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COMPARATIVE AND BENEFICIARY ASSESSMENT ON NATURAL MOSQUITO REPELLENT OVER SYNTHETIC MOSQUITO REPELLENT – A REVIEW

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ABSTRACT

The aim of the present study is to compare synthetic and natural repellents, causes of synthetic repellents and why the natural repellents are safe for human use. Synthetic repellents like DEET, picaridin, allethrin, IR 3535, permethrin and bog myrtle are the agents which causes various diseases like dermatitis, allergic reactions, neurologic and cardiovascular toxicities such as seizures some of them are toxic to aquatic life and other negative health effects such as encephalopathy, tremor, slurred speech, behavioural abnormalities, coma and even death also have been reported. A variety of negative health outcomes like respiratory and neurological complications occurred by the usage of synthetic repellents when compared to synthetic repellents natural repellents doesn't cause any side effects so we conclude that natural repellents are safer than synthetic repellents.

KEYWORDS: Synthetic mosquito repellents, Natural mosquito repellents, DEET, Clove oil, Lemon oil.

INTRODUCTION

Mosquito mosquito mosquito. the mosquitos are present in everywhere in the world they cause severe human tropical diseases like malaria, dengue, yellow fever and filariasis etc., which is spread by bites of mosquitos the use of mosquito repellents is most efficient way to control the disease transmission so the use of mosquito repellents are increases in the world. People mainly used synthetic repellents when compared to the natural repellents. The most

widely used synthetic repellent is DEET and insecticides such as pyrethroids are used. The long-term safety profiles of the synthetic repellents DEET and pyrethroids concerns related to possible toxicity and carcinogenicity to mammals is raised. Therefore, the last twenty years the researchers are directed towards a natural product to fabricate new mosquito repellents. The consumers considered that natural mosquito repellents are safer than synthetic mosquito repellents. In ancient China, Egypt and India the natural products like essential oils used for their insecticidal and repellent properties. Citronella oil is the first plant-based mosquito repellent but its effectiveness is short when compared to synthetic repellents. In recent years hundreds of studies derived and thousands of plant material exhibiting insecticidal and repellent activity. The natural products are derived from plant essential oils so they have a limited residual activity (< 2 to 4 years) primarily due to high volatility. The residual activity of such plant-based repellents was increased up to 8 hours by addition of fixative like vanillin. The main drawback of the natural repellents is their short time protection because of their volatility of the active ingredients.[1]

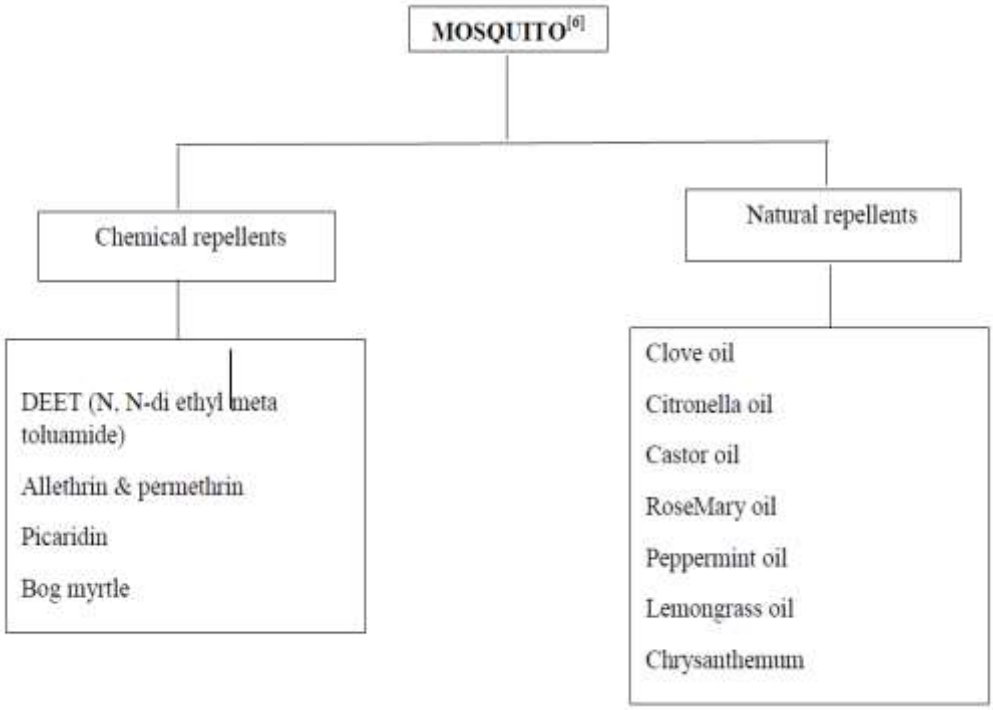
Oral insect repellent has always been of great interest. Oral repellents are convenient and eliminate the need of creams to the skin or put on clothing but unfortunately there is no oral repellents has been discovered. Lots of literature says vitamin B1 (Thiamine) and garlic has a mosquito repellent property but not yet proven scientifically.[2]

The anti-mosquito measures

- Insect repellents
- Knock down insecticides
- Bed nets
- Long-sleeved Shirts & trousers.[3]

Insect repellents prevents from bites of vector mosquitos and other biting orthopods. Personal protective measures are the first line defence against vectors of infectious disease. Although personal preventive measures prevent the vector born disease. They can rarely eliminate the risk in all individuals in the community.[4]

Types of repellents



Synthetic repellents

There are n number of synthetic repellents are used in this world. Mainly used synthetic repellent is DEET (N, N-diethyl-meta-toluamide). The DEET has been in public use since 1957.

Every year, an estimated one-third of the U.S. population to protect them from mosquito born illness like West Nile Virus, zika virus or malaria and tick born illness like Lyme disease and rocky mountain spotted fever. The products such as liquids, lotions, sprays and impregnated materials have DEET (towelettes, roll on). the toxicity of different mosquito repellent formulations decreases in the order of **Coil>Liquids>Mat.**[13] The DEET directly applied to the skin for repel the insects like mosquitos. The allowable concentration for DEET is 5-40%. The protection time for DEET is depending on the concentration, 5 to 12 hours. The DEET shouldn't use for Childrens below 2 months. The American academy of paediatrics currently recommends that Childrens older than 2 months can safely use DEET up to 30% concentration. If DEET used more than that of allowable concentration it produces neurotoxicity. DEET contact with plastics e.g., watch crystals, eyeglass frames should be avoided because DEET can damage these surfaces.

Picaridin also known as icaridin and KBR 3023 it is alternative to DEET products which provides long lasting against mosquito bites. Since 1998, it is available in the market. Compare to DEET picaridin is nearly odourless does not cause skin irritation and it has no adverse effects on plastics. The picaridin is available in the form of sprays pumps, lotion, creams& liquids. The allowable concentration is 5 to 20% protection time 2 to 8 hours. For paediatrics it is safe. For toxicity study having limited data for picaridin it has low potential for toxicity.

IR3535 the chemical name 3-[N-BUTYL-N-ACETYL]-amino propionic acid, ethyl ester this available in the formulation like lotions creams gels sprays allowable concentration 7.5 to 15%. Protection time is 2.5 to 4 hours. Safe to paediatric use. It causes eye irritation when the chemical enters to the persons eyes. It is not harmful when ingested, inhaled or used on the skin

Permethrin it is available in the form of sprays (Only for cloths). The allowable concentration is 4 to 70%. Apply to the clothing, spray each side of the fabric (Outdoor) for 30 to 45 seconds. The clothing should then be allowed to dry for 2 to 4hours before being worn. Its potency lasts for at least 2 weeks. For paediatric it should not be used. The toxicity of this likely to be carcinogenic to humans by the oral route. Very high dose will have tangible neurotoxic effects on mammals and birds including human beings.[8]

Natural repellents

Some of the recorded uses of repellents are noted in the writings of Herodotus (484BC-425BC) detailing in the use of vegetable oil by an Egyptian fisher man to repel mosquitos. The interesting note of citronella oil was one of the first recommendation made in 1908 for the insect repellents the oil is still used in now a day. The essential oils extracted from various plant species has been recognised extremely interesting adult repellents these compounds as shown to protect against arthropods including mites, lice and mosquitos.[8] The cotton fabric samples finished with Akar kara flower extract had highest mosquito repellence.[14] Mentha spicata essential oil in its diluted form is used as potent mosquito repellent against aedes aegypti.[16] Natural repellents are greater structural diversity on a large scale and rich supply of molecules for therapeutic development than synthetic repellents. Natural products are the important sources of bioactive compounds and in a development of novel medications. In traditional days natural products have been used as mosquito repellent. Traditional practices

are now used as a valuable resource for fabrication of natural repellents than chemical repellents.

In the investigation need all over the world essential oils and plant extracts have found to kill the malaria vectors. The goal is to see if the plant-based repellent were effective against anopheles' mosquitoes. To have a safe environment against anopheles' mosquito, natural repellents made of plant essential oils should be used. plant essential oils such as clove oil, lavender oil, camphor, catnip, geranium, jasmine, broad leaved eucalyptus, orange, lemon grass, lemon scented eucalyptus, Amyris, narrow leaved eucalyptus, carotin, cedar wood, chamomile, cinnamon oil, soya bean, rosemary, olive shows good repellent properties. Peppermint oil have repellent activity against dengue vectors.[18] At low concentration natural repellents (i.e., lemongrass oil and eugenol) strongly activated small number of ORNs (Olfactory Receptor Neurons) in the Anopheles mosquito antennae.[15]

Clove oil

Clove oil has recommended alternative for DEET. Clove oil having properties like antibacterial, antifungal and antimicrobial. They are not harmless and safer to use of people. Health care professionals prescribe natural clove oil for insect repellent need.[6] Clove oil consist of eugenol (48.92%), caryophyllene (18.55%), -caryophyllene (3.25%), eugenol acetate (23%) and cis-13-docosenamide (3.21%), presenting more than 96% of the oil.[14]

Citronella oil

Botanical name of citronella oil was *Cymbopogon Nardus* has shown good effectiveness against mosquitos at the concentration range of 0.05% to 15% (p/v) alone or in combination with other natural insect repellents the essential oil of citronellal present in the following constituents: citronellal, citronellol, geraniol, citral, α-pinene and limonene with insect repellent activity compared to DEET. The protection time of citronella oil was 2 hours with 100% repellent activity. The protection time was extended by using fixative agent like vanillin it is derived from *vanilla planifolia.*[8]

Black pepper

The botanical name is *piper nigrum* it is the member of family: Piperaceae the genus *Piper* includes more than thousand species one of the best is piper nigrum L. this species contains secondary metabolites such as limonene, safrol, pinene, sabinene and caryophyllene which

has a slow repellent activity. The protection time for 1hour 30 mins with 100% repellent activity.[8]

Turmeric

The botanical name of turmeric is *curcuma longa* it is the member of family: zingiberaceae. It is an herbaceous plant with long lateral ramifications, originated from south east Asia probably in the Indian subcontinent. Essential oil of *Curcuma longa* has a demonstrated repellent effect against mosquito when applied to the skin. The protection time 8 hours with 100% repellent activity.[8]

Lemon grass oil

The botanical name of lemon grass oil was Cymbopogon pendulous is widely distributed in the region of Africa Asia and America. These are traditionally used as mosquito repellents the effective repellency of Cymbopogon pendulus is against Cx. Quinquefasciatus with 100% repellent activity with protection time of 4 hours.[8]

Need for herbal mosquito repellents

Researchers such as Tenenbein and records from poison control centre have reported that DEET containing products caused diseases like dermatitis, allergic reactions, neurologic and cardiovascular toxicities such as seizures due to use, ingestion and high concentration of DEET on children and adults. Other negative health effects such as encephalopathy, tremor, slurred speech, behaviour abnormalities, coma and even death have been reported.[6] A variety of negative health outcomes like respiratory and neurological complications occurred in the presence of transfluthrin in mosquito repellents.[12]

Comparative protection of mosquito repellents[17]

S. No.	Product	Active ingredients	Mean protection time (Minutes)
1	Ultrathon	DEET,33%	720
2	Maxi DEET	DEET,100%	600
3	Bens 30	DEET,30%	480
4	Off! Deep woods	DEET,23.8%	301
5	Sawyer controlled release	DEET,20%	234
6	Avon skin-so-soft bug guard plus	IR3535	22.9
7	Repel lemon eucalyptus	Oil of eucalyptus	120
8	Bite blockers	Soyabean oil	90
9	Natrapel	Citronella	20
10	Green ban	Citronella, peppermint oil	14
11	Avon skin-so-soft bug guard	Citronella	10

12	Avon skin-so-soft bath oil	Uncertain	9.5
13	Repello wristbands	DEET	9.5

Limitations of synthetic repellents

S. No.	Chemicals used in repellents	Limitations
1	DEET	Skin irritation Toxic Can dissolve synthetic fabrics as it is an effective solvent.
2	Picaridin	Toxic to aquatic life Eye irritation
3	Allethrin's	Low toxicity towards humans and birds but high toxicity levels towards aquatic life[6]
4	IR3535	Can cause eye irritation when the chemical enters into the eye
5	Permethrin	For Paediatrics it should not be used. It causes carcinogenicity when chemical enters in oral route. When using high dose, it causes neurotoxicity[7]

CONCLUSION

We conclude that the natural repellents are safer than synthetic repellents. Even though the synthetic repellents having a more protection time it has a many side effects like carcinogenicity, neurotoxicity, eye irritation etc... but the natural repellents don't have any serious side effects like synthetic repellents.

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