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Impact of different mosquito collection methods on indicators of *Anopheles* malaria vectors in Uganda

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Abstract

Background: Methods used to sample mosquitoes are important to consider when estimating entomologic metrics. Human landing catches (HLCs) are considered the gold standard for collecting malaria vectors. However, HLCs are labour intensive, can expose collectors to transmission risk, and are difficult to implement at scale. This study compared alternative methods to HLCs for collecting *Anopheles* mosquitoes in eastern Uganda.

Methods: Between June and November 2021, mosquitoes were collected from randomly selected households in three parishes in Tororo and Busia districts. Mosquitoes were collected indoors and outdoors using HLCs in 16 households every 4 weeks. Additional collections were done indoors with prokopack aspirators, and outdoors with pit traps, in these 16 households every 2 weeks. CDC light trap collections were done indoors in 80 households every 4 weeks. Female *Anopheles* mosquitoes were identified morphologically and *Anopheles gambiae* sensu lato were speciated using PCR. *Plasmodium falciparum* sporozoite testing was done with ELISA.

Results: Overall, 4,891 female *Anopheles* were collected, including 3,318 indoors and 1,573 outdoors. Compared to indoor HLCs, vector density (mosquitoes per unit collection) was lower using CDC light traps (4.24 vs 2.96, density ratio [DR] 0.70, 95% CIs 0.63–0.77, $p < 0.001$) and prokopacks (4.24 vs 1.82, DR 0.43, 95% CIs 0.37–0.49, $p < 0.001$). Sporozoite rates were similar between indoor methods, although precision was limited. Compared to outdoor HLCs, vector density was higher using pit trap collections (3.53 vs 6.43, DR 1.82, 95% CIs 1.61–2.05, $p < 0.001$), while the sporozoite rate was lower (0.018 vs 0.004, rate ratio [RR] 0.23, 95% CIs 0.07–0.75, $p = 0.008$). Prokopacks collected a higher proportion of *Anopheles funestus* (75.0%) than indoor HLCs (25.8%), while pit traps collected a higher proportion of *Anopheles arabiensis* (84.3%) than outdoor HLCs (36.9%).

Conclusion: In this setting, the density and species of mosquitoes collected with alternative methods varied, reflecting the feeding and resting characteristics of the common vectors and the different collection approaches. These differences could impact on the accuracy of entomological indicators and estimates of malaria transmission, when using the alternative methods for sampling mosquitoes, as compared to HLCs.

Keywords: *Anopheles*, Human landing catches, CDC light trap, Prokopack aspirators, Pit trap

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