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Original Research Article

Socio-economic and behavioural risk factors of visceral leishmaniasis in the East Champaran district of Bihar

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ABSTRACT

Background: Visceral leishmaniasis is a chronic and potentially fatal parasitic disease of the viscera which affect the organs due to infection by *Leishmania donovani*. Visceral Leismaniasis, also known as Kala-Azar (KA) in the Indian subcontinent. The worldwide incidence is estimated to be between 146,700 and 282,800 cases per year. In India, it is endemic in the states Bihar and it contains more than 90 % of the cases of VL. In this region, *Leishmania donovani* is the only species causing VL. Objective: To find out the socio-economic and behavioural risk factors of VL in East Champaran district of Bihar.
Methods: A case-control study was conducted to understand the socio-economic and behavioural risk factors associated with VL in areas of East Champaran district of Bihar, India. A total of 100 VL cases and 100 healthy controls selected randomly from the neighbourhoods of cases were included in the study.
Results: The risk factors identified were showed that presence of a granary inside houses (P=0.000), sunlight inside the living room (P=0.000), banana trees near the houses (P=0.003), presence of domestic animal in the house (P=0.044), people sleep near the animal (P=0.000) and drainage system (P=0.000) were risk factors of VL.
Conclusions: These results will be useful for further improvement in the VL control programs for intervention strategies in respect of separate granary house other than the living house, presence of sunlight inside the living rooms, banana trees far from the houses, separate domestic shelter for reducing transmission and incidence of this disease.

Keywords: Visceral leishmaniasis, East Champaran, Case-control, Risk factor

INTRODUCTION

Leishmaniasis, also spelled leishmaniosis, is a disease caused by protozoan parasites of the genus *Leishmania* and spread by the bite of certain types of sand flies.[1] Leishmaniasis manifests mainly in three forms: visceral leishmaniasis (VL), cutaneous leishmaniasis (CL), and mucocutaneous leishmaniasis (MCL). VL is the most severe form of this disease and it is often fatal, if not treated.[2]

Visceral leishmaniasis (VL) is a chronic and potentially fatal parasitic disease of the viscera which affect the organs due to infection by *Leishmania donovani*. The worldwide burden of this disease is estimated to be between 146,700 and 282,800 cases per year.[3] Visceral Leishmaniasis is also known as ‘’Kala-azar’’, is a major cause of morbidity and mortality and of tremendous public health priority in India, Bangladesh and Nepal affecting the poorest population groups, primarily in rural

areas. With an estimated 200 million people at risk, India, Nepal and Bangladesh harbour an estimated 67% of the global VL disease burden.[4] Fifty percent of VL cases worldwide occur in India. In India, it is endemic in the states of Bihar, West Bengal, Uttar Pradesh and Jharkhand, but Bihar state contains more than 90 % of the cases of VL.[5] In this region, *Leishmania donovani* is the only species causing VL, the female sand fly *Phlebotomus argentipes* is the only vector and humans are the only known reservoir.[6,7] The occurrence of visceral leishmaniasis in several districts of the state Bihar has been a constant feature. This is partly due to inadequate information about the various risk factors associated with this disease.

The country is under Visceral Leishmaniasis elimination mode; therefore reduction in Visceral Leishmaniasis incidence has been the key developmental goal for monitoring the progress of the national elimination program. The need of setting such goals has been discussed and documented in various national and international deliberations and brain storming meetings at office of the directorate, national vector borne disease control program, New Delhi (NVBDCP).[8,9]

As the visceral leishmaniasis control program moves to an elimination trajectory, the program has set itself the goal of reducing the annual incidence of VL to less than 1 per 10,000 populations in at least half the currently affected blocks by the year 2017. Visceral Leishmaniasis is familiar to communities in Bihar, at least in the endemic areas. But very few people know about the various risk factors of visceral leishmaniasis in disease-endemic areas of East Champaran district, Bihar. We must understand the patterns of disease occurrence at the community level and at broader geographic and ecologic levels. To elucidate the determinants at the community level, we studied spatial patterns and risk factors for visceral leishmaniasis in a highly affected community in the east Champaran district of Bihar, India.

All the strategies adopted so far, for control of VL in India, particularly in Bihar, have concentrated on the reduction of the transmission of disease through case detection, treatment, and two rounds of spraying with DDT per year to reduce vector density. Despite the implementation of various control programs, the occurrence of VL in several parts of the state has been a constant feature. This is partly due to inadequate information about the various risk factors associated with the disease. Very little is known about the influence of socioeconomic factors on visceral leishmaniasis in disease-endemic areas of Bihar.[10-12]

Maximum research activities concerning visceral leishmaniasis have primarily focused on the characteristics of the parasite and the host. Therefore, a case-control study was conducted to determine whether socioeconomic, behavioural, and household characteristics are risk factors for occurrence of VL.

Epidemiology of visceral leishmaniasis in India

The word kala-azar was first used in India, and before this, term was coined, the manifestations of this disease were known by various other names.[13] The causative agent of Visceral Leishmaniasis remained unknown for several decades. In 1903, Major W.B. Leishman, who was posted in the Dum-Dum area of Calcutta (Eastern India), published his microscopic observations in an issue of the British Medical Journal. According to him, he had observed trypanosomes. Two months later, Prof. Charles Donovan, Professor at the Madras Medical College, Madras (Southern India), suggested that the causative agent was a new parasite. In the November 1903 issue of the same journal, Sir Ronald Ross, recognizing the contribution of both of these doctors, named the parasite *Leishmania donovani*.[14] During the first 50 years of the twentieth century, visceral leishmaniasis moved from the southern parts of India and remained endemic only in the eastern states of Assam, Bengal, and Bihar.

Objective

1. To find out the socio-demographic characteristics of the study population.
2. To determine the risk factors of visceral leishmaniasis in study area.
3. To assess the economic burden of the visceral leishmaniasis.

METHODS

Study design

The study will be based on primary data and quantitative nature. Case control study is adopted in this study.

Study duration

The data has been collected during the period June 2016 to November 2016 from East Champaran district of Bihar.

Study area

The data for this study is collected from the East Champaran district of Bihar. All 100 confirmed VL cases were taken from the Blocks of East Champaran District and controls were taken from the neighbourhood of the cases. The VL cases were taken in the study from January 2014 to December 2014. Informed consent was obtained from all cases and controls subjects before including them into this risk factor study.

Brief profile of the study district East Champaran

East Champaran district was constituted as a district on 2nd November 1972. The district came into existence after the split up of Champaran district into two parts, such as East Champaran and West Champaran. The headquater of

East Champaran district is at Motihari. Presently East Champaran consists of six sub-division and twenty seven Blocks. The District covers an area of 3968.0 sq. km. The main river of the East Champaran is Gandak, Budhi Gandak and Bagmati are important rivers flowing through this region. The district lies on the northern end of the state Bihar. It touches the Indo-Nepal border. There are 6 sub-division and 27 community development block in the district. There are 1293 village, 405 panchayat and 10 statutory towns in the district (2011 census).

East champaran is an important pilgrim centre for both Buddhists and Hindus. They are Shiv mandir at Areraj, Kesariya Bodh Stup, Gandhi memorial and Surya Mandir. It is 153 kilometers from state capital and just after crossing river Ganga. East Champaran latitude = 26.6098'N and longitude = 84.8568'E. The total population of district was 50, 82,868 with 2,681,209 males and 2,418,162 females, literacy rate as 58.26 and sex ratio of 901/1000. The population density is 1293 inhabitants per square kilometre and the population growth rate over the decade 2001–2011 was 29.43% as per 2011 census (Figure 1).

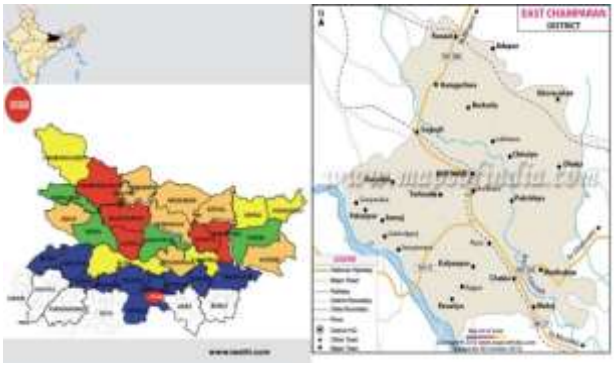

Figure 1: Endemicity of VL in East Champaran, Bihar.

Endemicity of visceral leishmaiasis in Bihar: The map shows different colors as per incidence of the disease. Red colored areas are districts with high incidence followed by green, orange and yellow. Blue colored areas are places with lower incidence.

Inclusion criteria

All the Visceral Leishmaniasis cases aged 2 years and above will be included in the study in respect of gender.

Exclusion criteria

Cases which were less than 2 year were excluded from the study.

Sample size

In this study 100 Kala-azar cases are taken from the study area and 100 healthy controls are neighborhood of the cases. There are 27 Blocks in the East Champaran District. Out of which 12 blocks had reported kala-azar cases more than 20, in the year 2014. Five Block having larger number of kala azar cases are chosen randomly. From each block 20 kala-azar cases are taken as per convenience.

Data collection

Schedules method will be used for collection of data.The socioeconomic factors for VL was included and questions relating to the nature, type of houses, presence of sunlight in the living room, the presence of granary into the house, the presence of banana tree around the house and presence of vegetation around the house were checked during the data collection.

Statistical technique

Initially data has been entered in MS excel, then transferred to trail version of SPSS 16.0. The number and percentage of a age, education, income, occupation and various factors for cases and control group were determined. Odd ratios and its 95% confidence interval of various risk factors of visceral Leishmaniasis were calculated.

RESULTS

The study is based on 200 subjects out of which 100 are case and the same are control. The important findings of demographic data and characteristics of the cases and controls are presented in the Table 1. Majority of the study population belongs to age group less than 15 year i.e. 36.5% in which cases were 42% and controls were 31% followed by 21% for the age group 15-30 year in which cases were 23% and controls were 19%. A very less 4.5% are in the elderly age group in which cases were 4% and controls were 5%.

The male population is more than female in the case (56%) as well as in the control (60%). Further overall illiteracy is high in the study population of east Champaran district i.e. 52.5%. The main occupation of the head of household is farmer i.e. 45% followed by private job i.e. 26.5% in the study area. Maximum of the family (67.5%) has total yearly income is less than Rs. 40,000. However a very few percentage i.e. 9.5% having more than Rs. 80,000 income in a year. The housing condition of the respondent in the study area was not better. 92% of the houses were at high risk of VL as they are either semi-pacca or kacha or hut. Only 8% of the houses were pacca in the study area of East Champaran district.

Difference in the proportion in each age group (P=0.088), gender (P=0.567) and education (P=0.066) of cases and controls were not statistically significant (Table 2). And most of the cases and controls belong to low socioeconomic group of the community. Because maximum people were farmer. And their housing condition is not good.

Table 1: Demographic characteristics of the study subjects.

Characteristics	Case	Control	Total
Age group (in years)			
<15	42(42%)	31(31%)	73(36.5%)
15-30	23(23%)	19(19%)	42(21%)
31-45	23(23%)	17(17%)	40(20%)
46-60	8(8%)	28(28%)	36(18%)
>60	4(4%)	5(5%)	9(4.5%)
Sex			
Male	56(56%)	60(60%)	116(58%)
Female	44(44%)	40(40%)	84(42%)
Educational status			
Illiterate	46(46%)	59(59%)	105(52.5%)
Literate	54(54%)	41(41%)	95(47.5%)
Occupation of head of household			
Unemployed	10(10%)	10(10%)	20(10%)
Private job	28(28%)	25(25%)	53(26.5%)
Farmer	45(45%)	45(45%)	90(45%)
Others	17(17%)	20(20%)	37(18.5%)
Total family income (in year)			
<40,000	65(65%)	70(70%)	135(67.5)
40,000-80,000	24(24%)	22(22%)	46(23%)
>80,000	11(11%)	8(8%)	19(9.5%)
Types of house			
Pacca	5(5%)	11(11%)	16(8%)
Semipacca	29(29%)	23(23%)	52(26%)
Kacha	30(30%)	30(30%)	60(30%)
Hut	36(36%)	36(36%)	72(36%)

Table 2: The Distribution of the cases and controls by age, gender and education.

	Cases	Control	OR	95% CI	P-value
Age (in years)					
<20	51	39	1.628	(0.929,2.854)	0.088
>20	49	61			
Gender					
Males	56	60	0.848	(0.484,1.489)	0.567
Females	44	40			
Education					
Illiterate	46	59	0.592	(0.338,1.036)	0.066
Literate	54	41			

The unadjusted odds ratio of the risk factors is shown in the Table 3. The results showed that presence of sunlight in the living room (OR =14.194, 95% CI = 7.096-28.394, P=0.000), presence of granary inside the house (OR =10.149, 95% CI=0.736-21.750, P=0.000), presence of vegetation around the house (OR =10.149, 95% CI=1.011-3.149, P=0.045) presence of banana tree around the house (OR =2.398, 95% CI=1.328-4.329, P=0.003), sleeping near the domestic animal (OR =6.107, 95% CI=2.469-15.104, P=0.000) and improper drainage system (OR =0.211, 95% CI=0.111-0.401, P=0.000) were significant risk factors by univariate analysis.

DISCUSSION

This study is done to assess the association of various socioeconomic and the environmental factors with occurrence of visceral leishmaniasis using case control design approach. Poor housing condition lack of knowledge in the form of sanitation, bed net and illiteracy. In the present study shows preponderance among males (56%). A male preponderance was also observed in the previous study.[15-17] Maximum numbers of the VL cases were found living in the house which were hut (36%) and kacha house (30%) and 65% of VL cases having less than 40,000 income per year. Which has also

been previously reported.[18] Thus poverty could be the major determinant for the transmission of visceral leishmaniasis in the East Champaran district and other parts of Bihar.

Table 3: The unadjusted ORs of the risk factors for individual and family characteristics.

	Cases	Control	OR	95% CI	P-value
Sunlight in					
No	73	16	14.194	(7.096,28.394)	0.000
Yes	27	84			
Granary					
Yes	90	47	10.149	(4.736,21.750)	0.000
No	10	53			
Vegetation					
Yes	61	51	1.784	(1.011,3.149)	0.045
No	35	49			
Banana					
Yes	73	53	2.398	(1.328,4.329)	0.003
No	27	47			
Bamboo					
Yes	78	71	1.448	(0.763,2.748)	0.256
No	22	29			
Domestic animal					
Yes	77	64	1.883	(1.014,3.498)	0.044
No	23	36			
Separate shelter					
Yes	37	38	0.633	(0.324,1.237)	0.180
No	40	26			
Sleep near animal					
Yes	33	7	6.107	(2.469,15.104)	0.000
No	44	57			
Proper drainage system					
Yes	18	51	0.211	(0.111,0.401)	0.000
No	82	49			
Presence of latrine					
Yes	8	6	1.362	(0.455,4.080)	0.579
No	92	94			
Knowing VL					
Yes	18	29	0.537	(0.275,1.049)	0.067
No	82	71			
Can you protect VL					
Yes	33	24	1.560	(0.839,2.899)	0.159
No	67	76			
DDT spray in house					
Yes	85	77	1.693	(0.828,3.477)	0.149
No	15	23			

The presence of granaries inside the houses was found to be significantly associated with visceral leishmaniasis because they are usually kept inside the houses. In the village area of East Champaran, houses are usually surrounded by the high density of vegetation such as seasonal crops, banana trees, bamboo trees and herbs. The presence of vegetation was significantly associated with VL in univariate analysis. The presence of vegetation as a risk factor of VL has been previously reported.[11] In this study presence of banana tree around the house was significantly associated with visceral leishmaniasis.[19] Also sleeping near the domestic animal and improper drainage system was significantly associated with visceral leishmaniasis. Better housing and improved living conditions in disease area of East Champaran, Bihar could reduce the transmission of the disease by eliminating conditions suitable for the breeding of sand flies inside the houses.

CONCLUSION

These results will be useful for further improvement in the VL control programs for intervention strategies in respect of separate granary house other than the living

house, presence of sunlight inside the living rooms, banana trees far from the houses, separate domestic shelter for reducing transmission and incidence of this disease and proper implementation of existing health awareness programs could help people in the rural areas to change their behavioural pattern by keeping granaries outside the living rooms and minimise vegetations around the house that support sand flies. Block level awareness program, aaganbadi (local women's group dealt with nutrition and sanitation awareness) and local Non-Government Organizations (NGO) should also be actively involved in awareness programs.

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