

Which mosquito repellent works best?

Michael F. Evans, MD, CCFP

Fradin MS, Day JF. Comparative efficacy of insect repellents against mosquito bites. *N Engl J Med* 2002;347:13-8.

Research question

Which mosquito repellent works best?

Type of article and design

Randomized controlled trial in a laboratory.

Relevance to family physicians

When this article came out, I thought it would be a very practical one to summarize but now, in the “new normal” of viruses, and particularly West Nile virus, it seems even more important to provide evidence-based advice to our patients about preventing mosquito bites. Other countries have had to deal with this type of problem in the form of malaria, which kills more than a million people annually.¹ Mosquitoes are part of our daily summer life in Canada, and my patients swear by many different repellents. Now there are new medical consequences to mosquito bites, we need to know which repellent works best.

Overview of study and outcomes

Investigators acquired 16 different mosquito repellents, randomly obscured their names, and assigned each a number. Fifteen volunteers offered to put their arms in an enclosed space in a certain sequence to assess the efficacy of the repellents (note to self: do not volunteer for any trial that mentions “arm-in-cage”). Compounds included varying concentrations of N-diethyl-3-methylbenzamide (DEET), soybean oil, citronella, “Skin-so-Soft” moisturizing cream with IR3535 (“Skin-So-Soft BugGuard Plus”), wristbands impregnated with repellent, and one repellent that

was a blend of “botanical agents.” Primary outcome was time to first bite.

Results

Repellents with DEET crushed the others. The percentage of DEET predicted the length of time protected. The 23.8% DEET lasted 302 min (5 hours), the 20% DEET lasted 235 min (almost 4 hours), and the 6.65% DEET lasted 112 min (almost 2 hours). Repellents that contained more natural ingredients did not fare nearly as well. The leader was 2% soybean oil (94 min); citronella-based products lasted 2 to 20 min. Bands do not work at all (20 to 30 s) regardless of whether they contain DEET or citronella.

Analysis of methodology

This was not a real-world study (it took place in a laboratory), but it was randomized and blinded. As well, this study was not funded by industry and seems free of bias. I know there are many different types of mosquitoes, so I wonder whether we can generalize prevention of mosquito bites to bites of various kinds of mosquitoes. I would also be curious about the effectiveness of DEET and other agents in preventing other insect bites.

Application to clinical practice

This trial gives us some concrete information to pass on to our patients: DEET seems to work best in preventing mosquitoes from biting people. When we think about the real-world application, I only have to think back to my tree-planting days and the “solvent” effects of my DEET-based repellent on my rain jacket to understand why patients have concerns. The authors of this paper ruminate on this and comment:

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Dr Evans practises in the Department of Family and Community Medicine at the Toronto Western Hospital, University Health Network, and teaches in the Department of Family and Community Medicine at the University of Toronto.

DEET has a remarkable safety profile after nearly 40 years of use and nearly 8 billion human applications. Fewer than 50 cases of serious toxic effects have been documented in the medical literature since the 1960s, and three quarters of these resolved without sequelae. A review by the United States Environmental Protection Agency in 1998 concluded that "normal use of DEET does not present a health concern to the general US population."

In Ontario we have come up with the following guidelines (www.HealthyOntario.com).

- DEET is the most effective agent for adults who can use 20% to 30% for long-lasting protection. For briefer exposures, patients can use a lower concentration of DEET. Concentrations higher than 50% do not seem to provide extra protection.
- Children 2 to 12 years old should use $\leq 10\%$ concentration of DEET.
- Using DEET on infants aged 6 months to 2 years is tricky. Parents will have to decide for themselves whether they want to dress babies in more protective clothing or use repellent or other measures. I suppose it is similar to what I tell parents about suntan lotion. Most do not want "chemicals" spread over their kids, but if the kids are going to get sunburned, lather up.
- For babies younger than 6 months, given their lack of mobility, mosquito netting is the best option.
- Most "natural" repellents lasted only 2 to 20 minutes, with the exception of 2% soybean oil, which lasted for 94 minutes. In contrast, 23.8% DEET lasted for 5 hours.
- Bracelets, whether they contained DEET or not, did not work at all.
- Although the methodology was sound, the study was conducted in a laboratory with certain types of mosquitoes. I wonder whether the findings are generalizable to my local pond. ❖

Points saillants

- Le diéthyltoluamide est l'insectifuge le plus efficace pour les moustiques. Plus la concentration du produit est forte, plus longtemps il protège. C'est un facteur important parce que les parents qui utilisent le produit en moins forte concentration pour leurs enfants devront en appliquer plus souvent sur les enfants que sur eux-mêmes (s'ils utilisent une plus forte concentration).
- Les données probantes jusqu'à présent démontrent l'innocuité du diéthyltoluamide, mais la science évolue, et les préoccupations des patients sont fréquentes et compréhensibles.
- La plupart des insectifuges «naturels» ne dureraient que de 2 à 20 minutes, sauf en ce qui concerne l'huile de soya à 2%, qui durerait 94 minutes. Par comparaison, le diéthyltoluamide à 23,8% durerait 5 heures.
- Les bracelets, qu'ils contiennent ou non du diéthyltoluamide, n'étaient pas du tout efficaces.
- La méthodologie était appropriée, mais l'étude était effectuée en laboratoire avec certains types de moustiques. Je me demande si les constatations peuvent être généralisées et si elles s'appliqueraient à mon étang local.

If you, like me, cannot remember all this, send your patients to www.HealthyOntario.com for a general description of mosquito repellents and reviews of the effectiveness of specific brands.

Bottom line

- For mosquitoes, DEET is the most effective repellent. The higher the concentration of DEET, the longer it protects. This is important because parents who apply a lower concentration to their children will have to apply repellent more frequently to them than they do to themselves (if they use a higher concentration).
- Evidence to this point shows that DEET is safe, but the science is evolving, and patient concerns are common and understandable.

Reference

1. Centres for Disease Control and Prevention. *CDC travel website*. Atlanta, Ga: Centres for Disease Control and Prevention; 2000. Available at www.cdc.gov/travel/malinfo.htm. Accessed 2003 June 26.