Efficacy of Deltamethrin and Cyfluthrin Impregnated Cloth over Uniform against Mosquito Bites

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Abstract

Background : The difficulty with insecticide treated mosquito nets is that in military operation, it may not be practical for the personnel to carry mosquito nets with them. In mobile military operations, availability of pre-treated 'patches of cloth' or 'bands', which can be applied over the uniform at strategic sites, could be a feasible alternative.

Methods : A double blind randomised controlled trial was undertaken among troops deployed in counter-insurgency operations in the northeastern parts of the country, to assess the efficacy of synthetic pyrethroid pretreated patches in reducing man mosquito contact, as compared to conventional repellents.

Result : The study indicated that pretreated patches, when affixed over the uniform, provided significantly higher protection from mosquito bites, when used in addition to the conventional repellents.

Conclusion : The study recommends that synthetic pyrethroid treated patches be made available to troops operating in highly malarious areas.

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Key Words : Synthetic pyrethroid treated patches; Man-mosquito contact

Introduction

Treatment of mosquito nets with synthetic pyrethroids like permethrin or deltamethrin enhances the protection provided by the mosquito net. It has been studied in various community level settings and recommended as a malaria control measure [1,2]. However during mobile military operations, it may not be practical for the personnel to carry mosquito nets with them. Various protective modifications include, impregnation of curtains, treatment of cloth-sheets used for making temporary shelters and treatment of screenings/flyes of tents with insecticides [1,3-6]. The method of treatment of clothing with insecticides has its own difficulties in military operations, since it requires frequent impregnation of the whole or part of the uniform with subsequent drying, and the effect of insecticide is lost quickly following exposure to sunlight and repeated washes [7,8]. In addition, the chemical is likely to be absorbed by the subjects quickly through skin under hot and humid conditions. In the absence of data regarding long term effects of synthetic pyrethroids, treatment of entire uniform can not be recommended on ethical grounds. Pre-treated 'patches of cloth' or 'bands' which can be applied on the uniform with 'Velcro' or which can be worn around the wrists or ankles, could be a feasible alternative. The concept of using n,n-diethyl-

m-toluamide (DEET) as the repellent, has given encouraging results [9]. These patches were envisaged to give protection for upto six months if not washed or ironed, as in the case of impregnated mosquito nets.

Material and Methods

The present study was a randomised controlled field trial, undertaken in a military garrison in the Northeastern part of the country, known to be endemic for MT malaria, over a period of six months from July to December 2003. The reference population was defined as "all serving male personnel of the Indian Army, deployed in the North-East". The actual (study) population was defined as "All serving male personnel of the Indian Army serving in Tezpur/Solmara garrison". Sample size calculation for comparing the difference between means was undertaken. It was estimated that the mosquito biting rate per man-hour on the baseline control repellent would be approximately six, while the same parameter among the trial repellents was expected to be approximately eight. The standard deviation (SD) in the two groups was expected to be approximately 1.75. The minimum sample size for each group was worked out to be six subjects. This was increased by five times with the view to improve the precision of statistical estimates. Thus a total of 30 subjects per group were studied.

The entomological parameter studied was 'man-mosquito contact' (number of mosquito bites) which was compared among the 'test groups' (those with treated patches) and the

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control group. The 'Per man-hour biting rate' (between 1700 – 1800 hrs) using the 'Flashlight method' was recorded by health assistants. The subjects were informed of the scope of the study and a verbal, informed consent was obtained. The subjects affixed the pre-treated patches over their uniform at the pre-decided sites and were made to roll up their sleeves above the elbow and raise the bottom of the trousers till the knee level. After this, all subjects were made to sit in the open at a distance of at least 50 feet from each other. The health assistants collected the number of mosquitoes landing on the exposed parts of the subject's body in one hour, using the 'suction tube' and flashlight method. The number of mosquitoes caught in one hour (Per Man-Hour Mosquito Catch) was recorded for each group separately. All the data collectors were centrally trained, pretested and certified by the principal worker with the view to ensure repeatability of the measurements.

Double-blinding was carried out and code was assigned to each group (known only to the principal worker). The procedure was repeated after crossing over the subjects so that each subject was part of each group, thus obviating subject related bias. Steps were taken to ensure that person, climate and place related bias were obviated.

Result

Analysis of Variance (ANOVA) was done for comparison of means of the five groups and it was found to be highly significant (p value = 0.001925). Barlett's test for homogeneity of variances indicated variances were homogenous at 95% confidence interval (Barlett's Chi square = 0.0858, df = 4, p value = > 0.05).

Since ANOVA was found to be highly significant with F statistic at 4.479 and p value 0.001925, intergroup comparison using Least Significant Difference (LSD) method was undertaken, which revealed the following (Tables 1-3):

- The difference in repellent action of odomos and deltamethrin patches was not significant ($p > 0.1$). Hence no significant benefit can be obtained by applying only deltamethrin patches in the absence of odomos.
- The difference between the repellent action of odomos and cyfluthrin was also not significant ($p > 0.1$), hence no significant benefit can be obtained by applying only cyfluthrin treated patches in the absence of odomos.
- Significant difference was found in the repellent action when odomos was used alone and when used along with deltamethrin treated patches, with the latter having significantly higher repellent action as compared to only odomos group ($p < 0.05$).
- Cyfluthrin patches when applied in presence of odomos were found to have much more repellent action as compared to only odomos. The difference in the repellent action was very highly significant ($p < 0.001$). Thus it can be inferred that significant benefit is achieved in reducing man-mosquito contact when cyfluthrin patches are applied over the uniform by the troops in addition to using odomos as compared to those using odomos only.
- No significant difference was found in the repellent action of deltamethrin and cyfluthrin patches in the absence of odomos. Thus, no significant benefit was found in using

Table 1

Group wise mean, variance and standard deviation

Group	Observations	Mean	Variance	SD
Odomos	30	7.90	11.334	3.367
Deltamethrin	30	8.133	11.982	3.461
Cyfluthrin	30	8.033	9.068	3.011
Deltamethrin + Odomos	30	6.333	9.747	3.122
Cyfluthrin + Odomos	30	5.367	9.413	3.068

Table 2

Analysis of variance (ANOVA) table

Source of variation	Sum of squares	df	Mean square	F statistic	p value
Between groups	184.707	4	46.177	4.479	0.001925
Within groups	1494.767	145	10.309		
Total	1679.474	149			

Table 3

Intergroup comparison using least significant difference (LSD) method

Groups being compared	't' value by LSD method	Degrees of freedom	p value
Odomos vs Deltamethrin	0.2711	145	$p > 0.1$
Odomos vs Cyfluthrin	0.1604	145	$p > 0.1$
Odomos vs Deltamethrin + Odomos	1.794	145	$p < 0.05$
Odomos vs Cyfluthrin + Odomos	3.05	145	$p < 0.001$
Deltamethrin vs Cyfluthrin	0.1206	145	$p > 0.1$
Deltamethrin vs Deltamethrin + Odomos	2.171	145	$p < 0.01$
Deltamethrin vs Cyfluthrin + Odomos	3.736	145	$p < 0.001$
Cyfluthrin vs Deltamethrin + Odomos	2.751	145	$p < 0.005$
Cyfluthrin vs Cyfluthrin + Odomos	3.216	145	$p < 0.001$
Deltamethrin + Odomos vs Cyfluthrin + Odomos	1.1752	145	$P > 0.1$

either deltamethrin or cyfluthrin patches in the absence of odomos ($p > 0.1$) or as compared to those using odomos only.

- f) Deltamethrin patches when used after applying odomos were found to be significantly better in reducing man-mosquito contact as compared to only deltamethrin patches ($p < 0.01$).
- g) Cyfluthrin patches after applying odomos were found to be more effective as repellent as compared to only deltamethrin patches applied without odomos ($p < 0.001$).
- h) Deltamethrin patches applied after applying odomos were significantly better repellent as compared to only cyfluthrin patches ($p < 0.005$).
- j) Cyfluthrin patches when used in presence of odomos were a much better repellent as compared to only cyfluthrin patches without odomos ($p < 0.001$).
- k) Deltamethrin patches and cyfluthrin patches in presence of odomos were not significantly different in their repellent action ($p > 0.05$). Hence no significant benefit can be offered by deltamethrin or cyfluthrin patches over one another when used in the presence of odomos.

Discussion

The findings of the study have indicated that use of synthetic pyrethroids pre-treated patches applied over the uniform at strategic sites and used in addition to conventional repellents, provided significantly higher protection against mosquito bites. These pre-treated patches when applied over the uniform, have the added advantage that they are not in direct contact with skin, and hence there is no absorption of the chemical even under hot and humid environment. The pre-treated patches (of the same cloth as FSMO) were applied as epeulletes over collar, as waistband over cuffs and as anklets. These patches are expected to retain their repellent action for upto six months, if not washed or ironed, based on the experience with pre-treated bed nets.

It is recommended that such patches of cloth (made of the same cloth as FSMO) be impregnated with synthetic pyrethroids (cyfluthrin/deltamethrin) and issued to troops operating in highly malarious areas of the North-East during military operations. Use of these pre-treated patches along with conventional repellents is likely to reduce the man-mosquito contact significantly.

Conflicts of Interest

None identified

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