

ABSTRACT

Malaria continues to be an important disease in the tropics posing a major obstacle to sustainable development. Malaria control is dependent on pyrethroid insecticides yet resistance to these insecticides in the malaria vector *Anopheles gambiae* is receiving increasing attention because it threatens the sustainability of malaria vector control programs targeted at indoor resting mosquitoes in Western Kenya. Common mechanism of resistance reported to these insecticides is target site insensitivity and through degradation of the insecticides by metabolic enzymes. When a female mosquito takes a blood meal, altered gene expression occurs in order to accommodate and utilize the nutrients; hence, it is hypothesized that the enzymes responsible for the detoxification of xenobiotics in the blood meal may influence the subsequent level of susceptibility to insecticides following exposure. The aim of this study was to determine the influence of blood meal status on deltamethrin tolerance in wild collected (Bungoma) *Anopheles gambiae* alongside Kisumu susceptible strain of *Anopheles gambiae* as a reference strain. WHO-tube susceptibility test was done to determine the difference in susceptibility to deltamethrin in *Anopheles gambiae* with different gonotrophic status at different age groups (2-4 and 14-16 days old) from the two populations. Metabolic assays were done to measure change in levels of detoxification enzymes (Oxidase, non-specific esterases and Glutathione- S- transferases), in response to the presence of a blood meal. The Mortality rates were calculated as a percentage of individual mosquitoes that died within 24 hours of exposure and levels of resistance were classified according to WHO guidelines. All means were compared using either a 2-sample t-test or a 1-way Analysis of Variance (ANOVA) with a Tukey comparison-of-means as a post-hoc test. All confidence intervals were set at 95%. Statistical analysis was done using SPSS version 21.0. Bioassay results showed younger (2-4 days) unfed wild mosquitoes were more resistant to pyrethroids than older (14-16) unfed ones (Mortality rates 83% vs 98%) which was significantly different ($p < 0.047$). Results showed reduced mortality in younger wild collected mosquitoes with various gonotrophic status (mortality ranged from 36-83%). Older females from the same population with varying gonotrophic status showed increased mortality to the same insecticide (85-98%). Kisumu susceptible population showed 100% susceptibility independent of their gonotrophic status. Biochemical estimations on the wild population revealed significantly ($P < 0.05$) higher levels of oxidase, non-specific esterase and glutathione-S-transferases activity in the blood fed and half gravid survivors of *An. gambiae* as compared to unfed survived younger individuals. For older females from the same population, blood fed and half gravid survivors showed significantly higher oxidase and glutathione-S-transferases activity as compare to unfed and gravid survivors. For the Kisumu susceptible strain, oxidases, non-specific esterases and GSTs levels were higher in both younger and older fed groups compared to the unfed groups ($P < 0.05$). Thou there was no significant difference in elevation of all the three enzyme measured between the means of unexposed live groups and the exposed knocked down groups for both age groups ($P > 0.05$). The results showed that blood feeding in vector mosquitoes plays an important role in the toxicity of deltamethrin. It is believed that this change in susceptibility may be due to increasing systemic expression of detoxification enzymes as metabolic activity increases during the process of blood digestion. These enzymes may also confer increased tolerance of blood fed mosquitoes to insecticides. These may have implications for the sustained efficacy of the indoor residual spraying and insecticide treated nets based control programs that target indoor resting female mosquitoes of various gonotrophic status.

