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European Journal of Experimental Biology, 2013, 3(2):187-190

ISSN: 2248 –9215
CODEN (USA): EJEBAU

Lambdacyhalothrin (pyrethriod insecticide)-treated curtains, mats and blankets as alternative to insecticide treated bed-nets for mosquitoes control

[1]Okoh Ngozi, [2]Odikamnoro O. O and [2]Uhuo A. C.

[1]Department of Zoology, University of Nigeria, Nsukka, Enugu State, Nigeria
[2]Department of Applied Biology, Ebonyi State University, Abakaliki, Ebonyi State, Nigeria

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ABSTRACT

The study on lambdacyhalothrin (pyrethriod insecticide)-treated curtains, mats and blankets as alternative to insecticide treated bed-nets for mosquito control was conducted between January to November 2004. Sampling was done every month within the period. Thick and thin smear blood samples were taken from the index finger of pupils to detect Plasmodium parasites. Blood smear for parasite detection was done three times, monthly before and after the deployment of the treated materials. Two yards of curtain were soaked in 0.025mg/l or 0.001mg/l concentration of lambdacyhalothrin respectively. Same was done for local mats (from Pandanus sanderi) and blankets. Data collected were analyzed using analysis of variance (ANOVA) Chi-square and least significant difference (F-LSD = LSD) after a preliminary f-test. The result of the pre-test that necessitated the use of 0.025mg/l and 0.001mg/l of lambdacyhalothrin showed that in guinea pigs, there were no significant effects of the insecticide on haemoglobin values, packed cell volume, heart rate, respiration and temperature ($p>0.01$) examined respectively. Morbidity indicators studied were found to decline with the deployment of the household treated materials. Malaria prevalence also declined in sampled children. Before the deployment of the treated items, the percentage prevalence was 68.3%. By the end of the research, it dropped to 30.12%. Efficient malaria control, especially among children, often results from environmental improvements, such as good sanitation and destruction of mosquito-breeding sites while the effective use of insecticide treated nets will help reduce the incidence of malaria mostly among the predisposing group.

Keywords: lambdacyhalothrin, insecticide, mosquitoe, control.

INTRODUCTION

Malaria in Africa remains a serious health problem. It is particularly dangerous to children because it can cause life threatening condition and sometimes leading to death. Many researchers have sought different ways to eradicate malaria to no avail. It is noted that the control of malaria transmission through the prevention of mosquito-human contact is often termed “personal protection” and may include the use of barriers and repellants. A WHO inter-ministerial meeting in Brazzaville in 1991, defined personal protection as “measures including use of insecticide treated materials such as repellant soap, burning of local plant products and use of bed nets”. Sometimes wearing of protective clothing is counted among personal protective measures, which not only is uncomfortable in humid tropical environment but also rarely deters the determined mosquitoes. According to historical records, the use of

repellant soap dropped significantly after charges were imposed. The protective effect of the soap also dropped to 81% six hours after use and three hours for people who were more physically active. Research in Guinea Bissau found that burning of local plant products had a positive repellents effect on mosquitoes keeping them out of bedrooms. Insecticide treated bed nets (ITNs) and eave hangings have been tested thoroughly in the field. Various research trials using the insecticide treated bed nets have demonstrated reduction in morbidity and mortality [4]. For example, in Gambia, [11], in Kenya [7], in Ghana [2] and in Nigeria [3]. It is noted that even if nets are torn or have holes, as long as they are retreated, they will still have effect on mosquito vectors. Insecticide treated bed nets have also been found to reduce all causes of mortality in the community [5]. A drop from eighty percent to sixteen percent in families that brought their nets for re-treatment was seen after charges were introduced in some communities [6]. And this led to a resurgence of mosquitoes and subsequent increase in malaria disease. This potential negative impact of insecticide treated bed net for malaria control means that search for other control technologies is inevitable. Described here are findings from a study to find an alternative to insecticide treated bed-nets by using Lambdacyhalothrin treated household items, like curtains, mats and blankets in controlling mosquitoes and consequently leading to a reduction of malaria prevalence among children in Oruku. The objective of this study is to find an alternative to insecticide-treated bed nets by using treated household items, like curtains, mats and blankets and to study malaria prevalence amongst children.

MATERIALS AND METHODS

The study area was Oruku, a town near Enugu, Enugu state, Nigeria. Permission was obtained from medical services department of the State Ministry of Health for the study, after which a pre-test was conducted using guinea pigs. Based on the permission obtained, an epidemiological registration of randomly selected households in four of the villages of Oruku was undertaken.

Sample Selection: Out of the six villages that make up Oruku community**,** four were selected by random sampling. The names of the villages were compiled and the ones to be used were selected by balloting. The study villages selected were Ameke, Eziobodo, Isienu and Obinagu. In the selected villages, all households were registered and from the registered households, the sampled households were selected using systematic random sampling techniques [1] in which a sample is picked after every three. Forty households were selected from each village, 30 used for experimental study and 10 as their control, making a total of 160 households. House to house visit, and registration of information on ages, weight, health record and hospital or health seeking visits were documented for each individual within a given household.

Malaria Prevalence Study: Malaria prevalence study started in January 2004 and ended in November 2004. Datas were collected three times monthly. The first was collected pre deployment of the treated household items. The second and third data collection was done post deployment of the treated household items. Data on blood samples for malaria parasite detection were collected three times monthly from sampled children of ages from one month to 15 years in both the experimental household and their control within the various villages used for the study. Blood smears (thin and thick smear) for malaria parasite detection were taken from the index finger of sample children (from ages 1-15) on slides (plate 1). They were air dried and then packed in slide racks within which there were taken to the laboratory for analysis. Data on trend of malaria cases at community health centre Oruku, using the health centre records was also collected four months before (January, February, March and April, 2004) and after (August, September, October and November, 2004) the deployment of the treated items. A total population of 498 was studied for malaria prevalence, 369 (74.1%) was from the experimental households and 129 (25.9%) from the control households. Almost half the studied population was aged < 5 years.

Laboratory Studies: In the laboratory, the slides were first of all stained with Giemsa stain for parasite identification and when the parasite was identified to be present, it was then stained further with Leishman's stain for species identification. They were then viewed under oil immersion objective microscope and the parasite specie and degree of infection were identified. All the individuals who were confirmed parasite- positive for malaria were treated with standard therapy by an accompanying nurse.

Treatment and Deployment of Control Materials: The materials used for the study were curtains, local mats and blankets. These were treated with graded doses of lambdacyhalothrin. Curtain materials 180cm × 90cm were dipped in lambdacyhalothrin, local mats 164cm× 110 and blankets 107cm × 92.5cm had their edges soaked with lambdacyhalothrin. The dipping and soaking were performed to achieve a target dose of 75cl of 0.001mg/l or

0.025mg/l concentration of the chemical. The treatment was done a week before the day of the deployment and allowed to dry. After the first malaria prevalence study, these household items were deployed to the experimental households-curtains were hung on door leading to the outside and windows, mats were spread on beds or floors, blankets were used to cover the children's body when they sleep. Monitoring of the functioning of these materials especially curtains was done weekly. Checks were conducted between 5pm-7pm to check the position of doors and windows curtains to see if they were hanging down and covering the entrance to the house or tied/held back in some way by.

Statistical Analysis: Data collected on the effect of treatments with local mats, curtain and blankets treated with Lambdacyhalothrin, on malaria prevalence were analyzed using analysis of variance (ANOVA). Data on malaria prevalence study from sampled children in both experimental households and their controls were analyzed using chi-square (χ^2) statistic. Data on hospital records of malaria cases for four (4) months before and after deployment of the treated items were standardized by converting them to percentages using months and age groups in the standardization before the analyses of variance were performed. Differences between treatment and effect means were detected using the least significant difference (LSD =LSD) or protected LSD after a preliminary f-test [7].

RESULTS

Table 1: Prevalence of malaria infection according to age group of sample children in both the experimental households and their control prior to deployment of treated items.

Age Group	Experimental Household		Control Household	
	No Examined	No Infected (%)	No Examined	No Infected (%)
1 – 5	192	141(73.4)	58	39(67.2)
6 – 10	114	72(63.2)	9	25(64.1)
11 – 15	63	39(61.9)	32	23(71.9)
TOTAL	369	252(68.3)	129	87(67.4)

$\chi^2 = 146.41$, $P > 0.05$, $df = 14$, $\chi^2 = 24.91$, $P > 0.05$, $df = 14$

Table 2: Prevalence of malaria infection according to the age groups of sampled children in both the experimental households and their control by the end of the study. (For third prevalence study)

Age Group	Experimental Household		Control Household	
	No Examined	No Infected (%)	No Examined	No Infection (%)
1 – 5	186	60 (32.3)	50	39 (78)
6 – 10	111	33 (29.7)	33	23 (69.7)
11 – 15	60	15 (25)	21	16 (76.2)
Total	357	108 (30.25)	104	78 (75)

$\chi^2 = 145.91$, $P > 0.05$, d.f. = 14).

Table 3: Prevalence of Malaria for four months before and after deployment of treated protective items using hospital records.

	Age (Years)			
Treatment	1 – 5	6 – 10	11 – 15	Mean
Before (%)	75.01	80.08	68.99	74.69
After (%)	41.82	14.61	40.72	32.38
Mean	58.42	60.85	54.85	

LSD ($P < 0.05$) for comparing treatment means = 4.68% Differences in Ages of patients and months within treatment were statistically non-significant.

DISCUSSION

Before the deployment of the lambdacyhalothrin treated materials in the experimental households, the infants (ages 1-5 years) had the highest prevalence for malaria (73.4%). The lowest prevalence was recorded in the 11-15 years age bracket (61.9%). Malaria prevalence is independent of age. On the other hand 67.4% of all the sampled children in the control households had malaria infection at the start of this study. Children of older age (11-15 years) had the highest prevalence for malaria infection (71.9%) and the lowest prevalence was recorded in 6-10 years age bracket (64.1%). However, analysis of the data showed that age was not statistically significant ($P > 0.05$) in the distribution of malaria infection among the sampled children in both groups. Prior to deployment of treated items in the various villages of Oruku, peak prevalence varied among the sampled children in the control group within the various villages, such that Obinagu had the highest prevalence of 81.8% for the 1-5years age group, Ameke had 78.6% as the highest in the 6-10years age group. In the older children (11-15years) the peak prevalence was 66.7% at Isienu

village. Therefore malaria is highly endemic in the area especially among children. Obinagu village had the highest prevalence for malaria infection of approximately 82% and 75% for ages 1-5 years in both the experimental households and their control respectively.

Malaria prevalence also varied among the sample children in the control groups within the various villages. Obinagu had the highest prevalence of 75% for children of age's 1-5years and 11-15years age group respectively. This is followed by 73.3% in Ameke found in 11-15 years age group. For children within ages 6-10 years of age, the highest prevalence was 66.7% but recorded in Ameke and Isienu respectively. Distribution among the age groups and within the villages is not statistically significant. One month after the deployment of the treated household items to the experimental households, a post prevalence (second prevalence) study was done. The malaria prevalence rate changed statistically (P = 0.05) from 68.3% to 41.7%. It also changed from 73.4% to 42.9%, 63.2% to 41.4% and 61.9% to 38.9% for the sampled children within ages 1 – 5, 6 – 10 and 11 – 15 years respectively. Differences in age group of sampled children were statistically not significant. Malaria prevalence also changed from 73.3% to 24.2%, 66.7% to 52.4%, 72.7% to 31.8% and 59.4% to 56.9% in Ameke, Isienu, Obinagu and Eziobodo villages respectively.

After another check (third prevalence), there was a visible drop in malaria prevalence in all age groups within the experimental households. It changed from 68.3% at the start of the survey to 30.25% by the end of the survey. This showed a statistically ($P < 0.05$) significant difference in prevalence among the age groups. Also in the experimental household within the various villages malaria prevalence changed from 73.3% to 16.7%, 66.7% to 45.8%, 72.7% to 9.1% and 59.45 to 51.6% for all the sampled children in Ameke, Isienu, Obinagu and Eziobodo villages respectively. However it was still slightly high in Isienu (45.8%) and Eziobodo (51.6%) villages than in Ameke (16.7%) and Obinagu (9.1%) villages. The treated items gave near total mosquito / malaria control in the affected villages. There was equally a statistically significant reduction ($P < 0.05$) in the mean malaria cases of children from ages one month and 15 years based on the town health center records used from approximately 75% before treatment to 32.38% after treatment. Differences in age of patients and months within treatment were statistically not significant ($P < 0.05$).On the other hand, malaria prevalence was still on the increase among children in the control households within the various villages. It increased statistically from 66.7% to 78.8%, 68.2% to 72.7%, 69.2% to 78.3% and 66.7% to 70.8% ($p = 0.05$) for all the sampled children in the control households within Ameke, Isienu, Obinagu and Eziobodo villages respectively.

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