SEASONAL VARIATION OF INTESTINAL PARASITOSIS IN KISHANGANJ DISTRICT, BIHAR

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ABSTRACT

BACKGROUND

Seasonal variations in temperature, rainfall and resource availability are ubiquitous and can exert strong pressures on population dynamics. Several past studies, including a study on humans from the United States and a few others using animal subjects have revealed the burden of parasitic infections to rise during the monsoon months (July to October), showing the lowest load during winter. An attempt to assess the influence of seasonal variations on the prevalence of IPI, a retrospective study was done for a period of 36 months in our Tertiary Care Hospital in the eastern part of Bihar.

MATERIALS AND METHODS

The present study is a retrospective study undertaken in a rural medical college of Bihar, India. Patients of all ages who reported with gastrointestinal symptoms during the period of Jan. 2014 to Dec. 2016 were included in the study. A total number of 5638 patients of both sexes were found to fulfil the criteria of inclusion. Routine macroscopic examinations of stool were carried as per standard guidelines for presence of adult worms, scolices and proglottids. For microscopic examinations, saline wet mount and Lugol's iodine wet mount were prepared as per standard protocol.

RESULTS

Our study was done retrospectively on 5638 stool specimens obtained from patients who were referred from outpatient departments (OPD). It was found that out of 5638 stool specimens examined, 1489 were sent during the monsoon itself out of which 698 (46.88%) specimens were positive for parasites. In other words, out of total 2672 parasite-positive specimens in a total span of three years, the monsoon brunt was 26.12%, compared to the winter counterpart which was 251, i.e. only 9.39%. After rainy season, the next parasitic cases were found in the order of: summer (601, i.e. 22.47%), autumn (417, i.e. 15.6%), dewy season (389, i.e. 14.56%), spring (316, i.e. 11.83%) and lastly winter as already mentioned (251, i.e. 9.39%). It has to be noted here that rainfall does not necessarily occur solely during rainy season, but also in other seasons, notably in summer and autumn. Our study tallies well with other similar studies.

CONCLUSION

Our studies reveal that the situation of intestinal parasitosis is maximum in summer and rainy seasons and minimum in dry, winter months. Periodic preventive anti-helminthic treatment should be instituted keeping in view with these findings.

KEYWORDS

Seasonal Variation, Intestinal Parasitosis, Bihar.

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BACKGROUND

Intestinal parasitic infections (IPI) are endemic worldwide, and it represents a large and serious medical health problem in the developing countries, with high prevalence rate in many regions. It is estimated that 3.5 billion people are affected, and 450 million are ill as a result of these infections, the majority being children.^[1] The distribution and prevalence of various intestinal parasite species depend on social, geographical and economic conditions, as well as

customs of inhabitants.^[2] Poverty, illiteracy, high population density, proximity with animals, poor hygiene conditions along with unavailability of safe and potable water attribute to the higher prevalence of intestinal parasites in developing nations.^[3] Moreover, certain environmental factors like pollution, global warming and tropical humid weather conditions facilitate disease. These factors have a direct bearing on the frequency of parasitic infections, and consequently the prevalence of infection varies in different states of India.^[4]

The most common intestinal parasitic infestations as reported globally are *Ascaris* (20%), hookworm (18%), *Trichuris trichiura* (10%) and *Entamoeba histolytica* (10%).^[5] The WHO estimates that approximately 50 million people worldwide suffer from invasive amoebic infections each year, resulting in 40000-100000 deaths annually.^[6] Human beings acquire IPIs through several routes, including faecal-oral and skin penetration, and it causes untold suffering. Food-handlers may serve as the transmission agents and reservoirs of infection.^[7] The main clinical

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manifestation of the disease caused by these parasites is diarrhoea.^[2] In India, the overall prevalence rate of IPI ranges from 12.5% to 66% with varying prevalence rates for individual parasite.^[8]

Seasonal variations in temperature, rainfall and resource availability are ubiquitous and can exert strong pressures on population dynamics.^[9] Some of the theories relating seasonality with host-parasite systems have found the incidence of many infectious diseases due to changes in susceptibility of the human host to the particular pathogen.^[10] Several past studies, including a study on humans from the United States and a few others using animal subjects have revealed the burden of parasitic infections to rise during the monsoon months (July to October), showing the lowest load during winter.^[11,12]

Many factors or combinations of factors contributing to disease emergence include ecological changes, such as those due to human activities or anomalies in climate; demographic changes and behavioural changes, travel and immigration, technology and industry; microbial adaptation, change and breakdown of public health measures. The emerging infectious diseases are also attributed to the population growth, ageing population, poverty and malnutrition, environmental pollution, deforestation, crowding, inadequate infrastructure, poor sanitation and water supply, global warming, development of antimicrobial/insecticide resistance, etc. In addition to this, the immunocompromised patients including patients with AIDS, solid organ transplant recipients, and patients on immunosuppressive therapy for disorders, are at high risk for opportunistic parasites.^[13]

Bihar state is land-locked, bordered to the north by Nepal and split by the river Ganges which flows from west to east through the state. Located far from the sea and influenced by the Himalayas, the state has a continental monsoon climate, typical of most of the Northern India.^[14] Studies of seasonal parasitic prevalence amongst large patient populations are rarely reported from Bihar, where endemic parasitosis is still high, due to poor hygiene practices and high population density. It is important to know the monthly and season-wise distribution of single and multiple parasitic infections, in order to determine the peak incidence period. Therefore, in an attempt to assess the influence of seasonal variations on the prevalence of IPI, a retrospective study was done for a

period of 36 months in our Tertiary Care Hospital in the eastern part of Bihar.

MATERIALS AND METHODS

The present study is a retrospective study undertaken in a rural medical college and multispecialty hospital in eastern region of Bihar, India. Patients of all ages who reported to medical and paediatric OPDs of the hospital during the period of Jan. 2014 to Dec. 2016 with gastro-intestinal symptoms and who were subjected to routine stool examinations were included in the study. A total number of 5638 patients of both sexes were found to fulfil the criteria of inclusion. The age range of the patient population was 03 years to 76 years.

Specimen Collection

A single stool specimen was collected from each patient in a clean wide-mouthed container. Freshly voided stool specimens were processed using formol-ether concentration technique and examined microscopically for ova, cysts or parasites using saline and iodine mounts on grease free slides. Part of the stool specimen was preserved in 10% formal-saline and from this a concentrated smear was made on a grease-free slide, fixed with methanol and stained by a modified Ziehl-Neelsen stain. Routine macroscopic examinations were carried as per standard guidelines for consistency, colour, presence of mucus and blood and presence of adult worms, scolices and proglottids.

For microscopic examinations, saline wet mount and Lugol's iodine wet mount were prepared as per standard protocol. Each sample was examined under microscope for presence of ova, parasites and cysts.

The summer season was defined as the period between 16th April and 15th June; rainy season was defined as the period in between 16th June and 15th August. Similarly, autumn, dewy, winter and spring seasons were defined as the periods between 16th August and 15th October, 16th October and 15th December, 16th December and 15th February and 16th February and 15th April respectively.

RESULTS

The results are tabulated and depicted in Table 1 and Figure 1. Some of the stool specimens showed more than one parasite.

Parasites Seasons	Total Specimen	Parasite +ve Specimen	Ascaris lumbricoides	Entamoeba histolytica	Giardia lamblia	Ancylostoma duodenale	Enterobius vermicularis	Others
Summer	1236	601	86	228	98	49	79	83
Rainy Season	1489	698	115	238	112	56	74	130
Autumn	912	417	54	138	82	58	46	58
Dewy Season	783	389	36	122	165	36	26	22
Winter	594	251	28	85	52	34	35	28
Spring	624	316	38	101	54	41	62	37
Total	5638	2672	357	912	563	274	322	358

Table 1. Intestinal Parasites found in Different Seasons

Figure 1. Season-wise distribution of Different Intestinal Parasites

DISCUSSION

In total, our study was done retrospectively on 5638 stool specimens obtained from patients who were suspected to have intestinal parasitosis and were referred from outpatient departments (OPD). The samples were examined first under naked eye for consistency, colour, appearance, etc. and then under microscope for the detection of any ova, parasites and cysts of any of the intestinal parasites. The study period was for three years.

It was found in our study that out of 5638 stool specimens examined, 1489 were sent during the monsoon itself out of which 698 (46.88%) specimens were positive for parasites. In other words, out of total 2672 parasite-positive specimens in a total span of three years, the monsoon brunt was 26.12%, compared to the winter counterpart which was 251, i.e. only 9.39%. After rainy season, the next parasitic cases were found in the order of: summer (601, i.e. 22.47%), autumn (417, i.e. 15.6%), dewy season (389, i.e. 14.56%), spring (316, i.e. 11.83%) and lastly winter as already mentioned (251, i.e. 9.39%). It has to be noted here that rainfall does not necessarily occur solely during rainy season, but also in other seasons, notably in summer and autumn. However, the rainfall is least during dewy season and winter, the latter being usually practically rain-free.

In the monsoon, the commonest intestinal parasite observed is *Entamoeba histolytica* which is also the commonest in all other seasons. But, after that, in other seasons the next common parasites are *Ascaris lumbricoides* and *Giardia lamblia*. Most interestingly in monsoon, the commonest parasites are the so-called less common parasites, grouped as "others" in our study. These parasites include: *Hymenolepis nana*, *Taenia solium/saginata*, *Trichuris trichiura* and *Strongyloides stercoralis*. *Enterobius vermicularis*, notably again is more common in summer (79 in the total three-year study), compared to 74 in the rainy season in these three years. *Ancylostoma duodenale* (56) occupies the next in order in the rainy season. In spring also, though the number of parasite-positive cases were less than half (316) compared to monsoon, the cases of *E. vermicularis* were quite significant (62).

For many years, gastrointestinal parasites in animals and livestock are monitored by studying the number of eggs from faecal samples of animals over all different seasons of the year.^[15] On the other hand, meteorological data and computer simulation are at present deemed as an alternative approach for forecasting gastrointestinal parasitic infestation in many developed countries.^[16, 17] Altitudes of the places, temperature, humidity and rainfall are factors responsible for

both temporal (i.e. seasonal) and spatial variation of intestinal parasites.

A study from Meghalaya, India shows that the most common gastrointestinal parasite prevalent throughout the year is *Strongyloides stercoralis*.^[18] The reasons for that could be the high rainfall and humidity prevalent in the north-eastern regions of India, which augments the free-living larval development in soil to complete the life-cycle of strongyle group of parasites.^[19]

Prevalence of gastrointestinal parasitic load in animals measured by egg per gram of faeces (EPG) was found to have a linear correlation both with rainfall in millimetre and temperature (°C) of the region.^[20] It was also noted that beyond a critical temperature (around 30°C) the EPG rises enormously. Rainfall directly influences the pathogenicity of the parasitic infection level. Unlike other bacterial and viral infections, the gastrointestinal parasites maintain a steady host sustainable relationship, which prevents the host from dying out of this infection. Simultaneously, the parasite contributes to a severe loss of production level in animals through nutrition sharing with the host. Therefore, to prevent production loss, it was suggested by those authors that parasite-controlling anti-helminthic therapy (both preventive and curative) should be implemented at the time in the region when the rainfall is above 100 mm and the ambient temperature is around 30°C.

Seasonal variations of gastrointestinal parasitosis have also been reported by some other investigators.^[21,22] Intestinal parasitic infection is significantly associated with rainy season among HIV patients. Furthermore, rainy season may facilitate conditions and risk factors predisposing to intestinal parasitic infections. Indeed, other parasitic infections such as malaria parasitaemia have been reported to have higher prevalence in the rainy season. Considering individual parasitic agents, *Cryptosporidium* species and *Strongyloides stercoralis* were the only parasitic agents that were associated with rainy season. The finding of *Cryptosporidium* in association with rainy season had been noted and its transmission is via different routes such as water, person-to person, contact with animal, etc. During the rainy season cattle are seen roaming and grazing freely and as a result defecate on soil. These faeces are washed into nearby streams, and rivers by flood of rain.^[21] For parasites where eggs are deposited in faeces, temperature can influence both rates of parasite development and the survival of external stages. For larval stages to develop, first the temperature must exceed a critical threshold, and then parasite development rates further increase with temperature above this threshold. Moisture is also critical for the development, survival and movements of helminth larvae. Dry conditions can limit transmission and cause larvae to migrate into the soil, although excessive rainfall can wash away eggs and other infectious stages.^[9] Consumption of such contaminated water can lead to *Cryptosporidial* infection and indeed, the prevalence of *Cryptosporidial* infection has been reported to be higher among HIV patients that use streams and rivers as a source of water.

In resource-poor settings, mostly people walk and play in open field barefooted, especially in the rainy season and these habits increase the chances of *Strongyloides stercoralis* infection. This may explain the association of *S. stercoralis* with the rainy season. Although, a similar mechanism of

infection is also utilised by hookworm, the reason for the lack of association between hookworm and season is unclear. No significant association was seen between intestinal parasitic infection and seasonal variation among the non-HIV patients and the reason for this finding is unclear. *Ascaris lumbricoides* and hookworm infections were the only intestinal parasites recovered from the non- HIV patients.^[21] However, our study is probably the first of its kind originally from Bihar which emphasises on the relationship of seasonal changes with that of intestinal parasitosis.

CONCLUSION

From our as well as other national and international studies, it can now be safely concluded that seasonal variations do occur in the rates of occurrences of different intestinal parasite infestations, due to differences in temperature, humidity and rainfall, in particular. These findings could be utilised for proper timing of preventive anti-helminthic therapy as is done in school children and also for more detailed analysis and further research.

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