THE SEASONAL ABUNDANCE OF *ANOPHELES GAMBIAE*, MALARIA TRANSMISSION AND THE PARASITE SENSITIVITY TO SULFADOXINE-PYRIMETHAMINE IN WESTERN KENYA

ANDREW AMBOGO OBALA

DOCTOR OF PHILOSOPHY IN ZOOLOGY

(Medical Parasitology & Entomology)

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

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ABSTRACT

The retrospective and prospective data collections were done at Chemelil Sugar Company Limited and Kopere village respectively, in western Kenya. Retrospective malaria and weather data were analyzed to provide clues on critical weather components responsible for malaria epidemics in the neighbourhood highland districts. A cross-sectional study design and two-stage sampling techniques were used to collect prospective malaria and mosquito vectors' data. A sub-sample of captured indoor-resting mosquitoes was investigated for species composition, feeding preference, parity and sporozoite rates, and the entomological inoculation rates (EIR). Malaria prevalence, mean parasites densities (MPD) and gametocytaemia were determined using finger-prick blood from volunteer candidates. Malaria positive cases were treated with sulfadoxine/pyrimethamine (SP), and repeat blood smears (BS) done after every three months to determine SP resistance. Spatial and temporal malaria incidence rate distributions were demonstrated using geographic information system (GIS) plots on the digital map of the study area.

Malaria prevalence of 49.5 and 46.8 percent were obtained from the retrospective and prospective data respectively with significant non-uniform malaria incidence distribution detected in the latter ($t=5.771$, $p=0.029$), although malaria prevalence trends for two-year period were highly correlated ($r=0.943$). Compound clusters proximal to mosquito residual breeding habitats had consistently high parasite incidence rates, one of which averaged 55.3 percent compared to 42.1 percent for one located further away

from these habitats. These findings demonstrate GIS potential in identifying temporal and spatial pattern of malaria transmission, and showed this technique has the ability to assist in targeting malaria control where it is most needed to minimize cost of operations. The highest MPD of 3,744-parasites/μℓ blood was obtained among children 2-4 years compared to 232-parasites/μℓ blood for older age-group 15 years and above. This makes children in former age-group most parasitaemic and were the main parasite reservoir which feed local malaria transmission cycle. The SP parasite resistance of 29.2 percent was higher than WHO recommended limits of 10 percent, and this drug has since been replaced as first-line drug for malaria treatment in Kenya.

Anopheles gambiae sensu stricto (ss) and *An. arabiensis*, two cryptic species of *An. gambiae* comprised 75.2 and 24.8 percent of total indoor resting malaria vectors respectively. Significant differences were found in vector densities between months during the study period ($p < 0.001$). Combined climatic components had significant impact on vector densities (ANOVA: $p < 0.05$), but this statistical method could only account for 49.9 percent of the variance in the data ($R^2=0.499$). Both rainfall and minimum temperatures were positively associated with the vector densities ($r=0.280$ and $r=0.626$ respectively), but only the latter had significant impact on the vector densities ($p < 0.05$). Human blood preference, parity and sporozoite rates, and EIR were moderately high (57.7, 62.0, 5.7 percent and 259.4bites/person/year respectively) suggesting efficiency in malaria transmission in the study area.

These results showed malaria control should aim at reduction of MPD to less than 1,000-parasite/μℓ blood to temper gemetogony and reduce transmission. This parameter is easily amenable to control in the short-term than often used malaria incidence and prevalence rates. The SP parasite resistance of 29.2 percent exceeds 10 percent limit recommended by WHO, and this drug has since been replaced by artemisinin combination therapy (ACT) in Kenya. Both insecticides residual sprays (IRS) and insecticide treated nets (ITN) are recommended for effective malaria control due to heterogeneous resting habits of a component of the vectors caught resting indoors.