

COMPARATIVE STUDY ON THE HUMAN LANDING CATCH AND LIGHT TRAP METHODS IS VERIFICATION OF MOSQUITO VECTOR INDICES IN AN ENDEMIC AREA

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Abstract

As part of a longitudinal study on the epidemiology of filariasis, this study was carried out to test a hypothesis that three light traps catch about the same number of mosquitoes as a team of two Human Landing Catch collectors. The comparison was done to analyze possible differences between the two techniques in the species composition, population density, and the age of the mosquitoes caught. The spectrum of species composition was basically the same. The population density of the mosquito species was comparable between the two methods. The percentage of parous females obtained from human landing catch was higher than that from the light trap catch for the species caught. However, the differences were not statistically significant (X^2 -test; $p > 0.05$, for all tests). A scatter plot of the log-transformed number of female mosquitoes caught by human landing catch and log-transformed number of females caught by the light traps, with a fitted regression line, and a double log-transformed scale, showed a strong correlation between the catching methods. The Spearman's rho Correlation Coefficient was statistically significant (0.94; $p > 0.001$); and the relationship between the two methods was independent of the size of the measurements for the mosquito species. It is therefore concluded that entomological results on mosquitoes obtained using three light traps are comparable to same results obtained using a team of two Human Landing Catch collectors.

Key words: Mosquito, filariasis, population density, collection techniques

Introduction

Collection of mosquitoes in epidemiological studies using the human landing catch method has been criticized as being crude, laborious, and very dangerous as it exposes the human baits to danger of being bitten by infective vectors. There is also the problem of differences in efficiency between different catchers, which perhaps affects the number of mosquitoes collected during studies, making the results difficult to rightly compare with another. The need for another mosquito collection method that will eliminate these

problems cannot be emphasized. This study was therefore aimed at testing the hypothesis that three light traps (LT) catch about the same number of mosquitoes as a team of two Human Landing Catch (HLC) collectors. The comparison of these two methods (that is LT and HLC) was done to analyze any possible differences between the two techniques in the species composition, population density, and the age of the mosquitoes caught. This study formed part of a longitudinal study on the epidemiology of filariasis in the Imo River Basin.

Materials and methods

The study was carried out in a filariasis endemic area in Umuowaibu, Okigwe, Imo State. Every week, during 12 months from September, 1995 to August, 1996, two night-time HLC and two nights of LT collections (3 LT each night) were carried. A four-man team of collectors alternated pair-wise between collecting and resting from 18-00 hours to 06.00 (18.00 hours to 22.00 hours outdoors, 22.00 to 06.00 hours indoors). The light traps were used in rooms where only one occupant slept. The traps were turned on at 18.00 hours and at 06.00 hours the cages were closed with a piece of string and turned off by the occupants. Collected vectors from the two methods were kept in cool boxes until dissected (those alive), after being sexed, and identified based on external morphology using Gillies and Coetzee (1987), Gillies and de Meillon (1968) and Edwards (1941).

During dissection, ovaries were extracted and quickly transferred to a drop of distilled water on a slide, left to dry before being examined under high magnification for tracheal skeins and classified as parous or nulliparous (WHO, 1987). The head, thorax, and the remaining parts of the abdomen were then separated and put in different drops of saline. These parts were teased and examined under the microscope at x40 magnification for filarial larvae were identified as LI, L2, or L3 larvae using WHO (1987) and counted. All female mosquitoes were dissected fully whether parous or nulliparous.

Results

The species composition caught by the two methods was comparable. For expediency, comparative analysis was done using these three species. Overall, light traps captured 51.66% of the total catch (*An.gambiae* 51.8%, *Cx. quinquefasciatus* 50.6%, *Ae. aegypti* (57.0%), where human landing catches captured 48.4% (*An. gambiae*, 48.2%; *Cx. quinquefasciatus*, 49.4%; *Ae. aegypti*, 43.0%).

The percentage parous female mosquitoes obtained by the two collecting methods are presented in Table 2. The percentage of parous female mosquitoes obtained from the human landing catch was significantly higher than that from the light trap catch both for *An. gambiae* (X^2 -test; 6.94; $p<0.01$) and for *Cx. quinquefasciatus* X^2 - test; 7.01; $p<0.01$). A scatter plot of the log-transformed number of female mosquitoes caught by human catch (made up of two collectors) and log-transformed half of the number of caught by the six light traps, with a fitted regression line, and on a double log-transformed scale, showed a strong correlation between the two catching methods (Figure 1). The Spearman's Coefficient was statistically significant (0.94; $p<0.01$). Furthermore the relationship between the two methods was independent of the size of the measurements for the three species (Figure 2).

Table I. Number of female mosquitoes collected by three light traps and by human landing night at Umuowaibu, Imo State Nigeria

Species	Light trap catches			Human landing night catches			Total (%)
	Total collected	% by method	% by species	Total collected	% by method	% by species	
<i>An. gambiae</i>	7175	51.8	63.3	6674	48.2	62.7	13849 (63.0)
<i>Cx. quinquefasciatus</i>	3733	50.6	32.9	3648	49.4	34.3	7381 (33.6)
<i>Ae. aegypti</i>	426	57.0	3.8	322	43.0	3.0	748 (3.4)
Total	11334	51.6		10644	48.4		21978

Table II. Comparison of entomological indices assessed by light trap and human catch methods at Umuowaibu, Imo State, Nigeria

Species	Catch Method	No. of female mosquitoes				No.L3 (L3/inf.vec) ^b	ABR ^c (Bites/pers/yr)	ATP ^d (L3/pers/yr)
		Collected	Dissected (%)	Parous (%)	Infective (%)			
<i>An. gambiae</i>	HLC	6674	5354(80.2)	2214(41.4)	43(0.8)	73(1.7)	23487	320.2
<i>An. Gambiae</i>	LT	14350	4887(34.1)	1896(38.8)	13(0.3)	18(1.4)	25250	93.0
<i>Cx quinquefasciatus</i>	HCL	3648	3043(83.4)	1296(42.6)	0(0)	0(0)	13190	0
<i>Cx. quinquefasciatus</i>	LT	7465	2338(31.3)	912(39.0)	0(0)	0(0)	13135	0
<i>Ae. aegypti</i>	HLC	322	0(0)	0(0)	0(0)	0(0)	1133	N.A
<i>Ae. aegypti</i>	LT	852	0(0)	0(0)	0(0)	0(0)	1499	N.A

Legend: Figures in brackets, in the last three columns to the right, represent mean intensity per vector

b L3/inf.vec represents number of L3stage larvae per infective vector.

c ABR represents Annual Biting Rates

d ATP Annual Transmission Potential

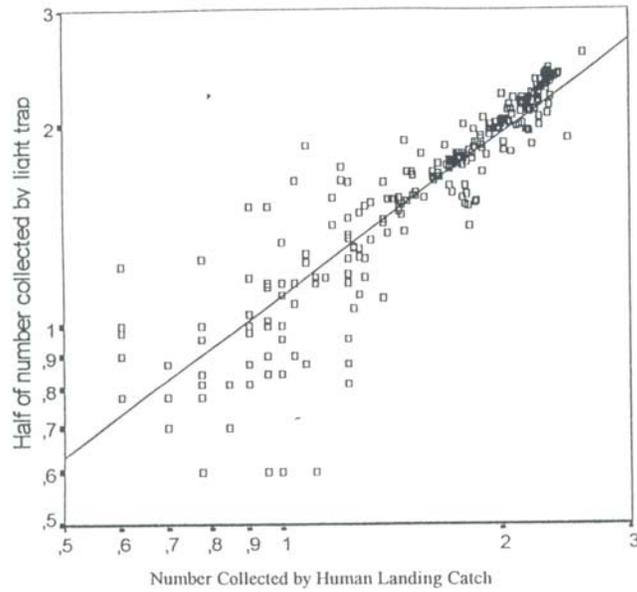


Figure 1. Comparison of number of female mosquitoes collected from Umuowaibu by the two methods using scatter plot of the log-transformed number of female mosquitoes caught by human landing catch (made up of two collectors) and log-transformed half of the number of females caught by the six light traps

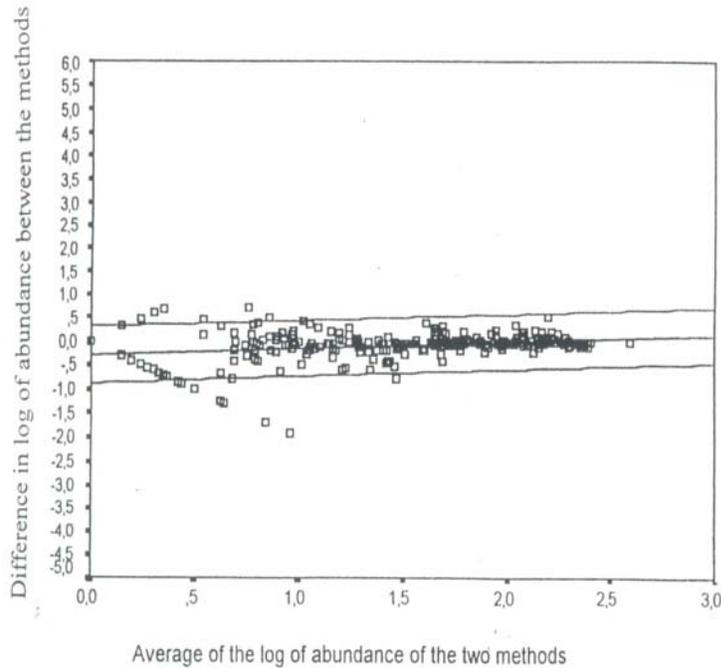


Figure 2. The relationship between the two methods (LT and HLC) used for mosquito collection Umuowaibu, Imo State, Nigeria

Discussion

Our finding on the comparability of the two catching methods agreed with the earlier conclusion by Lines *et al.* (1991) that three light traps catch approximately the same as human landing catchers during a normal HLC catch. No significant difference was observed between the collection by three LTs and collections by a two-man HLC team. The estimate of a sampling efficiency show that the geometric mean of collections by the two light traps was 1.38 times the geometric mean of collections by the two-man HLC team. This is in consonance with the findings from a similar study in Tanzania by Davies *et al.* (1995). The LT method may thus be used for estimating the human biting activity of *An. gambiae*, and probably also of *Cx. quinquefasciatus*. Similar conclusions have been made by other workers (Zaim *et al.*, 1986; Lines *et al.*, 1991). However, the percentage of parous females was significantly higher using the HLC than the LT method. This agrees with the findings of Davies *et al.* (1995) who found that unfed mosquitoes comprised the majority of mosquitoes captured by light traps. The Annual Transmission Potential was lower when measured using LT than HLC. The reasons for this are unclear. However, the HLC method is established as being more accurate for estimating human-biting rates, and the LT method may be inefficient in areas of low vector density (Githeko *et al.*, 1996). Further work is needed to study the relationship between these methods. There is need for a vector sampling method other than the HLC method to eliminate the occupational exposure of human collectors to infective vectors and to reduce the element of human error in capturing biting mosquitoes (Davies *et al.*, 1995).

It is therefore concluded that entomological results on mosquitoes obtained using three light traps are comparable to same results obtained using a team of two Human Landing Catch collectors.

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