

A Cross-sectional Survey to Indicate Factors Associated with Kala-Azar in Humans at Fulbaria Upzila of Mymensingh, Bangladesh

*Khan, M.F.H.¹, Bari, F.Y.², Bari, A.S.M.³

1. *Department of Medicine and Surgery, Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh*

2. *Department of Surgery and Obstetrics, Bangladesh Agricultural University, Mymensingh, Bangladesh*

3. *Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh*

Abstract

A cross-sectional survey was carried out in the people of eight selected villages of Fulbaria upazila, Mymensingh district where occurrences of kala-azar were reported over the last 5 years. To assess the risk factors of the disease, a total of 385 randomly selected individuals in the said kala-azar prone area were assessed with a pre tested questionnaire. The results showed that 19% of the kala-azar cases developed post kala-azar dermal leishmaniasis. Among the kala-azar positive respondents 30.4% were male, and 21.2% female. Children less than 10 years of age (36.76%) were recorded with a relatively higher risk and the frequency of kala-azar get decreased with increment of age ($p=0.0057$). People who reared domestic animals and had animal sheds in vicinity of their houses had a higher prevalence (33.0%) ($p= 0.0019$). Other factors associated with a higher risk included no knowledge about sand fly ($p= 0.02$), sleeping on bed during night, living in mud house and small-sized family. Interestingly, mosquito curtain users experienced a higher frequency (26.3%) of kala-azar compared with non-users (15.38%). The causalities of the identified factors need to be investigated further to formulate an effective public health policy against kala-azar in that area, and the need for a well-structured case-control study was stressed.

Keywords: Animal shed, Kala-azar, Sand fly

* *Corresponding author:* forrukh.dvm@gmail.com

1. INTRODUCTION

Kala-azar, also known as visceral leishmaniasis (VL), black fever, and Dumdum fever, is a disease caused by an intracellular protozoan parasite of the genus *Leishmania* and is transmitted by the sand fly of the genus *Phlebotomus*. It is considered to be the second-largest deadly parasitic disease next to malaria, responsible for an estimated 500,000 cases each year worldwide (Desjeux, 2001). The *Leishmania* parasite migrates through internal organ routes including liver, spleen, and invades to other visceral organs before they lodge to bone marrow to lead to mortality, unless treated. Common signs and symptoms of leishmaniasis include fever, weight loss, mucosal ulcers, fatigue, anemia and substantial swelling of the liver and spleen.

In Bangladesh, sporadic kala-azar cases were reported initially in the 1970s, followed by an outbreak occurred in Pabna district in 1980 before it became widespread (Elias *et al.*, 1989). The annual number of kala-azar cases in Bangladesh has been reported to be close to 45,000 (Bern and Chowdhury, 2006). Ninety percent of total cases in Bangladesh were reported from the 10 districts, found by an extensive retrospective hospital-based case study during the period of 1994-2004. More than 50% cases reported to have originated in Mymensingh district and in it Fulbaria upazilla was recorded with the highest number following an epidemic in 2004. Post-kala-azar dermal leishmaniasis (PKDL) is usually a sequel of kala-azar (Das *et al.*, 2010). PKDL is also an important health hazard with skin lesions ranging from hypopigmented macules, erythematous patches and papulo-nodular lesions either singly or in combination in the absence of systemic involvement. It is mostly developed in those who received inadequate and irregular treatment of kala-azar (Zijlstra *et al.*, 2003, Zijlstra *et al.*, 2000). Importantly, patients with PKDL are considered as reservoirs of kala-azar (Ganguly *et al.*, 2010).

The frequency of kala-azar was reported higher in male than female, but negatively correlated with age (Palumbo, 2010; Singh *et al.*, 2010a; Singh *et al.*, 2010b; Joshi, 2009). A few earlier studies on kala-azar indicated some inconclusive demographic and family-linked factors in Fulbaria upazila, where economic and living standards are poor (Mamoon *et al.*, 2006). A more intensive and structured survey might find out more possible risk factors. With this background, this present survey was undertaken to unveil some more potential risk factors for kala-azar in the upazila of Fulbaria, Mymensingh.

2. MATERIALS AND METHODS

A cross-sectional survey was carried out among the people of eight selected villages of Fulbaria upazila in the district of Mymensingh between June and December, 2010. This upazila was selected because previous kala-azar outbreaks occurred here in the last five years (Bern and Chowdhury, 2006). The selected eight villages were Kaladah, Kalakanda, Pachkohania, Kalanajani, Bakta, Andarpara, Chowda, Chankanda. Hospital records helped in selecting these villages. A questionnaire was administered to the villagers to record data for the variables listed there. The kala-azar patients registered to the hospital were the cases and clinically healthy people nearby the cases were the controls. All the cases and controls were within 20 km radius of the upzila health complex. Cases were diagnosed at the upazila health complex. A total of 100 cases and 285 controls were enrolled. The questionnaire was filled out with direct interviews with the case and the control respondents. Variables included in the survey were related to detailed information and demography of the respondents (Name, age, sex, family size, housing standard, sleeping patterns, use of mosquito curtain, knowledge about sand fly, total number of infected people in the family, type of infection (kala-azar or PKDL), livestock rearing practice and their composition).

To record data only unanimous codes were used and all the respondents gave their verbal approvals to be included in the survey. The collected data were compiled and entered into Microsoft Excel 2007 for sorting and later subjected to cross-checking for screening of missing values, duplication and outliers, before importing into statistical software (SPSS). Descriptive analysis with respective response proportion on exposures and contingency tabulation were constructed to measure association and effect between kala-azar/PKDL positive cases with their possible exposures. Chi-square test and respective P values were calculated to test the significance of measured associations.

3. RESULTS AND DISCUSSION

The survey results are summarized in Table 1. Out of the 100 kala-azar cases 19 developed PKDL. Children less than 10 years of age (36.8%) were recorded to be more vulnerable to be infected with kala-azar than adults. Kala-azar frequency had a downward trend with advanced age. The relationship between age categories and kala-azar was statistically significant ($p = 0.0057$). A positive

association between different age categories with kala-azar was also reported earlier in Bangladesh (Mamoon *et al.*, 2005) and elsewhere (Palumbo, 2010; Sarkari *et al.*, 2010; Albuquerque *et al.* 2009; Bern *et al.*, 2007; Zerpa *et al.*, 2003; Mohebali *et al.*, 2001; Davies *et al.*, 1999; Soleimanzadeh *et al.*, 1993). This association could be attributed to low immunity and relatively lower protective delayed type of hypersensitivity (DTH) response in the children and the young compared with the adults (Bern and Chowdhury, 2006). The male patients were at higher risk. The association of sex with kala-azar was also significant ($p=0.0408$). This result is consistent with other earlier studies in Bangladesh (Rukunuzzaman and Rahman, 2008; Mamoon *et al.* 2005) and also in other countries (Rijal *et al.*, 2010; Singh *et al.*, 2010a, Singh *et al.*, b; Alvar *et al.*, 2007; Guerra *et al.*, 2004; Zerpa *et al.*, 2003; Soleimanzadeh *et al.*, 1993).

Kala-azar frequency was higher (33.0%) in people who reared domestic animal and whose houses were at close proximity to animal sheds ($p=0.0019$). This finding is in accordance with the observation of Singh *et al.*, (2010a), Singh *et al.*, (2010b), Amro *et al.*(2009); Mamoon *et al.*(2006), Gavgani *et al.* (2002). Animal sheds and surrounding areas, in absence of proper drainage facilities, could act as a breeding site for *Phlebotomus argentipes* (Singh *et al.*, 2008; Kundu *et al.*, 1995; Kesari *et al.*, 1992; Ghosh *et al.*, 1991; Dhiman *et al.*, 1983). *Phlebotomus argentipes* also sucks cattle and goat blood to live on, thus facilitating the transmission of the causative protozoa (Palit *et al.*, 2005; Basak *et al.*, 1995; Ghosh *et al.*, 1990). Therefore, keeping domestic animals in the vicinity of human dwellings might be an important risk factor for kala-azar in Bangladesh.

About 29.8 % of kala-azar positive patients and their family members had no idea of sand fly as being the transmitting agent of kala-azar, opposed to 19.6% who recognized the fact – this perception was significant ($p=0.02$), an agreement with Mamoon *et al.* (2006). Lack of knowledge and awareness about the transmitting insect vector might increase the risk of kala-azar in Fulbaria upazila.

Sleeping on mattress during night had a higher risk (28.12%) for kala-azar compared with sleeping on bare floor (15.4%) ($p=0.0328$). Contrary to this finding, a higher frequency of kala-azar was reported in floor-sleeping people (Rukunuzzaman and Rahman, 2008).

Living in mud house had a proportionate but not significant higher risk (26.1%) compared with better non-mud ones. Cracks and crevices usually in mud houses with dampness and earthen floor might facilitate sand fly to breed.

Table 1. Results of the survey to identify risk factors for kala-azar in the Fulbaria Upzila, Mymensingh district, Bangladesh

Variable		No. case	No. control	χ^2	P
Age (years) (N=385)	Upto 10	25(36.76%)	43(63.24%)	16.44	0.0057
	11-20	21(30.89%)	47(69.11%)		
	21-30	23(30.67%)	52(69.33%)		
	31-40	19(26.03%)	54(73.97%)		
	41-50	8(13.56%)	51(86.44%)		
Sex (N=385)	>50	4(9.52%)	38(90.48%)	4.185	0.0408
	Male	61(30.35%)	140(69.65%)		
	Female	39(21.20%)	145(78.80%)		
Domestic animal (N=385)	Present	63(32.98%)	128 (67.02%)	9.68	0.0019
	Absent	37(19.07%)	157(80.93%)		
Knowledge about sand fly (N=385)	Yes	28(19.58%)	115(80.42%)	5.36	0.02
	No	72(29.75%)	170(70.25%)		
Sleeping on: (N=385)	Mattress	90(28.12%)	230(71.88%)	4.557	0.0328
	Bare floor	10(15.38%)	55(84.62%)		
House made of: (N=385)	Clay	47(26.11%)	133(73.89%)	0.003	0.95
	Other	53(25.85%)	152(74.15%)		
Using Mosquito curtain (N=385)	Yes	98(26.34%)	274(73.66%)	0.279	0.596
	No	2(15.38%)	11(84.62%)		
No. of Family member (N=385)	≤5	80(27.59%)	210(72.41%)	1.581	0.2086
	>5	20(21.05%)	75(78.95%)		

Some previous studies indicated mud-house an important risk factor for kala-azar (Bern *et al.*, 2010; Singh *et al.*, 2010a; Singh *et al.*, 2010b; Saha, 2009; Kumar *et al.*, 2009; Rukunuzzaman & Rahman, 2008; Mamoon *et al.*, 2006; Schenkel *et al.*, 2006; Bern *et al.*, 2000).

Among mosquito curtain users 26.3% were kala-azar positive, significantly higher than those who did not use it ($p=0.596$), an agreement with Rukunuzzaman and Rahman (2008), Mamoon *et al.* (2006) and Schenkel *et al.* (2006). This may be due to the fact that the pore-size of mosquito net might not prevent sand fly from entering the net. Therefore, sand fly repellent-treated bed net might be an alternative option to conventional mosquito net to protect people from kala-azar (Picado *et al.*, 2010; Bern *et al.*, 2005). On the contrary, some studies showed that use of normal bed net could provide protection against kala-azar (Bern *et al.*, 2010; Saha, 2009; Bern *et al.*, 2007; Bern and Chowdhury, 2006). The discrepancy between these findings could be attributed to different geographic locations and ecologies. Participants having ≤ 5 family members had a higher risk for kala-azar compared with a family size of >5 members ($p=0.2086$).

Like many other retrospective observational studies, this survey although attempted systematically but still had inherent limitation of having systematic and random error attributed to recall information and selection biases. A well-designed case-control study conducted within no later than 6-12 months of the occurrences of the cases and with a larger sample size could identify and elucidate more risk factors of kala-azar in Bangladesh.

4. CONCLUSION

Although a limited retrospective survey was conducted among villagers of eight selected villages, several factors associated with age, sex, rearing of domestic animal in closer proximity to human houses and no knowledge about sand fly as the transmission vector were found to be positive influences on the occurrences of kala-azar. Well-structured further case-control studies are needed to verify the risk factors identified from this preliminary study, and to unveil more other new ones.

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