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MOSQUITO-REPELLENT MEASURES

The malaria mosquito only bites between dusk and dawn. Not noticing mosquitoes does not mean that there aren't any present (Anopheles mosquitoes do not buzz).

The avoidance of contact with the malaria mosquito is in itself a very effective measure in the prevention of malaria and is particularly useful for young children.

A. General measures

During the evening and at night, stay in a room with windows and ventilation holes that are covered with **gauze** that is impenetrable to mosquitoes. Air conditioning vents should also be covered by **gauze**.

N.B. Air conditioning reduces the aggressive behaviour of mosquitoes, but does not always prevent them from biting. Even if you are staying in rooms with air conditioning, you should take preventive measures against mosquito bites.

- You can apply a pyrethrum-based insecticide either by **spraying** (using an aerosol can) or **evaporation** (using electrically heated plates: these can be used either during the day in a well-closed room (be sure not to remain in the room during application), or during the night while you are sleeping in a well-ventilated room).
- In the evening outside the house, wear clothes that **cover the arms and legs as much as possible**. Mosquitoes are more readily noticed on light-coloured clothing.

B. Insect repellents

Insect repellents contain a product that deters insects, without killing them. These products are applied to exposed parts of the skin. Do not forget to apply it to your ankles and feet! The following protective measures are recommended for all travellers, and for children and pregnant women in particular:

- Avoid excessive rubbing when applying, and avoid contact with the lips, mouth, mucous membranes and eyes, as well as with damaged or irritated skin (wounds, eczema patches, severe sunburn). If product is applied to these areas, rinse immediately with water.
- Rub into the entire exposed area, but use just enough product to cover the skin.
- Do not apply to children's hands to prevent the product from coming into contact with the mouth or eyes.

- Wash the product off when it is no longer needed.
- Store these products well out of reach of children.

Which products are recommended?

DEET (diethyl-m-toluamide – now called N,N-diethyl-3-methylbenzamide) such as MoustiMug[®], Z-stop[®], Anti-M[®], OTC repellent[®], Mouskito[®], Care Plus[®] DEET and other products. This is the most well-known product, but can damage plastics. The optimum concentration for DEET is between 20 and 50 % in the tropics; the higher the concentration, the longer the protection period, which is very practical. The protection time offered by concentrations lower than 20 % is too short. Certain preparations contain 50 - 100 % DEET, but from 50 % upwards the protection period does not increase significantly and higher concentrations therefore have no additional clinical advantage.

The protection period offered by DEET products is usually shorter than that listed on the packaging and these products should be re-applied regularly if necessary, on average every four to six hours (DEET 20 - 30 % only offers four to six hours of protection; a higher percentage of DEET 40 - 50 % offers about eight hours of protection, but you cannot get through the night or even a long evening with just one application!). New preparations with delayed DEET release may be introduced in the future and these will offer a longer period of protection (e.g. Ultrathon[®] cream with an efficacy of 12 hours is currently available in some areas), with a much lower risk of cutaneous absorption.

Most international guidelines on travel medicine (CDC, UK, BEH) allow the use of DEET with **children** from the age of two months, although the WHO does not recommend using DEET on children under the age of two years. Concentrations between 20 and 30 % are recommended for children and **pregnant women**. For young children under the age of two years, the recommendation is to apply the product only once a day.

When combining it with sun lotion, the sun lotion should be applied first (with a higher sun protection factor because DEET reduces the effectiveness of sun lotion) and then DEET afterwards.

The use of insect repellents that do not contain DEET has not been studied in as much detail.

- Products based on **(p)icaridin** (Care-Plus[®] Repel-it; Parazeet[®]) are good and safe products that do not damage plastics. (P)icaridin may be used from the age of two years. Use in pregnant women is permitted, but not very well documented.
- Products based on **IR3535** (including Cinq sur Cinq[®], Moustidose[®]) are good and safe. A formulation containing 30 % and 35 % has recently been placed on the market, meaning that the protection time is now similar to that of DEET 30 - 50 % (up to eight hours, according to the packaging). The 25 % formulation may be used for children under the age of two years. Use in pregnant women is permitted, but not very well documented.

- Products based on the **citrodiol extract of eucalyptus oil** (also called p-menthane 3,8 diol or PMD) (Care Plus[®] Natural, Mosegor[®]/Mosiguard[®]). These products can be used on young children from the age of 6 months (from the age of 3 years according to CDC). This product may not be used by pregnant women. “Pure” oil of lemon eucalyptus is not recommended because it gives not sufficient protection.

All these products are also moderately effective against fleas and ticks.

Other alternatives are currently not recommended. Products based on plant-derived substances only offer a very short protection period (for example, citronella is only effective for a few minutes). Bracelets impregnated with an insect repellent are also not effective enough.

Gadgets that (allegedly) keep mosquitoes at a distance by emitting (ultra)sound are useless! The efficacy of taking vitamin B1 has never been proven.

C. Treated (impregnated) mosquito nets

A **mosquito net that has been impregnated by the manufacturer** is preferable to and more effective than a non-impregnated mosquito net or a mosquito net that has been treated at home. Any mosquitoes that come into contact with the net will be killed before they can bite. In addition, any mosquitoes in the room will be repelled or killed. If an impregnated mosquito net is used over a cot, it is important to ensure that the baby cannot grab hold of the net and suck on it.

When impregnating a mosquito net at home, the quality is usually sub-standard and the treatment poses an unnecessary risk to personal safety and the environment. A mosquito net impregnated at home has a much shorter protective period (maximum of six months for permethrin, 500 mg/m² to 12 months for deltamethrin, 25 mg/m² active substance) and authorised products for this application are no longer available on the Belgian market. It is hoped that mosquito nets with improved impregnation will be available in Belgium in the near future, as these nets have the insecticide incorporated into the fibres of the net, resulting in a prolonged period of protection (Long Lasting Impregnated Nets (LLIN), including PermaNet[®]).

Deltamethrin

Deltamethrin is not officially available in Belgium. In many African countries it is commercially available under the name K-O TAB[®] Aventis (insecticide tablets), which are specifically intended for the impregnation of mosquito nets, albeit not for cotton nets.

Permethrin

Until recently, permethrin was available in a number of specialised stores, including under the name “Care Plus[®] Klamboe Impregneerset” by the company “Tropenzorg”.

Permethrin is still available in some large chemist shops, but these products are not registered for the impregnation of mosquito nets. Some professional outdoor stores import permethrin from other countries (e.g. No Bite®).

These products are extremely toxic to fish, so they must be disposed of at the waste sorting station and should never be poured into waste water or a river!

D. Clothing treated with repellent or insecticide

Repellent on the clothing

There are various repellents that can be applied to clothing, but repellents are very inefficient at a distance and they are less effective when applied only to clothing. DEET also causes synthetic materials (including spectacles) to dissolve. (P)icaridin does not damage plastics.

Clothing treated with insecticides

Pre-impregnated clothing and clothing where permethrin has been incorporated into the fabric during the manufacturing process - for example Nosi Life®, Colombia Bug Shield® - are available and according to the manufacturer, these items remain effective even after dozens of washes. Until recently, permethrin sprays and impregnation sets for clothing could be purchased at most outdoor stores, but these products have been withdrawn from the Belgian market due to the burden placed on the environment, particularly fish (although they are still imported through some professional outdoor stores). The same comments made for the impregnation of mosquito nets also apply here.