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Control of endophagic *Anopheles* mosquitoes and human malaria in Guinea Bissau, West Africa by permethrin-treated bed nets

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Abstract

We compared the anti-mosquito and antimalarial potentialities of placebo-treated versus permethrin-impregnated bed nets in north-western Guinea Bissau. Baseline, pre-intervention entomological and parasitological data were collected during the rainy season of 1990 and bed nets were distributed shortly before the rainy season of 1991. Pairs of 3 ethnically different villages were investigated. The villages in each pair were at least 2 km apart but belonged to the same ethnic group in an ecologically similar area. After one year permethrin-treated bed nets were provided to all people in one village of each pair and placebo-treated bed nets to the other villages. About 98% of mosquitoes caught in bedrooms belonged to *Anopheles gambiae* and *A. melas*, which we consider to be the main malaria vectors in the study villages. Mean *Plasmodium falciparum* sporozoite rate in *A. gambiae* (9·6%) and *A. melas* (12·4%) was highest during October–November. The *Plasmodium* index in children 2–9 years old in the 6 villages, at the end of the rainy season 1990, ranged between 44% and 79%. Of these, 98% were identified as *P. falciparum*, 1% as *P. malariae* and 1% as mixed infections of these species. Significant reductions of *Anopheles* indoor resting densities and malaria parasite rates in humans were recorded in villages which had received permethrin-treated nets, but not in the control villages. The mean number of *P. falciparum*-infective mosquito bites received indoors in untreated villages during the rainy season was estimated to be about 4 per child and 20 per adult. This inoculation rate was reduced by at least 78% by the use of permethrin-impregnated bed nets. The malaria parasite rates and proportions of people experiencing 'disease with fever' decreased significantly in villages provided with permethrin-treated nets but not in the control villages. Impregnated nets may be an important tool to reduce disease and death due to malaria in Guinea Bissau.

Introduction

In Guinea Bissau malaria is considered to be the most important public health problem amongst children. In large areas of the country malaria also causes much morbidity among adults, particularly during and shortly after the rainy season when transmission intensity may be high (Ministry of Public Health, Bissau, unpublished data). No precise data are available on the true prevalence of malaria in different parts of Guinea Bissau, but most rural areas are considered to be mesoendemic to holoendemic (A. Nauclér, personal communication).

In different countries the use of pyrethroid-treated bed nets has been associated with reductions in spleen index, high parasitaemias, parasite rates and/or clinical attacks with heavy parasitaemia, and child mortality (ALONSO *et al.*, 1991, 1993; further references are given by LINDSAY & GIBSON, 1988 and CURTIS *et al.*, 1989). Permethrin has very low mammalian toxicity (WHO, 1989a; CURTIS, 1992) and its use has been sanctioned by the World Health Organization (WHO, 1989b).

Apart from our project, there is no current malaria control project in Guinea Bissau and the antimalarial potentiality of impregnated bed nets has not been previously evaluated in that country.

The main aim of this investigation was to assess the potential of utilizing placebo-treated or permethrin-impregnated bed nets to control malaria in different ecological settings with different ethnic groups in north-western Guinea Bissau. In addition, we investigated the prevalence of *Plasmodium falciparum* in *Anopheles gambiae* and *A. melas*, and the prevalence of *Plasmodium* spp. in the human study populations.

Materials and Methods

Study area

Our investigations were carried out between July 1990 and December 1991 in 6 villages in the Cacheu region of north-western Guinea Bissau. The climate of the study area is Sudano-Guinean with a single rainy season that usually lasts from early June to late October or early November. The study villages were Augusto Offers and Tomazia Martins (inhabited by Balanta people), Dabatear and Badjique (Mancanja people), and Cachalam and Mata de Ucó (Felupe people) (Figure). The total population of these villages in October 1990 was 87, 49, 187, 86, 33 and 151, respectively.

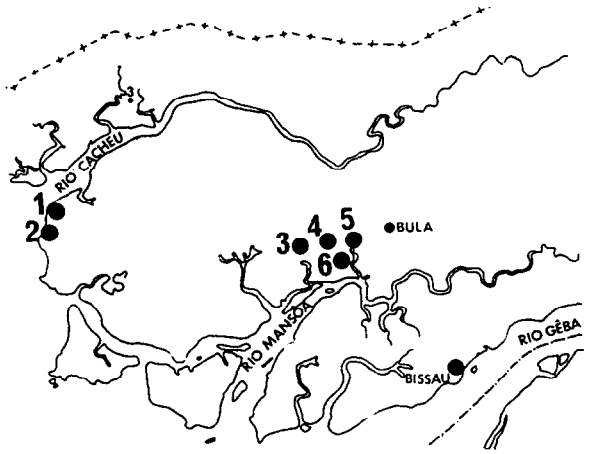

Figure. Locations of the 6 study villages in north-western Guinea Bissau. 1 Mata de Ucó; 2 Cachalam; 3 Badjique; 4 Dabatear; 5 Augusto Offers; 6 Tomazia Martins.

Interviews

The houses and bedrooms in each village were mapped and numbered. Each person was recorded and given a numbered registration card with his/her name, sex, age, house number, etc. Most people living permanently in the study villages participated in the study. Each person was interviewed, according to a standard questionnaire, once each month from August to December 1990, and in April/May and once monthly during June–December 1991. The questions concerned fevers during the last month, treatment of any such disease, deaths in the family during the previous month, symptoms and possible cause of death, and what anti-mosquito measures they

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