

EFFECTS OF MOSQUITO REPELLENTS ON PULMONARY FUNCTIONSVenkatesh S¹, Puneeth M²**HOW TO CITE THIS ARTICLE:**

Venkatesh S, Puneeth M. "Effects of Mosquito Repellents on Pulmonary functions". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 39, August 28; Page: 9892-9896, DOI: 10.14260/jemds/2014/3281

ABSTRACT: Mosquito bite transmits diseases like Malaria, Filariasis, Dengue etc. and usage of repellents is very common and has been in use for a long time. The smoke contains Polyaromatic Hydrocarbons, Aldehydes and Ketones. Review of literature has shown ill effects of this smoke. Hence we intended to study the effect of mosquito repellents on lung functions. This study would be important to create awareness regarding usage of mosquito repellent and to adapt to non-harmful methods of preventing mosquito bites. PFT parameters FVC, FEV1, FEV1/ FVC %, FEF 25-75 and PEFr were recorded in mosquito coil users, liquidator's users and controls that used neither. It was found that FVC and FEV1 were significantly less in coil and liquidators users compared to controls ($P < 0.05$). Also it was found that in both coil users and liquidator users FVC, FEV1, FEF 25 -75 and PEFr and showed progressive decline with increased duration of usage ($P < 0.05$). Hence it was concluded that mosquito coils and liquidators can cause progressive decline in lung functions. Alternative methods to combat mosquito menace, like personal and environmental hygiene and non-chemical methods of protection are therefore recommended.

KEYWORDS: Mosquito repellents, pulmonary function test.

INTRODUCTION: Mosquito bite transmit diseases like malaria, filariasis, dengue etc and mosquito transmit diseases to 700 million people annually.⁽¹⁾ Usage of mosquito repellents is very common and these have been in usage for a long time as they are effective, cheap and easily available and it is been used without knowing the composition of the product and their safety. Marketing of repellents in India is well organized, hence there are many brands found throughout the country to reduce the transmission of mosquito-borne diseases.

The mosquito repellents are made of pyrethrum powder which contain Pyrethrin, Pyrethrin, Allethrin, Esbiothrine, Dibutyl Hydroxy etc, which are all insecticide, introduction of insecticides is subjected to registration by the central insecticide board, should be safe to human health, wildlife and non-target species. However once the insecticide has been cleared there is no provision of post-monitoring the adverse health effects of these insecticides.

The best known mosquito repellent is N, N-diethyl-3- methylbenzamide (DEET)⁽²⁾ it repels mosquito thereby reducing the chances of being bitten but does not provide mosquito-proof of a person thereby reducing the transmission of mosquito- borne diseases. The burning of coils is not safe as it is a source of fire, may lead to accidents burning of the body as well as house hold articles. Burning of one mosquito coil produces particulate matter 2.5 μm which is equally produced by the smoke of 75-137 cigarettes and emits formaldehyde on burning which can be as high as that released from burning 51 cigarettes.⁽³⁾

The average combustion time for one coil is 8 hours. The smoke from burning of mosquito coil particulate matter contains polycyclic aromatic hydrocarbon, Aldehydes, Ketones all of these are injurious to health. They also produce large volatile organic compounds, carcinogens and suspected

ORIGINAL ARTICLE

carcinogens. The mosquito repellents which we use every day is not safe and studies have shown that persons with conditions like asthma may reduce in prevalence of persistent wheeze, chest illness and asthma up to 29% on reducing exposure to mosquito coil. (4)

Case reports have shown that the DEET which is an effective mosquito repellent is associated with seizure in young children (5-6) and most of the DEET's toxic effects in humans is due to ingestion of the chemical which may lead to hypotension, seizures and coma within as little as 1 hour. Deaths have been associated with serum concentrations of 1 mmol/L.(7) An analysis performed revealed that Bis chloromethyl ether is potent lung carcinogen which is formed by formaldehyde and hydrogen chloride combustion.(8)

It is evident from different studies that mosquito repellents which are in use are not safe and continue to pose a threat to human health issues, the aim of this research is to make people aware regarding the unknown adverse effects of mosquito repellents on pulmonary system and to create awareness regarding the usage of mosquito repellents and to adopt to non-harmful methods of preventing mosquito bites.

OBJECTIVE: To record pulmonary function test parameters (FVC, FEV1 and FEV1/FVC%, FEF2-75 and PEF) in mosquito coil users and liquidator users and controls.

To compare the results for significance.

METHODOLOGY: The survey was conducted among 90 subjects of age group 15-60 years from general population of Bangalore city belonging to different socio-economic status of the society which includes students, housewives and employed members of the family. The study is based on general questionnaire and general interviews which were taken along with the type of repellents they were using in their house hold, comprises of 3 groups – Group 1 mosquito coil users, Group 2 mosquito liquidator users and Group 3 controls who used neither, comprising 30 subjects in each group.

After obtaining a written informed consent the general physical examination was done and the procedure was explained and demonstrated, these 3 groups were age, gender & BMI matched and the subjects were made to perform spirometry after application of nose clips using Spirothor wave front hand held spirometer and three spirometry recordings were obtained and the best out of the three was taken into consideration.

Exclusion Criteria: Smokers/Tobacco chewers, subjects with musculo-skeletal disorder, history of any acute/chronic respiratory illness, Hypertension and any cardiovascular disorders, endocrine disorders and air borne occupational diseases.

STATISTICAL ANALYSIS: The data was analyzed using SPSS 15 software and Descriptive statistical analysis were carried out and the results were presented in Mean + SD (Min-Max), and Student t test (two tailed, independent) $P < 0.05$ –was taken as significant the results were expressed in tables.

ORIGINAL ARTICLE

RESULTS:

variables	Coil users	Liquidator users	Control	P value
Age in years	29.73 ± 10.31	28.60 ± 9.53	29.40 ± 11.19	0.910
Age in years	29.73 ± 10.31	28.60 ± 9.53	29.40 ± 11.19	0.910
BMI (kg/m ²)	24.41 ± 4.44	24.17 ± 2.42	23.63 ± 3.19	0.670

Table 1: Anthropometric parameters in coil users, liquidator users and controls

PFT Parameters	Mosquito coil users	Liquidator users	Controls	Over all P value
FVC	2.69±0.86	3.18±0.71	3.23±0.97	0.028*
FEV 1	2.38±0.71	2.78±0.66	2.96±0.95	0.015*
FEV1/FVC%	88.53±7.22	87.27±7.10	90.83±5.99	0.126
FEF25-75	3.15±1.27	3.04±1.23	3.74±1.76	0.135
PEFR	5.99±1.71	6.72±1.76	6.65±1.97	0.233

Table 2: Comparison of pulmonary function test in coil users, liquidator users and controls

Duration of coil usage(in years)	1-2 years	3-4 years	>4 years	P value
FVC	3.51±0.59	2.75±0.75	1.96±0.34	<0.001**
FEV1	3.08±0.61	2.33±0.47	1.83±0.35	<0.001**
FEV1/FVC%	86.4±5.56	85.5±9.26	92.33±5.58	0.055+
FEF25-75	3.95±1.24	2.92±0.84	2.63±1.27	0.038*
PEFR	7.04±1.36	5.93±1.54	5.15±1.71	0.030*

Table 3: Comparison of PFT parameters within coil users based on the duration of usage

+ Suggestive significance (P value: 0.05<P<0.10), * moderately significant (P value:0.01<P ≤ 0.05), ** strongly significant (P value: P≤0.01)

Duration of liquidator usage(in years)	1-2 years	3-4 years	>4 years	P value
FVC	3.68±0.58	3.01±0.38	2.4±0.38	<0.001**
FEV1	3.25±0.59	2.55±0.34	2.14±0.35	<0.001**
FEV1/FVC%	87.93±5.89	84.67±7.65	89.29±8.65	0.402
FEF25-75	3.79±1	2.36±0.88	2.4±1.3	0.004**
PEFR	7.59±1.94	6.01±1.43	5.89±0.84	0.033*

Table 4: Comparison of PFT parameters within liquidator users based on the duration of usage

ORIGINAL ARTICLE

The FVC, FEV1 was significantly reduced in mosquito coil users and liquidators users compared to normal with $P > 0.005$ FVC, FEV1, FEF25-75% and PEFr, reduced significantly with increased duration of exposure to coil and liquidator. Intra-group comparison of lung function with duration of exposure shows significant reduction in FVC, FEV1, FEF25-75% and PEFr with increased duration.

DISCUSSION: The FVC and FEV1 are significantly reduced in mosquito coil users and liquidator users compared to normal. Decline in FVC, FEV1, FEV1/FVC%, FEF 25-75 % and PEFr with increasing duration of usage of mosquito coils and liquidators suggest restrictive and obstructive type of mixed lung pathology.

The smoke of mosquito coil contain polycyclic aromatic hydro carbons, Aldehydes and Ketones⁽⁴⁾ they are known to cause metaplasia of bronchial epithelial cells and morphological alterations of alveolar macrophages both these changes lead on to low grade inflammatory responses bringing about restrictive and obstructive changes. In addition there is also thickening bronchial epithelial wall, alveolar thickening and consolidation of alveolar areas as a result exposure to mosquito coil smoke ⁽⁹⁾ which is exaggerating the restrictive and also bringing obstructive changes.

CONCLUSION: From the current study as well as from other similar studies, it is evident that mosquito repellents that we use every day are not safe enough their usage is associated with a progressive decline in lung function may be delirious to the health of the community.

Alternative combat Measure to combat mosquito's other than chemical based repellents should involve personal attention and action by local and political bodies by reducing source of breeding areas of mosquito's, providing good drainage and periodical desilting of drains, employing biological control of mosquito breeding by releasing larvivorous fishes in ponds, lakes, drains etc, personal protection methods by using mosquito nets, wire meshing of doors, windows and ventilators and using herbal non harmful alternative to chemical mosquito repellents such as neem oil, mustard oil etc ⁽¹⁰⁾ and buzzing and electrocuting devices etc.

REFERENCES:

1. Mark S Fradin, John F Day. Comparative efficacy of insect repellants against Mosquito bites, N Engl J Med 2002; 347:13-18.
2. Mafong EA, Kaplan LA. Insect repellents. What really works? J of Scientific and Innovative research 1997; 102(2):63, 68-9, 74.
3. Weili Liu, Junfeng Zhang, Jamal H Hasim, Bernard D Goldstein. Joint Graduate Program in exposure Measurement and Assessment, University of Medicine and Dentistry of New York Jersey and Rutgers University, 170 Frelinghuysen road, Piscataway, NJ 08854, USA. Environ Health perspect.2003; 111 (12):1454-1460
4. Azizi BH, Henry RL. The effects of indoor environmental factors on respiratory illness in primary school children in Kuala Lumpur. Int J Epidemiol 1991; (1): 144-150.
5. Lipscomb JW, Kramer JE, Leikny JB. Seizure following brief exposure to insect repellent N, N-diethyl-m-toluamide. Ann Emerg Med 1992; 21: 315-7.
6. Epidemiologic notes and reported seizures temporally associated with use of DEET insect repellants – New York and Connecticut. MMWR Morb Mortal Wkly Rep 1989; 38: 678-80.

ORIGINAL ARTICLE

7. Treinenbein M. Toxicity of diethyltoulamide-containing insect repellents. JAMA 1988; 259:2239-40.
8. Sharma VP. Health hazards of mosquito repellents and safe alternatives. Current Science. 2001 Feb; 80 (3): 341-343.
9. Okine LKN, Nyarko AK, Armah GE, Awumbila B, Owusu K, Setsoafia S et al. Adverse effects of mosquito coil smoke on lung, liver and certain drug metabolizing enzymes in male wistar albino rats. Ghana Medical Journal 2004 Sep; 38 (3): 89-91.
10. Sharma VP, Ansari MA, Razadn RK. Mosquito repellent action of neem (*Azadirachta indica*) oil. J Am Mosq Control Assoc, 1993, 9, 359-360.

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Date of Submission: 19/08/2014.

Date of Peer Review: 20/08/2014.

Date of Acceptance: 23/08/2014.

Date of Publishing: 27/08/2014.