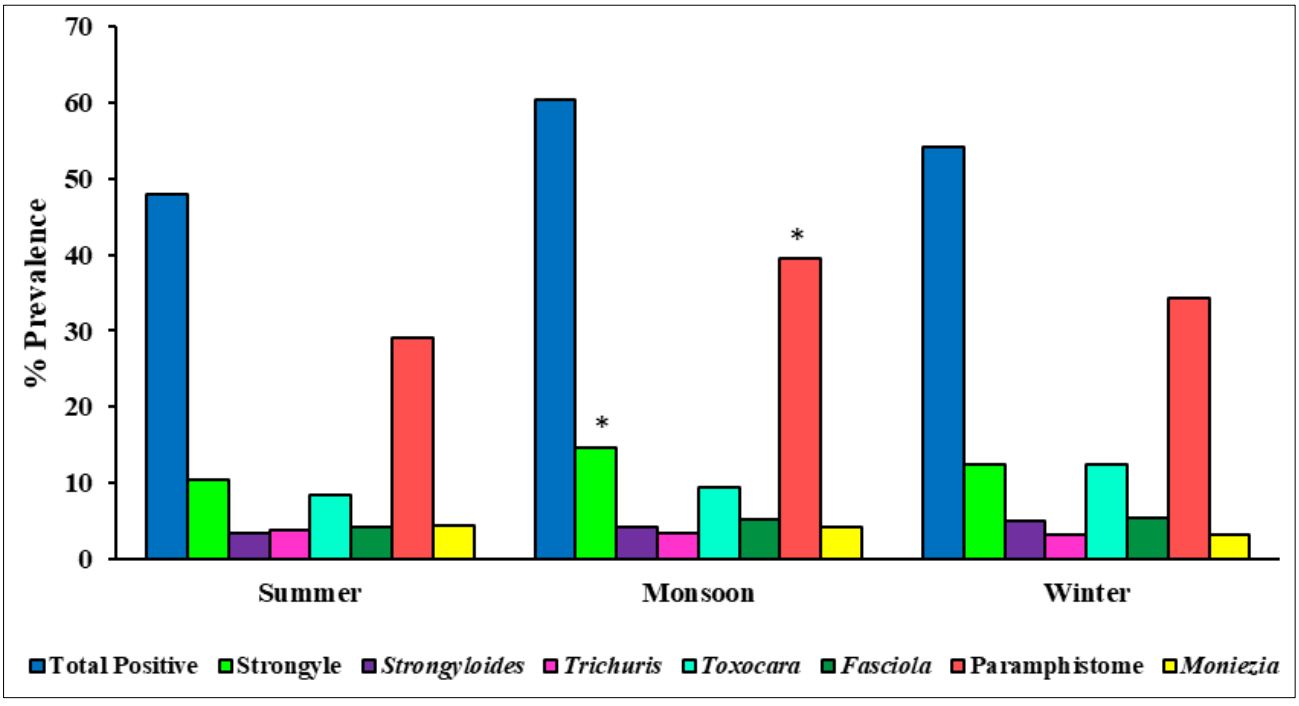

Fig 1: Seasonal Prevalence of Gastrointestinal helminthoses in buffalo of Red Laterite zone of West Bengal

Age-wise prevalence of gastrointestinal helminths

Buffaloes were divided into adult and young according to their age as specified earlier in the 'Materials and Methods' section and data on prevalence were recorded accordingly. The prevalence of GI helminths irrespective of their species was significantly ($p<0.05$) higher in young animals (63.93±2.61%) compared to adult buffaloes (49.32±2.83%). Other helminthes parasites except Paramphistome were observed significantly ($p<0.05$) higher in young animals than the adult animals (Fig. 2). On the other hand, the prevalence of Paramphistomes was significantly ($p<0.05$) higher in adult buffaloes (33.76±3.38%) compared to the young animals (23.70±3.32%). The overall prevalence as well as prevalence of Strongyle and *Toxocara* infection was significantly higher in young animals than the adult buffaloes in the present study and this finding was in agreement with earlier reports

(Wadhwa *et al*., 2011, Sreedevi and Hafeez, 2014, Zaman *et al*., 2014, Deeba *et al*., 2019, Jas *et al*., 2020) [15 17, 18, 4, 7]. Comparatively higher susceptibility of young animals might be accredited to lower exposer to infection resulting into low resistance (Deeba *et al*., 2019) [4]. High prevalence of GI helminths was recorded in adult buffalo by Das *et al*. (2018) [3] and Biswas *et al*. (2019) [2] which was not in line with our findings. This discrepancy might be due to the difference in the agroclimatic conditions and number of adult and young animals involved in the study.

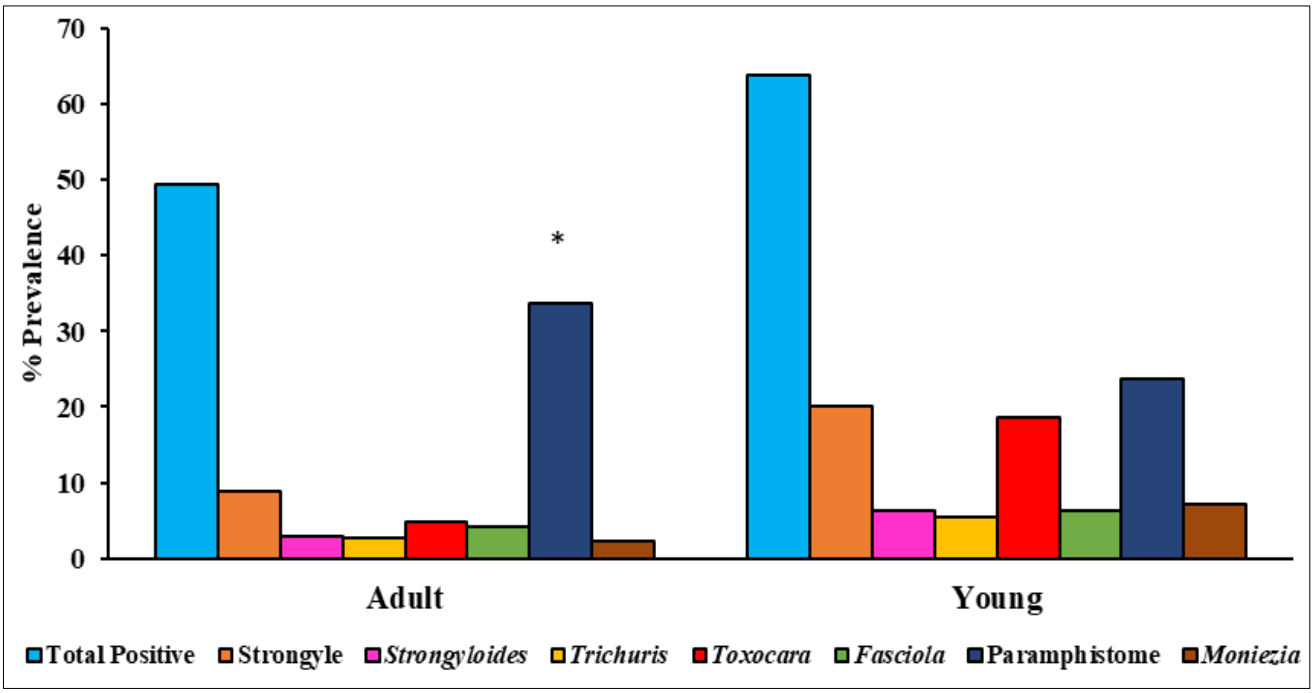

Fig 2: Comparative prevalence of GI helminthoses between adult and young buffaloes of RLZ of West Bengal

Sex-wise prevalence of gastrointestinal helminths

The occurrence of GI helminths was recorded for male and female animals. In the present study, the overall prevalence of GI helminths as well as different types of parasites were found to be significantly ($p<0.05$) higher in female than the male buffaloes (Fig. 3). Irrespective of age of animal and season of the year female buffaloes were found to be more susceptible to naturally occurring gastrointestinal helminths than the male animals. Significantly ($p<0.05$) prevalence of GI helminths has been recorded in female animals in the present study than the male and this observation was in agreement with the earlier report by many authors (Bhutto *et al*., 2002, Raza *et al*., 2012) [1, 10]. Comparatively higher prevalence in female buffalo might be due to productive and reproductive stress (Jas *et al*., 2020) [7]. In contrast to our present finding, Biswas *et al*. (2014) [2] and Deeba *et al*. (2019) [4] reported higher prevalence of GI helminths in male buffalo which might be due to variation in rearing practice.

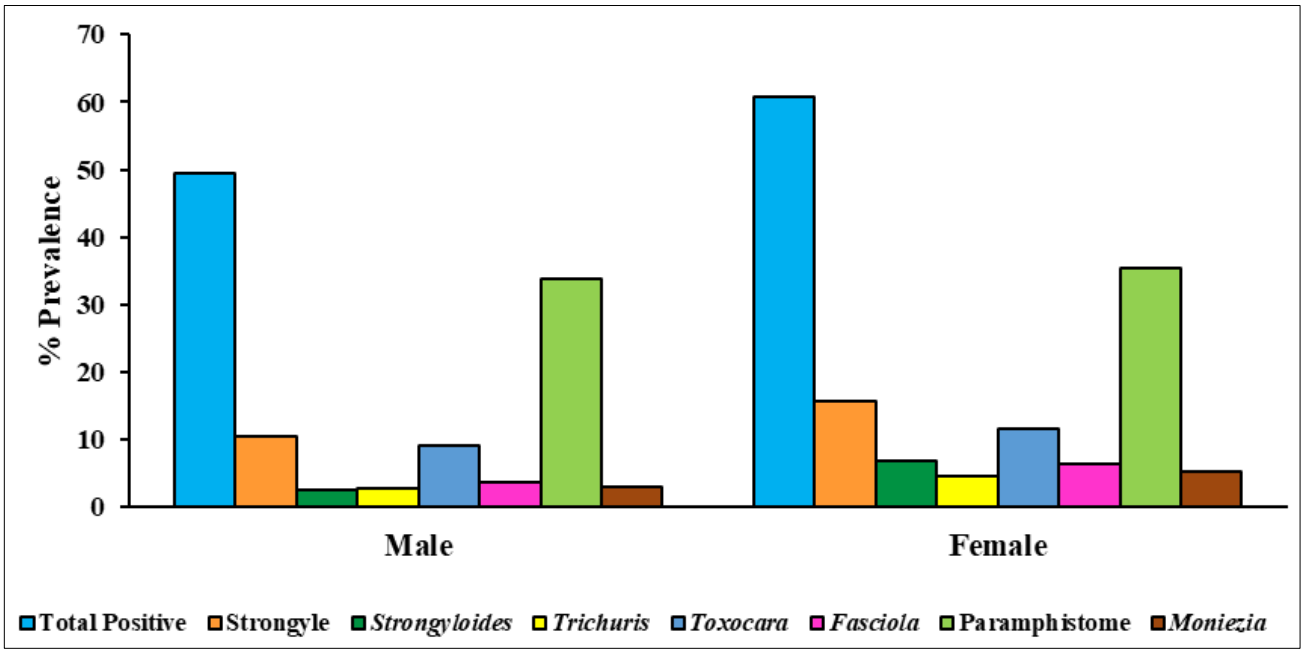

Fig 3: Prevalence of GI helminthoses in male and female buffaloes of RLZ of West Bengal

Manage mental practice-wise prevalence of gastrointestinal helminths

Rearing practice of animals also influence the occurrence of different GI helminth parasite in buffaloes (Fig. 4). The prevalence of GI helminths was significantly (P<0.05) higher in buffalo maintained in semi-intensive system (59.17± 5.39%) compared to intensive system (41.36±3.09). The prevalence of pathogenic helminths such as Paramphistome, *Fasciola*, *Toxocara* and Strongyle group of nematodes was also significantly (p<0.05) greater in buffaloes rearing by semi-intensive than the animals maintained by intensive system (Fig. 4).

Manage mental practices play an important role in the prevalence of naturally occurring GI helminth infection in livestock. In the present study, buffaloes maintained by semi-intensive system showed significantly (p<0.05) higher prevalence of GI helminths than the buffaloes maintained by intensive system. Semi-intensive system of rearing allows the animals to be exposed to the infective stages of helminth parasites in the pasture for longer time which is responsible for higher prevalence of GI helminths. Whereas in the intensive system animals have very little exposure to infective stages of GI helminths and thereby lower prevalence than the animals reared by semi-intensive system.

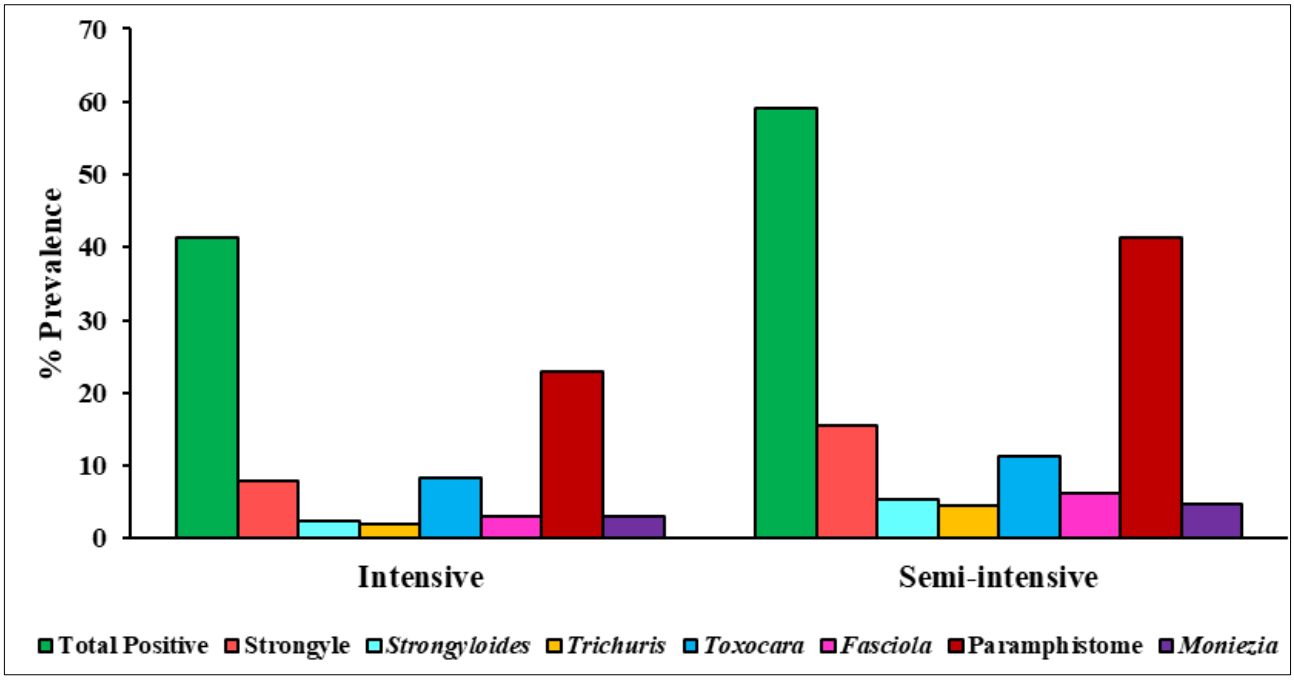

Fig 4: Comparative prevalence of GI helminthoses in buffaloes maintained by intensive and semi-intensive system in RLZ of West Bengal.

Conclusion

A moderate level of prevalence of GI helminths has been recorded in buffalo of Red Laterite zone. Various epidemiological factors such as season, age and sex of animals, and also the manage mental practices played significant role in the prevalence of GI helminths in buffalo. The data obtained in the current study might be considered while planning control strategy against GI helminthoses in buffalo of Red Laterite zone of West Bengal, India.

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Conflict of Interests

There is no conflict of interest.

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