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EFFECTS OF DELTAMETHRIN TREATED UNIFORM ON MALARIA PROPHYLAXIS IN TROOPS OF BAHAWALPUR GARRISON

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ABSTRACT

Objective: To determine the efficacy of deltamethrin treated uniforms on repellant action against mosquitos in serving soldiers.
Study Design: Randomized control trial.
Place and Duration of Study: Bahawalpur Garrison, from 18 Aug to 24 Aug 2014.
Patient and Methods: Two groups were selected for the study, one group comprising of 100 x soldiers wearing deltamethrin treated uniforms and other group comprising 100 x soldiers wearing non-treated (normal working) uniforms–control group. All soldiers were males, their age ranged from 20 years to 41 year. Uniforms were issued centrally with no group knowing which group has been issued treated uniforms, (double blind study was carried out to eliminate subject bias). Coding system was evolved while issuing the uniforms which were only known to the main researchers, president of the study board. Both the groups were made to sit for one hour in a large training ground of the formation in two separate groups at a distance of 50-60 feet between the groups and 10-15 feet between the individuals. All the individuals were asked to count the number of mosquitos attracted towards them, whether sitting/biting on their uniforms or on their bodies. Mosquito counting was also facilitated by the organizing/conducting staff. The study continued for a week from 18–24 Aug 2014. All soldiers were given 2 x tabs Chloroquine stat as prophylaxis for malaria prior to the study. Mean and SD of no of bites of both groups were compared and analyzed. Student t-test was applied to note the statistical significance among the study groups.
Results: Out of the two groups the individuals wearing deltamethrin treated uniforms showed about overall 90% protection from mosquitos as compared to the control group. The average number of bites by mosquitoes in the control group was 7/person in one hour, whereas it was less than one bite/person in the case group.
Conclusion: This study confirmed that the deltamethrin treated uniform is highly effective in having mosquito repellant action in the field and may be used during operational/training duties in the field so as to better protect the troops against this health hazard.

Keywords: Deltamethrin, Malaria, Repellant.

INTRODUCTION

In the last decade, malaria control efforts around the globe have gained a significant importance. The implementation of current anti-malarial interventions shows promising results in several countries. Malaria is a worldwide health problem with greater prevalence in the tropical countries[1] and has been a persistent health hazard for military troops particularly during operational commitments in the field/outdoor environment. Troops are faced with this disease even during movements[2]. Many protective measures have been enforced in the military setups since long, anti-mosquito sprays for indoor/outdoor surrounding areas and anti-adult/anti-larval measures to reduce the population of mosquitoes in general surroundings, most of these are good for static installations/ garrisons but are difficult to implement during mobile/operational activities. It has therefore led to suggest and find ways and measures to protect the soldiers during mobile operations in the field as well as individual protection in peace[3]. For this there are several methods/ applications available, including application of repellant oil on exposed parts of

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the body, use of mosquito nets, wearing protected dress (long sleeves and trousers). One of the personal protective methods is to medicate the soldier's mosquito nets/tents and their uniforms/clothing with anti-mosquito insecticide solutions such as deltamethrin or permethrin so as to provide repellant action against the vectors of malaria and dengue fever. US Army and Air Force have been using the permethrin treated army uniforms since long in the form of factory treated uniforms, manual dipping uniforms in permethrin solution and aerosol treatment with permethrin solution[4].

Deltamethrin is one of the types of pyrethroids, which are synthetic chemicals modeled after the pyrethrin components of pyrethrum[5]. It rapidly paralyzes the insects nervous system producing a knock down effect that lasts for several hours. It also has a very good residual activity for outdoor uses such as field crops and also for indoor use against mosquitoes, house flies and cockroaches. Deltamethrin plays a key role in controlling malaria vectors, and it is used in manufacturing long-lasting insecticidal mosquito nets[6]. However frequent use of deltamethrin over the years has also generated resistance among the mosquitoes and other insects thus threatening its efficacy in worldwide vector control programs.

Insecticide treated military uniforms like permethrin is presently one of the common hygienic measures in world armies such as US, France and Australian defence forces[7].

In this study we studied the effects of deltamethrin treated uniforms (worn by troops of Bahawalpur garrison) in repellant action against the mosquitoes.

PATIENTS AND METHODS

A double blind randomized control field trial was carried out in the dependent formation at Bahawalpur, from 18-24 August 2014 (for one week), after the approval of the institutional review committee. Inclusion criteria included all male serving soldiers of all ages residing in the cantonment, with no known disease/recent illness or history of malaria. Exclusion criteria included all those with any illness or history of fever and those unwilling for the study. The study participants were divided into two groups, each group comprising of 100 x soldiers with probability random sampling technique. One group was issued the deltamethrin treated uniforms, whereas the other was issued non-treated uniforms, but the groups were double blinded by not knowing which uniform they were issued. Coding system was evolved known only to the chief conducting officers and president of the study board. After issuing the uniforms the soldiers were asked to wear it and sit in the training ground for one hour at a distance of 10-15 feet from each other. Time selected for study was between 6pm to 7pm evening when there are maximum no of mosquitoes also this is soldiers evening guard duty time. All soldiers were also advised not to use any insect repellant such as mospel etc during the study period. The deltamethrin coded group was made to sit separately at a distance of 50-60 feet from the non-deltamethrin treated group; however both the groups were made to swap their positions after 30 minutes so as to avoid subject, place and observer bias. All the individuals were asked to count the number of mosquitos attracted towards them, biting or just sitting on their bodies/uniforms. Counting was

Table-I: Group wise comparison of mosquito bites per person in one hour.

Group	Observations	Mean	Variance	SD
Untreated Uniform Gp	100	7.03	14.28	3.8
Deltamethrin treated Gp	100	0.14	0.49	0.24

Table-II: Percent protection of deltamethrin treated uniforms against mosquitoes.

Untreated Uniforms	Treated Uniforms	Percent Protection
92	9	90%

also facilitated by the assistant members of the board. Informed consent was taken from all the participant troops and they were also given 2 x tablets of Chloroquine as prophylaxis against Malaria.

In this study we sprayed 100 x military uniforms with deltamethrin solution which was issued to army troops in Hygiene & Chemical items (75 ml deltamethrin liquid was mixed in 5 liters of water, 1.5% deltamethrin solution). These treated uniforms were assigned codes so as to avoid subject bias between the treated and non-treated groups. 100 x untreated uniforms were issued to other group (control group). The number of mosquitos attracted to each person/ soldier was counted and comparison between both the groups was observed.

Data Analysis

Baseline characteristics of both the groups were entered, compared and analyzed by using statistical package for social sciences (SPSS Inc, Chicago, IL, USA) statistical software version 19. Data were set and standardized based on number of biting per hour, for each subject of both groups. Mean and standard deviations (SD) of number of bites, were calculated and statistical significance was tested by using student's t test. A *p*-value <0.05 was considered as significant.

Mean (SD) was calculated of the number of bites by the mosquitos in one hour in both the groups. Protection percent of deltametharin treated uniform was calculated by the following formula/equation[5]:- that indicates the efficacy as well.

Protection percent (%) = Untreated biting– treated biting / Untreated biting x 100[5].

RESULTS

During the study it was found that the deltamethrin treated uniform was profoundly effective in repelling the mosquitos and provided significant protection to the troops against mosquito bite. The mean of biting by mosquitoes per person for all treated uniforms (100 subjects) was 0.1 per hour, whereas the mean of biting per person for all untreated uniforms (100 subjects) was 7.03 per hour (table I & fig). Comparison of treated and untreated uniforms showed that the protection percent of treated uniforms against mosquito biting was 90% (table II), which was significantly higher than the untreated uniforms (*p*-value <0.0001). This also indicates the efficacy of deltametharin treated uniform against the mosquito bites in one hour. Moreover it was also noted that there was considerable reduction in mosquito density over the group wearing treated uniforms. Two individuals from the deltamethrin treated group complained of itching without the appearance of any rash during the trial, they were given necessary medical treatment and both

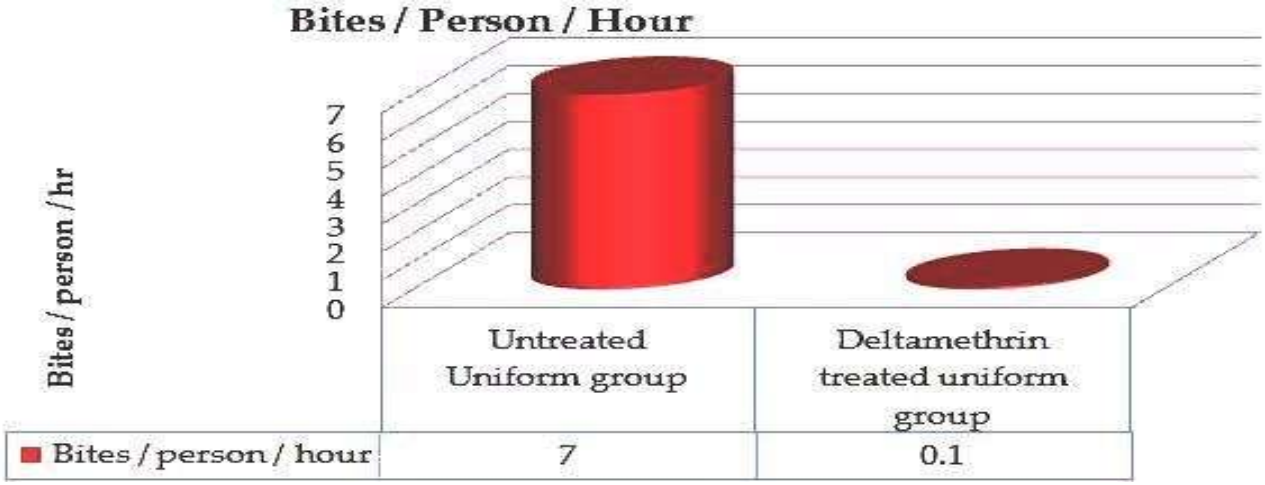

Figure: Group wise comparison of mosquito bites per person in one hour.

individuals were replaced immediately so as to avoid further side effects.

DISCUSSION

Success of a vector control strategy depends on the appropriateness of control measures in a given situation. Knowledge of micro-epidemiology of malaria including ecology and behavior of the vector, social and cultural characteristics of the human population, and changes therein due to interventions or developments, should be guiding factors in deciding the course of action[8]. The first line of defense against malaria or dengue is to avoid biting by the mosquito, and it is of paramount importance for the military troops as they are exposed the most during their duty in the field[9]. Several methods are available to the troops for this purpose including repellant oils issued for applying over exposed parts of the body, anti-mosquito nets for using during rest/sleep in the outdoor environment, and the spraying of living barracks/accommodation with insecticides such as permethrin or deltamethrin[10]. However insecticide treated uniforms have never been used in Pak Army earlier, however it has been a usual practice in the US army and other countries. Treated uniforms are used in several ways, it can be sprayed by the insecticides, or soaked in permethrin/deltamethrin solution, moreover several armies have even used permethrin treated cloth patches to be applied/worn over specific sites on the normal uniforms so as to repel the mosquitos. In field tests conducted in Pakistan in 1988, a mean of 0.9–1.1 bites per 3-hour test period (primarily from Aedesalbopictus) was recorded on the untreated United States battle dress uniforms, while no bites were recorded on insecticide-treated uniforms[9]. In Bahawalpur garrison however the predominant species of mosquitoes is Culex (80%) followed by Anopheles (20%) as already researched upon by the Station Health Office) of Combined Military Hospital.

The persons wearing deltamethrin treated uniform showed greater protection in terms of repellant action against mosquitos when compared to the non-treated group with 90% protection offered against the mosquito bite.

Limitations

Limitations of the study were that the deltamethrin treated uniforms were only used for the duration of study (one hour) due to the risk of side effects and its toxicity potential and also ethical issues. Thus the efficacy of the uniforms in the long run and the decline in its efficacy with wear and tear or repeated washings of uniform could not be assessed by this study. Moreover the study was conducted in the month of August, which is relatively hotter and less conducive to the growth and prevalence of mosquitos, it should have rather been carried out in end of September and October as the prevalence of mosquitos is more in these months. Most of the international studies have been conducted on permethrin whereas there is little data available on deltamethrin being used to premedicate military uniforms probably due to greater toxicity potential and long term effects as compared to permethrin which is comparatively a safer insecticide.

CONCLUSION

The deltamethrin aerosol treated uniform with 1.5% solution has strong repellent effect for mosquitoes in the field.

It is recommended that further studies should be conducted on mass scale to find out its efficacy and usefulness to protect troops from hazards of mosquito bites. Further studies are also needed to find out any toxic effect of deltamethrin on human body.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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