3 - Bite Prevention

3. Bite Prevention

Effective bite prevention should be the first line of defence against malarial infection.

3.1 When do female Anopheles mosquitoes bite?

Biting time varies between species, so travellers should assume they are at risk of being bitten from dusk to dawn inclusive. The biting of the two main malaria vectors in Africa peaks at about 2am so protection in bed is especially important. As other species of mosquito e.g. those which transmit dengue fever bite during the daytime, it would be prudent to also maintain bite precautions during daylight hours.

3.2 Measures to prevent mosquito bites

3.2.1 Repellents

ACMP strongly recommends DEET-based insect repellents. If DEET is not tolerated (or is not available), an alternative preparation should be used, but few are as effective as DEET (see below)

DEET

DEET (N,N-diethyl-m-toluamide) has been in use as an insect repellent for more than 50 years. It is available in a variety of concentrations and in various preparations including sprays and a slow release polymer.

Duration of protection is 1 to 3 hours for 20%, up to 6 hours for 30% and up to 12 hours for 50% DEET. There is no further increase in duration of protection beyond a concentration of 50%. Sweat-off time varies with activity. The interval between applications depends on this as well as the DEET formulation and concentration used.

When both sunscreen and DEET are required, DEET should be applied afterwards. DEET reduces the efficacy of sunblock, however sunscreens do not reduce the effectiveness of DEET[7,8].

DEET is not recommended for infants below the age of 2 months.

Use of 20% DEET in the second and third trimesters of pregnancy was not associated with adverse effects on infants from those pregnancies followed for up to 12 months after birth[9]. Given the seriousness of malaria in pregnancy, ACMP recommends the use of DEET at a concentration of up to 50% as part of the malaria prevention regimen for pregnant women, including those in the first trimester. DEET may be used at a concentration of up to 50% in breast feeding and for infants and children aged over 2 months.

ACMP advice on use of DEET for protection from mosquito bites:

- DEET is suitable for all individuals over the age of 2 months (unless allergic).
- 50% has the longest duration of action, and needs fewer applications per day

- There is no evidence that any group (including pregnant women and small children) is at increased risk from using 50% DEET.
- Lower concentrations are available: they need more frequent application and may not be as effective as 50%- care must be taken to re-apply or use a higher concentration DEET preparation if mosquito biting occurs after their use. Lower concentrations are not suitable for individuals who may expect prolonged exposure, such as that encountered by backpackers and expedition travellers.
- ACMP considers concentrations below 20% inappropriate in any circumstances.
- DEET applications can damage some plastic watch straps, watch 'glasses' and plastic jewellery; these items should not be allowed to come into contact with DEET.

p-menthane 3,8 diol (lemon eucalyptus)

p-menthane 3,8 diol (PMD) gives about the same amount of protection afforded by 15% DEET[10] but is reported to provide a shorter period of protection than extended duration (microencapsulated) DEET[11].

Picaridin (Icaridin)

Picaridin (KBR3023) (1-piperidinecarboxylic acid, 2-(2-hydroxyethyl)-,1-methyl-propylester) is reported to have repellent properties comparable to those of DEET[12-14]. Picaridin is sold in Europe as a 20% formulation whilst a 7% picaridin formulation is on sale in the US[15]. If a traveller elects to use picaridin for mosquito bite prevention, ACMP advises use of a 20% preparation.

3-ethlyaminopropionate

3-ethlyaminopropionate (IR3535) has a shorter duration of protection than DEET[13,16].

Oil of Citronella

Whilst oil of citronella-based products do have repellent properties, they provide short-lived protection[16] and are not recommended by ACMP. Citronella has been withdrawn in Europe.

3.2.2 *Insecticides*

Permethrin and other synthetic pyrethroids have a rapid knock-down effect on mosquitoes and are used to kill resting mosquitoes in a room.

3.2.3 Nets

If sleeping outdoors or in unscreened accommodation, insecticide-treated mosquito nets should be used. Protective efficacy for travellers has been estimated at 50%[17].

Mosquito bed nets must be free of tears and should be tucked in under the mattress.

Insecticide (pyrethroid)-impregnated bed nets improve protection because they help to prevent (a) biting through the net on part of the body touching the net, (b) mosquitoes surviving long enough near a net to find any tears in the net which may exist (c) diversion of mosquitoes from someone under a net to someone in the same room without a net[18].

Nets need to be re-impregnated every 6 to 12 months (depending on how frequently the net is washed) to remain effective. If a traveller purchases an impregnated net, the 6 months starts from the date when it starts to be used and washed, as washing and handling are the main factors removing the pyrethroid. Long-lasting nets, in which the pyrethroid is incorporated into the material of the net itself or bound to it with a resin, are now available. These have an expected useful life of 3 to 5 years and are expected to supersede nets which require re-impregnation.

3.2.4 Clothing

Within the limits of practicality, cover up with long-sleeved, loose-fitting clothing, long trousers and socks if out of doors after sunset, to minimise accessibility to skin for biting mosquitoes. There is no evidence that the colour of clothing is relevant to mosquitoes. Clothing may be sprayed or impregnated with permethrin[19] or purchased pre-treated to reduce biting through the clothing. As an alternative, cotton clothing (e.g. socks) can be sprayed with DEET.

3.2.5 Room protection

Air conditioning reduces the likelihood of mosquito bite as a result of substantial reduction in night time temperature. Ceiling fans reduce mosquito nuisance.

Doors, windows and other possible mosquito entry routes to sleeping accommodation should be screened with fine mesh netting which must be close-fitting and free from tears.

The room should be sprayed before dusk with a knockdown insecticide (usually a pyrethroid) to kill any mosquitoes which may have entered the accommodation during the day.

During the night, where electricity is available, use an electrically heated device to vapourise a "mat" (tablet) containing a synthetic pyrethroid in the room. A new mat is needed each night.

Burning of a mosquito coil is an alternative but is not as effective[20] and is not recommended for indoor use.

3.2.6 Fallacies

Herbal remedies

The ACMP strongly advises against relying on any herbal remedies for the prevention of malaria. Herbal remedies have not been tested for their ability to prevent or treat malaria.

Homoeopathy

The ACMP strongly advises against relying on any homoeopathic remedies for the prevention of malaria. There is no scientific proof that homoeopathic remedies are effective in either preventing or treating malaria.
In addition, the Faculty of Homeopathy does not promote the use of homoeopathic remedies for disease prevention and notes that their use in malaria prevention is unlikely to be acceptable to insurance providers.

Buzzers

Electronic buzzers (emitting high frequency sound waves) are completely ineffective as mosquito repellents. Companies selling them have been prosecuted and fined under the UK Trades Descriptions Act and ACMP advice is that they should not be used.

Vitamin B1

There is no evidence that vitamin B1 taken orally repels mosquitoes[21,22].

Garlic

There is no evidence that garlic taken orally repels mosquitoes[23].

Savoury yeast extract spread

It is sometimes stated that Marmite® taken orally repels mosquitoes either by giving off a cutaneous odour repellent to mosquitoes or via its vitamin B1 content. There is no evidence that either assertion is true.

Tea tree oil

There is no evidence that tea tree oil is an effective mosquito repellent.

Bath oils

There is no evidence that proprietary bath oils provide effective protection against mosquito bites.

"Once you get malaria it keeps coming back"

Hypnozoite-induced relapses occur in vivax and ovale malaria, but can be treated successfully and further relapses prevented. If the patient has received a full course of treatment with modern antimalarial drugs and has not been re-exposed to malaria, it is extremely unlikely that a history of recurrent febrile illness over a number of years is the result of chronic malaria.