

Original Research Article

Assessment of the use of impregnated bed nets in prevent and control sand fly bites in endemic area with visceral leishmaniasis, Eastern Sudan-2013

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ABSTRACT

Background: Leishmaniasis is a disease caused by protozoan parasites of the genus *Leishmania*. Sand flies, (members of the Phylum Arthropoda and belonging to the class Insecta) transmit leishmaniasis. Animals as reservoirs of infection include dogs, monkeys, and ponies. It was also found that other animals such as hyenas, and jackals could not be ruled out as potential reservoirs.

Methods: An epidemiological - cross sectional study conducted in Sudan, during the period 2011-2013, among the students in Gadaref university, aimed to determine the effectiveness of impregnated bed nets as control and protective measures for sand fly bites. The study included students coming from outside the study area, with no history of coetaneous Leishmaniasis. 155 students in first year were included in this study as study group (90) were male and (65) were female.

Results: The study revealed highly percentage regarding the effectiveness of bed nets in preventing insect access due to students answers with 92.1% male and 96.3% female, versus 7.9% and 3.7% with negative answers respectively. No infection by coetaneous or visceral Leishmaniasis were reported post intervention among study group while (11) cases where reported in control group.

Conclusions: The preventive measures such as impregnated bed nets are very effective in control of infection.

Keywords: Bed nets, Impregnated, Leishmaniasis Gadaref University, Orientalis LST, Phlebotomus, Pyrethrin

INTRODUCTION

Leishmaniasis is a disease caused by protozoan parasites of the genus *Leishmania*. The genus *Leishmania* is divided into two subgenera based on the development in the sand fly vector.¹

Geographical distribution: In the Old World, sand flies (phlebotomus) tend to be more numerous in relatively dry zones. In the New World, they favor the forests, which cover much of the tropics. Thus, they occur in warmer regions of temperate countries, e. g. Mediterranean countries, in the Middle East, Africa, India and China, and in tropical countries. Of medical importance there,

Lutzomyia species are especially common in forested areas of Central and South America.³

Table 1: Taxonomy of sand flies.²

Kingdom	Animalia
Subkingdom	Metazoa
Phylum:	Arthropoda
Class:	Hexapoda
Class	Insecta
Subclass:	Pterygota
Order:	Diptera (two-winged insects)
Suborder:	Nematocera
Family:	Psychodidae
Subfamily:	Phlebotominae
Genus	phlebotomus

Epidemiology

Sand flies have a limited chance to find a host since the distance they can travel is short compared with some flies or even mosquitoes. They often move in short hops. Most of them remain within 20-30 cm of the soil surface. Sand flies are usually not found at great altitudes, but have been reported as vectors of dermal Leishmaniosis at 2800 m in Peru.⁴

Prevention and control

The best way for prevention of leishmaniasis is by protection from sand fly bites. Vaccines and drugs for preventing infection are not yet available. The following instructions are important to decrease the risk of infection;

- Stay in well-screened or air-conditioned areas as much as possible. Avoid outdoor activities, especially from dusk to dawn, when sand flies are the most active.
- When outside, wear long-sleeved shirts, long pants, and socks. Tuck your shirt into your pants.
- Apply insect repellents on uncovered skin and under the ends of sleeves and pant legs.
- Follow the instructions on the label of the repellent. Spray clothing with permethrin-containing insecticides. The insecticide should be reapplied after every five washings. Spray living and sleeping areas with an insecticide to kill insects.⁵

Objectives of the study

To evaluate the effectiveness of impregnated bed nets in prevent and control of sand fly bites.

METHODS

Study design: Epidemiological - cross sectional study among first year students in University of Gadara 2013.

Study area: University of Gadaref was established in 1994, in Gadaref town. It consists of 7 faculties; Medicine and public health sciences, Islamic studies, primary education, computer sciences, Agriculture and environment, economics and faculty of education. The total number of the new student intake is about 1370 students annually.

Gadaref state is sited in the eastern part of the Sudan 413 km from Khartoum, between longitudes 34 and 36 east, and latitudes 12 and 17 north. The total number of population is 1,770,000 according to 1993 census.

Gadarif state consists of five localities: Gadarif, Elrahad, Alfawo, Alfashaga and Galabat. The total number of villages is 648.

Study population: First year students coming from outside the study area, with no history of leishmaniasis.

Sample size

Total population =1,770,000

Total number of the first year students = 956

Total number of cases in 2007= 4042

P =25%

$$n = \frac{Z^2 \times P \times Q}{D^2} = \frac{(1.96)^2 \times 25 \times (7.5)^2}{(0.05)^2} = 216$$

Where:

n=216 increased to 300.

n= sample size.

Z=standard normal distribution.

P=proportion.

Q=complementary probability = (1-P)

D =differences to be detected (level of confidence)

Table 2: Sample size calculation.

Faculty	Total number of new students	Sample size
Economic studies	217	87
Computer	171	68
Islamic studies	148	59
Agriculture	106	42
Education	110	44
Total	754	300

Sample technique

Proportion = 300x100 = 40%

754 students selected proportionally from the faculties lists, according to the calculated sample size. The sample randomly divided into two groups as:

Economics and computer as study group =155

Islamic studies, Agriculture and Education as control group = 145.

Data collection: A questionnaire was designed to collect information needed in the study. It consists of dependent variable as duration of using bed nets.

Leishmanin skin test (LST): Leishmanin is a reagent recommended for skin test in human for Immuno-epidemiological studies and as an aid in diagnosis.

Bed nets: Pyrethrin-impregnated bed nets with mesh size of 156 holes per square distributed to the study group.

Data analysis: Data collected from health records and questionnaire analyzed by special computer program (SPSS programme).

Night visits: Three night visits to student's settlements were done by the team to insure that the students were using the bed nets.

Inclusion criteria: Students involved in this study were from Gadaref University, from outside Gadaref State and with no history of leishmaniasis.

Exclusion criteria: Students with positive results to leishmanin skin test in pre-test were excluded.

Ethical considerations: Regarding the ethical consideration, agreement was obtained from Gadaref University, Ministry of Health, and National Program for Leishmaniasis Eradication and the Students involved in the study.

RESULTS

The socio-demographic characteristic of the respondents was 155. The respondents' ages ranged between 18 and less than 25 years, with mean about (21+) years.

There was no significant differences in duration of using bed nets between male and female among the study group (34% and 28.1%) male and female respectively, were using the bed net daily, the with p value=0.09 (Table 3).

The total number of respondents was (102), (63 male) and (39 female). According to their answers about the use of bed nets, there was strong relationship between the use of bed nets and it's comfort in use with p value= (0.001) (were correlation is significant at >0.05) (Table 4).

Highly percentage regarding the effectiveness of bed nets in preventing insect access due to students answers with 92.1% male and 96.3% female, versus 7.9% and 3.7% with negative answers respectively (Table 5).

After six months of using the impregnated bed nets, the study showed: 84.5% of bed nets were not damaged (only 6 and 18 bed nets showed 1-2cm and 2-3 cm damage

respectively). These results were calculated from the total of the male and female. Quantification of damage in bed net was measured by the end of the first six months, any damaged bed net during that period were replaced immediately (Figure 1).

Table 3: Duration of using bed nets Cross tabulated to the gender n=155.

Duration of the using of bed nets	Gender		Total
	Male	Female	
Daily	51	41	92
	55.4%	44.6%	100.0%
	34.9%	28.1%	63.0%
Rare	21	12	33
	63.6%	36.4%	100.0%
	14.4%	8.2%	22.6%
Never	17	4	21
	81.0%	19.0%	100.0%
	11.6%	2.7%	14.4%
Total	89	57	146
Percentage of total	61.0%	39.0%	100.0%

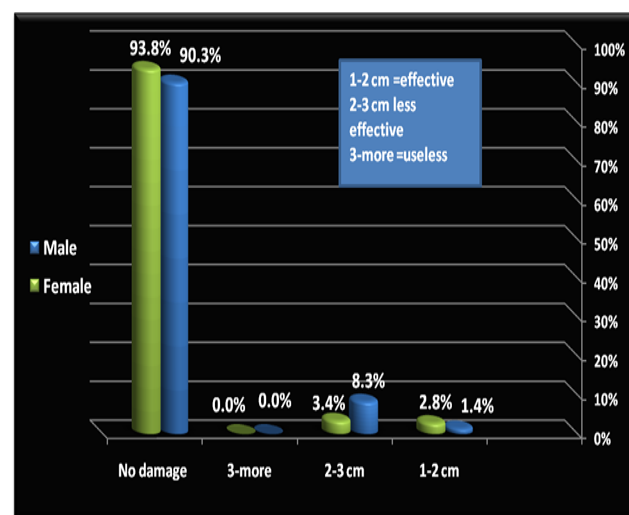


Figure 1: Quantification of damage in the bed nets frequency distribution (n=155).

The post-test by leishmanin skin test (LST) revealed increase in positivity within the control group (although statistically not significant) compared with study group 9 cases (6.52%) to 2 (1.34%) respectively (Table 6).

The independent variable using of bed nets Since $t = 19.047$, and the level of significance = 0.000. This result is statistically significant at 0.05. The study showed strong relation between frequency of using bed nets and the results of leishmanin skin test, post intervention with P value = 0.000 (Table 7).

Table 4: Shows student's experiences regarding use of impregnated bed net n=155.

Student feedback				Gender		Total	
				Male	Female		
Comfortable				63	39	102	
				61.8%	38.2%	100.0%	
				43.2%	26.7%	69.9%	
Disturbing				10	14	24	
				41.7%	58.3%	100.0%	
				6.8%	9.6%	16.4%	
I don't know				16	4	20	
				80.0%	20.0%	100.0%	
				11.0%	2.7%	13.7%	
Total				89	57	146	
Percentage of Total				61.0%	39.0%	100.0%	
Equation	Model summary				Parameter estimates		
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	0.475	130.482	1	144	0.001	0.246	1.138

Table 5: Assessment of bed net preventing insect's access.

Student feedback		Gender		Total
		Male	Female	
Dose bed net prevent insects access	Yes	Count	70	52
		% within of the total male and female	57.4%	42.6%
		% within the gender	92.1%	96.3%
		% of Total	53.8%	40.0%
	No	Count	6	2
		% within dose bed net prevent insects access	75.0%	25.0%
		% within what is the gender?	7.9%	3.7%
		% of Total	4.6%	1.5%
	Total		76	54
	% within Dose bed net prevent insects access		58.5%	41.5%
	% within what is the gender?		100.0%	100.0%
Percentage of Total			58.5%	41.5%

Table 6: Results of leishmanin skin test frequency distribution post intervention.

	Positive LST	Negative	Missed	Total
Study group	0 (0.0%)	149 (96.1%)	6 (3.9%)	155
Control group	11 (7.6%)	129 (89.1%)	5 (3.5%)	145

Table 7: Correlations between leishmanin skin test results and using of bed nets post intervention in study group n=155; one-sample test.

	Test Value = 0					
	T	DF	Sig. (2-tailed)	Mean difference	95% Confidence interval of the difference	
					Lower	Upper
Using of bed nets	19.047	155	0.000	1.88356	1.6881	2.0790
Test result						

DISCUSSION

Results of our interventions regarding the use and quantification of bed nets revealed that there is no significant differences in duration of using bed nets between male and female, the daily use is 34.9% in male and 28.1% in female with p value=0.09 (Table 3). Most rural communities have good knowledge and practice towards bed nets and repellents as revealed in a study carried out in Muzaffarpur district of Bihar State-India 2006.⁶

Also the study revealed 43.2% of male said the use of bed nets is comfortable 6.8% disturbing and 11% don't know compared to 26.7% female said its use is comfortable, 9.6% disturbing, and 13.7% don't know. There is strong relationship between the use of bed nets and its comfort in use with p value= (0.001) (were correlation is significant at >0.05) (Table 4). No study touched the use of bed nets in term of comfortability and disturbance before.

Highly percentage regarding the effectiveness of bed nets in preventing insect access due to students answers with 92.1% male and 96.3% female, versus 7.9% and 3.7% with negative answers respectively (Table 5).

Regarding the damage in bed nets in the third night visit (after 6 months use) showed 4.1% with holes diameter between 1-2 cm, 11.7% holes of 2-3 cm, 1.4% between 3-4 cm and 7.6 % more than 4 cm (Figure 1), but there is no relationship between the use of bed nets and the damage, by means damage was not barrier for the use with P value >0.05 (0.678). These results were comparable to the study conducted in Kenya 1992 assessing impregnated bed nets efficiency in controlling sand flies which revealed that impregnated bed nets with damage less than 3cm were effective in preventing insects access to the host.⁷

All these results are comparable to field investigation study in Sudan, in the year 1999, in (Bellow & Elgamel) and Dinder National park.⁸ All mentioned studies also concluded that IBNs provide complete protection from bites of the sand fly.

The study reported 11 positive cases representing (7.6%) of the total number of control group within one year. The study confirmed the effectiveness of using bed nets, repellents and health education as preventive measures.

The study showed strong relation between frequency of using bed nets and the results of leishmanin skin test, post intervention with P value =0.000 (Table 7).

This finding coincided with the study of Kala Azar vector control measures in Eastern Nepal 2007.⁹ And the study carried out in Isfahan (Iran) from march 2003-march 2005.¹⁰

And also comparable to field investigation study in Sudan, in the year 1999, in (Bellow & Elgamel) and Dinder National park.¹¹ All mentioned studies also concluded that IBNs provide complete protection from bites of the sand fly.

CONCLUSION

The study reported 11 cases with positive results for leishmanin skin test within one year, so students were victims of the diseases as a result of lack of knowledge and experience regarding health problem which they may face in their new settlements, in addition to the poor living conditions, and bad nutrition status.

The preventive measures such as impregnated bed nets are very effective in control of infection.

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