INFORMATION BRIEF (RAPID REVIEW)

MOSOFF MOSQUITO REPELLENT CREAM

Malaysian Health Technology Assessment Section (MaHTAS)
Medical Development Division
Ministry of Health Malaysia
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Rapid Review
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TITLE: MOSOFF MOSQUITO REPELLENT CREAM

PURPOSE

To review the effectiveness, safety and cost-effectiveness of Mosoff mosquito repellent cream based on request from a clinician who received a proposal from a company for combating dengue using the natural repellent cream.

BACKGROUND

Insect-borne diseases particularly from mosquitoes have a great impact on public health, labour output and economic loss mainly in temperate regions. Mosquitoes transmit all the mosquito-borne diseases through biting their hosts. Mosquito bites cause allergic reactions including local skin irritation and systemic response, such as urticaria and angioedema. Anopheles, Culex and Aedes species are the major vectors, which transmit most prominent mosquito-borne diseases such as Japanese encephalitis, lymphatic filariasis, dengue, malaria, dengue haemorrhagic fever, yellow fever, Zika, West Nile fever, and chikungunya.[1]

Repelling mosquitoes from their biting is one of the measures to control the transmission of the infectious diseases that are transmitted through the biting of infected mosquitoes. The most usual prevention strategy against these diseases consists of personal protection items such as long-sleeved clothing or clothing impregnated with synthetic substances such as permethrin, or installing mosquito nets. Additionally, the use of topical repellents containing synthetic substances is recommended, e.g., N,N-diethyl-m-toluamide (DEET) or ethyl 3-acetyl(butyl)amino (IR3535) propanoate. However, the effectiveness of these synthetic repellents contrasts with reports on their adverse effects, such as nervous system toxicity and skin irritation in children and older adults.[2]

For this reason, the search for alternative protection based on naturally occurring compounds has focused on the use of essential oils (EOs) produced by plants, e.g., by species from the genera *Citronella*, *Citrus*, *Eucalyptus*, *Cymbopogon*, and *Thymus,* whose repellent effect has been noted both by science and cultural tradition.[2]

Mosoff mosquito repellent is a natural based mosquito repellent cream. It contains kaffir lime (*Citrus hystrix DC*) essential oil. The cream features a 3-in-1 formulation that repels mosquitoes, relieves itchy bug bites and moisturises the skin at the same time. It is claimed to be safe for baby, hypoallergenic and effectively masks off the carbon dioxide released from the skin that is highly attractive to female mosquitoes.[3]

EVIDENCE SUMMARY

There were 61 articles retrieved on the natural mosquito repellent from the scientific databases such as Medline, EBM reviews, Pubmed and from the general search engines [Google Scholar and US Food and Drug Administration (USFDA)] using the search term *mosquito, aedes, dengue, insect repellent, essential oil, plant derived insect repellent, natural mosquito repellent, kaffir lime, Citrus hystrix.* Last search was conducted on 5th July 2022. Most of the studies were on natural mosquito repellent other than kaffir lime. Only two laboratory studies on mosquito repellent using kaffir lime as active ingredient were included in this review. However, one of the studies is a conference paper. A document submitted by a company was also included.

EFFICACY/ EFFECTIVENESS

Nararak J conducted a laboratory study to compare the spatial repellent and contact irritant (excitation) activities of the essential oils derived from kaffir lime (*Citrus hystrix*) leaf and lime peel as well as to determine the appropriate concentration for maximal excito-repellancy effects on laboratory-reared *Aedes aegypti* and *Anopheles minimus* using an excito-repellancy system. The essential oil at four different concentrations (0.5, 1.0, 2.5 and 5.0% v/v) were studied for their repellancy, excitation and knockdown properties. Opaque stainless steel test chamber were used. The chamber was connected to an exterior cardboard box for collecting mosquitoes escaping from each test chamber. The number of escaped mosquitoes from each chamber was recorded at one minute intervals up to the end of observation period of 30 minutes. Knockdown effect was observed at the end of 30 minutes exposure and mortality was recorded after 24 hours. They reported that, unadjusted escape responses *Anopheles minimus*, leaf oil had strong combined irritant and repellent activity responses at 1% to 5% concentrations (90.0% to 96.4% escape) and the strongest spatial repellent activity at 1% and 2% (85.9% and 87.2% escape, respectively). The peel oil exhibited good excitation with repellancy at concentrations of 2.5% (89.8% escape) and 5% (96.28% escape), while concentrations 1% to 5% showed more moderate repellent activity against *Anopheles minimus.* As for *Aedes aegypti*, 2.5% leaf oil produced the greatest response for both contact (56.1% escape) and non-contact (63.3% escape) trials, while 2.5% produced the strongest response among all concentrations of peel oil, with 46.5% escape. However, both effects were lower compared to *Anopheles minimus*. The knockdown responses above 50% were only observed in *Aedes aegypti* exposed to 5% leaf oil. They concluded that kaffir lime oils had potential as natural based mosquito repellent. However, it needs to be explored further.[4]

Anita Rosanty, Reni Yunus and Dian Yuniar SR conducted a laboratory experimental study to determine the effectiveness of the *Citrus hystrix* leaf extract as a repellent against *Aedes aegypti* mosquitoes. The extract of *Citrus hystrix* solution was made at concentration of 10%,

20% and 30%, and was used as a stock to make 100 gram base lotion. The repellent testing was carried out by applying the extract (10%, 20%, 30% and 70% alcohol as control) to the forearm of the volunteers. The forearm was inserted into the mosquito cage for 30 seconds and observed for the mosquito perch. They reported that, the percentage of repellent protection used with the basic ingredients of *Citrus hystrix* leaf extract at concentrations of 10%, 20%, and 30%, respectively, at 93.33% 94.67%, and 97.33%.[5]

The company also submitted an evaluation report done in a laboratory to evaluate the bioefficacy of the product contain *Citrus hystrix* oil in comparison with Malaysian standard repellent 10% w/w N,N-diethyl-meta-toluamide (DEET). The experiment was conducted in screened wooden cage measuring 60cm^3. Fresh batch of 25 female sucrose fed A*edes aegypti* mosquitoes were introduced through the circular opening. The arm of volunteers were applied with test sample and exposed for five minute in 30 minutes interval up to four hours post-application. The number of mosquitoes landing/biting was recorded. The effectiveness of repellent product was assessed by determining the percentage reduction of mosquitoes biting/ landing on treated arm when compared with untreated arm. They reported that test product gave total protection at up to 2'30" hours. The performance was similar to 10% DEET up to that point. However, at 3'00" hours, 3'30" hours and 4'00" hours, the protection rate of the product test starts to reduce to 84.87%, 58.42.59% and 42.59% respectively. Meanwhile, protection from DEET remains 100% at that point.[6]

Previously, MaHTAS conducted a Technology Review on natural repellent namely OSMOS Mosquito Repellent Wristband. The report concluded that there was limited evidence to show that natural-based mosquito repellent is less effective compared to the widely and commonly used DEET-based mosquito repellent.[7]

SAFETY

There was no evidence retrieved on safety of the Mosoff mosquito repellent on the U.S. Food and Drug Administration and U.S. Environmental Protection Agency website.

COST-EFFECTIVENESS

There was no evidence retrieved on the cost-effectiveness of Mosoff mosquito repellent cream. The estimated cost for the Mosoff mosquito repellent cream is approximately ranged from RM 22.00 to RM 53.00.[8]

CONCLUSION

There was very limited evidence retrieved to suggest that mosquito repellent cream using kaffir lime essential oil as active ingredient had repellancy effect on *Aedes aegypti* and A*nopheles minimus*. However, the effect was less compared to DEET-based mosquito repellent.

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