Mosquito Repellents

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Female mosquitoes feed on blood to help their eggs develop into offspring (Figure 1). When she bites, she releases her saliva into the area where she is biting. Her saliva contains proteins that may cause some people to have an allergic reaction such as itchy red bumps and swollen hives. For those with increased sensitivity to bites, a blister, bruise, or large inflammatory reaction can occur. If a mosquito is harboring a virus, it is possible that she can transmit the virus to humans through her saliva. In Florida, the viruses that mosquitoes transmit can cause encephalitis. The most important mosquito-borne diseases in Florida are St. Louis encephalitis, eastern equine encephalitis, and West Nile virus encephalitis.

The best ways to avoid mosquito bites are to avoid infested areas, wear protective clothing, and wear insect repellent.

How Do Mosquito Repellents Work?

Repellents make humans unattractive to a mosquito so that it will avoid areas of the body that have been treated with the product. Repellents do not kill mosquitoes. The best repellents will provide protection from bites for a long period of time from just one application. The University of Florida mosquito researchers test and evaluate the effectiveness of mosquito repellents based on the amount of time the product will continue to repel mosquitoes after one application to the skin. This is known as Complete Protection Time (CPT).

What Kind Of Mosquito Repellents Are Available?

Repellents that are currently available are either synthetic chemicals, such as DEET, or plant derived chemicals such as Citronella. Various formulations of
these repellents are available that differ in the amount of active ingredient, which is the substance that actually repels the mosquito. These products are available as sprays, wipe-on's, sticks, foams, and lotions.

**Product Labels**

It is very important to read the label before using any mosquito repellent and remember the following:

- Both N,N-diethyl-m-toluamide and N,N-diethylbenzamide are chemical names for DEET; the label may or may not have the word "DEET" on it
- There are different recommendations for frequency of application for different repellents; do not over apply
- Check the container for an EPA-approved label and registration number; never use a repellent that has not been approved for use by the EPA
- Make sure that the repellent label lists the insect that you need to repel; some repellents are not formulated for certain insects

**What About Products That Combine Repellents And Sunscreen?**

The Centers for Disease Control (CDC) does not recommend using products that combine DEET with sunscreen. Sunscreens are intended for generous and frequent use while DEET is intended for less frequent use. The concern is that use of a repellent that combines the two compounds may promote increased and unnecessary use of DEET. Additionally, blending DEET with a sunscreen decreases the efficacy of both compounds. The CDC recommendation is to apply sunscreen first, then the insect repellent containing DEET, to be sure that each product works as specified.

**Will Garlic, Bananas, Or Vitamin-B Repel Mosquitoes?**

There is no scientific evidence that eating garlic, vitamins, onions, or any other food will make a person repellant to mosquitoes. The attractant level of each individual to biting arthropods is based on a complex interaction of many chemical and visual signals. Certain foods in certain individuals may effect their individual attractiveness to biting arthropods, for better or for worse.

**How To Decide Which Repellent Is Best**

Read the label to determine what the active ingredient is and what percentage of the active ingredient is in the container. Use Table 1, based on University of Florida research, as a guideline to compare products. Some provide protection for a long period of time and some have very short protection times.

In 2005, the CDC revised their recommendations on mosquito repellents and added two repellents, in addition to DEET: Picaridin [1-Piperidinecarboxylic acid, 2-(2-hydroxyethyl)-, 1-methylpropylester] and Oil of Lemon-Eucalyptus [p-menthane 3,8-diol (PMD)]. The oil of lemon eucalyptus has not been tested against mosquitoes that spread malaria and some other diseases which occur internationally. The label for oil of lemon eucalyptus specifies that it should not be used on children under 3 years of age.

Keep in mind that repellents do not protect all users equally. The effectiveness of a repellent depends on the mosquito species that is biting as well as the age, sex, level of activity, and attractiveness of the human using the repellent. Consider the following when choosing a repellent:

- Are you in an area where you know that mosquito-borne diseases are present?
- What is the mosquito population like? (A lot of bites expected? Or occasional bites?)
- Will time spent outdoors at night be longer than an hour?
Mosquito Repellents

- Will you be around heavily vegetated, humid areas during the day?
- What type of activities are going on: exercising, running, playing sports, etc.?
- Is the humidity and temperature high?
- Do not apply to the mouth or eyes, cuts, wounds, or on sunburned or irritated skin.
- To apply to face, spray on hands first and then rub on face.

<table>
<thead>
<tr>
<th>Products</th>
<th>Active Ingredient</th>
<th>Average Complete Protection Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF! Deep Woods</td>
<td>23.8% DEET</td>
<td>5 hours</td>
</tr>
<tr>
<td>Sawyer Controlled Release</td>
<td>20% DEET</td>
<td>4 hours</td>
</tr>
<tr>
<td>OFF! Skintastic</td>
<td>6.65% DEET</td>
<td>2 hours</td>
</tr>
<tr>
<td>Repel Lemon Eucalyptus Insect Repellent</td>
<td>Oil of lemon eucalyptus; p-menthane 3,8-diol (PMD)</td>
<td>2 hours</td>
</tr>
<tr>
<td>Bite Blocker for Kids</td>
<td>2% Soybean Oil</td>
<td>1.5 hours</td>
</tr>
<tr>
<td>OFF! Skintastic for Kids</td>
<td>4.75% DEET</td>
<td>1.5 hours</td>
</tr>
<tr>
<td>Skin-So-Soft Bug Guard Plus</td>
<td>7.5% IR3535</td>
<td>23 minutes</td>
</tr>
<tr>
<td>Natrapel</td>
<td>10% Citronella</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Herbal Armor</td>
<td>12% Citronella; 2.5% peppermint oil; 2% cedar oil; 1% lemongrass oil; 0.05% geranium oil</td>
<td>19 minutes</td>
</tr>
<tr>
<td>Green Ban for People</td>
<td>10% Citronella; 2% peppermint oil</td>
<td>14 minutes</td>
</tr>
<tr>
<td>Buzz Away</td>
<td>5% Citronella</td>
<td>14 minutes</td>
</tr>
<tr>
<td>Skin-So-Soft Bug Guard</td>
<td>0.1% Citronella</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Skin-So-Soft Bath Oil</td>
<td>Active Ingredient not known</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Skin-So-Soft Moisturizing Suncare</td>
<td>0.05% Citronella</td>
<td>3 minutes</td>
</tr>
<tr>
<td>Gone Original Wristband</td>
<td>9.5% DEET</td>
<td>0</td>
</tr>
<tr>
<td>Repello Wristband</td>
<td>9.5% DEET</td>
<td>0</td>
</tr>
<tr>
<td>Gone Plus Repelling Wristband</td>
<td>25% Citronella</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1. Protection Times of Tested Mosquito Repellents

How To Apply Mosquito Repellents

- **READ THE LABEL!!!** Apply according to the directions on the label. Do not use any repellent that has not been approved by the EPA. To find this information, you can visit the EPA’s Web site [www.epa.gov](http://www.epa.gov) or look for an EPA registration number on the label.
- **As with all over-the-counter products, use common sense when applying.** Watch for reactions, some people may be allergic to ingredients in the repellent.
- **Apply ONLY to the parts of the body that are exposed.** Some repellents can be applied directly to clothing, but check the label first. Do not apply to skin that will be covered by clothing.
- **Do not allow young children to apply repellents.**
- **Apply only as often as the label says.** More is **NOT** better! If the repellent wears off earlier than expected, read the label to determine how often it is safe to re-apply.
- **Keep in mind that some things may decrease the effectiveness of a repellent such as:** activities...
that cause perspiration, high humidity, high
temperature, rainfall, and swimming

**Safety of Mosquito Repellents**

The EPA has determined that the normal use of
DEET does not present a health concern to the general
U.S. population and is not classifiable as a human
carcinogen. The American Academy of Pediatrics
updated their recommendation for the use of DEET
products on children (2005) to state that repellents
containing DEET with a concentration of 10% appear
to be as safe as products containing a 30%
concentration when used according to the directions
on the label. They suggest that it is acceptable to
apply repellents with low concentrations of DEET to
infants over 2 months old. Non-DEET repellents
have not been as thoroughly studied as DEET, and
may not be safe to use on children. There are no
reported adverse events following use of repellents
containing DEET in pregnant or breastfeeding
women.

Oil of lemon eucalyptus should not be used on
children under 3 years of age. In the University of
Florida research, summarized in Table 1, it should be
noted that one subject experienced a skin reaction
when testing the efficacy of the oil of lemon
eucalyptus; the subject discontinued that portion of
the study.

"**Natural**" Products

"Natural" is a word that is sometimes used to
promote "safe" products. Unfortunately, the wording
can be misleading for the uninformed individual.
"Natural" products are usually essential oils distilled
from plants; oils that have evolved with plants to
defend the plant from insect feeding. These oils can
be toxic and irritating in high concentrations.
"Natural" repellents are not necessarily safe repellents.

In some cases, use of any repellent product may
cause skin reactions. Anyone who suspects they are
having a reaction to the repellent should discontinue
use, wash the treated area and call the National
Poison Control Center to find the closest center:
1-800-222-1222.

**Useful References**

-How to use insect repellents safely
http://www.epa.gov/pesticides/citizens/
insectrp.htm

-Reregistration of the insect repellent DEET
http://www.epa.gov/opp00001/citizens/deet.htm

-Updated information regarding mosquito
repellents.
http://www.cdc.gov.ncidod/dvbid/westnile/qa/
insect_repellent.htm

Fradin, M. S. and J. F. Day. 2002. Comparative
efficacy of insect repellents against mosquito bites.