

Post market surveillance of a PBO LLIN, PermaNet® 3.0

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Introduction

Pyrethroid-PBO long-lasting insecticidal nets (LLINs) are one of the core malaria prevention interventions targeted for deployment in areas of pyrethroid resistance. In line with the calls for durability monitoring and understanding the long-term effectiveness of active ingredient(s) in new types of nets (PMI, 2021), Vestergaard has conducted post market surveillance of PermaNet® 3.0, 2-3 years following distribution. For medicines and health products, post market surveillance aims to monitor and ensure product safety and efficacy in use. Post market field sampling of LLINs after distribution is a way to monitor and assess LLIN insecticidal activity in real use conditions.

Materials and methods

The procedure used by Vestergaard is an adaptation of the WHO guidelines for laboratory and field testing of LLINs (WHO, 2013) and the WHO guidelines for monitoring durability of long-lasting insecticidal mosquito nets under operational conditions (WHO, 2011).

Working in cooperation with National Malaria Control Programmes, national research institutes and implementing organizations, PermaNet® 3.0 were identified and collected from households, 2-3 years post-distribution (Figure 1). For each collected net, a brand new PermaNet® 3.0 was given as replacement. Collected samples were packed in separate plastic bags and shipped to the Vestergaard-NMIMR Vector Labs in Accra, Ghana where cone bioassay tests with the pyrethroid susceptible *Anopheles gambiae* s.s. Kisumu strain. After bioassay, the net samples were wrapped individually in aluminium foil, labelled carefully, and shipped to the Vestergaard Quality Control Lab in Hanoi, Vietnam for chemical content analysis. The analytical methods used are published by the Collaborative International Pesticides Analytical Council (CIPAC). Proportional hole index data, as a measure of physical durability, were also collected (but not reported in this poster).

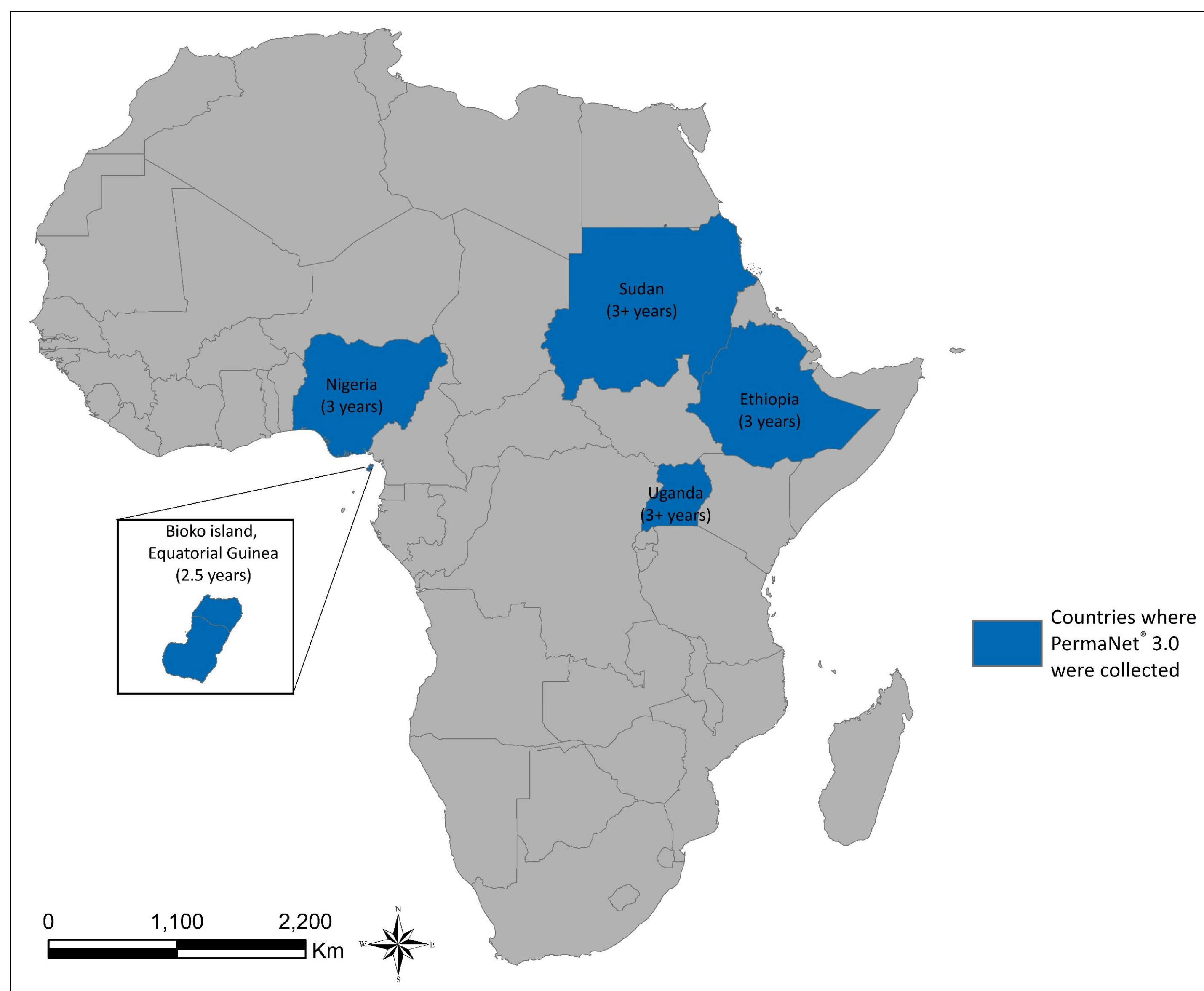


Figure 1: Map of PermaNet® 3.0 collections

Results

- Tests with *An. gambiae* s.s. Kisumu indicated all PermaNet 3.0 roof samples passed the optimal effectiveness threshold ($\geq 95\%$ knockdown or $\geq 80\%$ mortality with a pyrethroid susceptible lab strain) (Figure 2). Knockdown was 100% for all samples.
- Deltamethrin content on the PermaNet® 3.0 roof samples varied by location with three-year-old samples from Ethiopia having the least amount of deltamethrin (Figure 3).
- PBO content also varied in PermaNet® 3.0 roof with samples from Ethiopia reporting the least PBO content (Figure 4).

References

- U.S. President's Malaria Initiative (PMI). *PMI Technical Guidance FY2022*. PMI; 2021
- World Health Organization (WHO). *Guidelines for Laboratory and Field-Testing of Long-Lasting Insecticidal Nets*. WHO; 2013.
- World Health Organization (WHO). *Guidelines for Monitoring the Durability of Long-Lasting Insecticidal Mosquito Nets under Operational Conditions*. WHO; 2011.

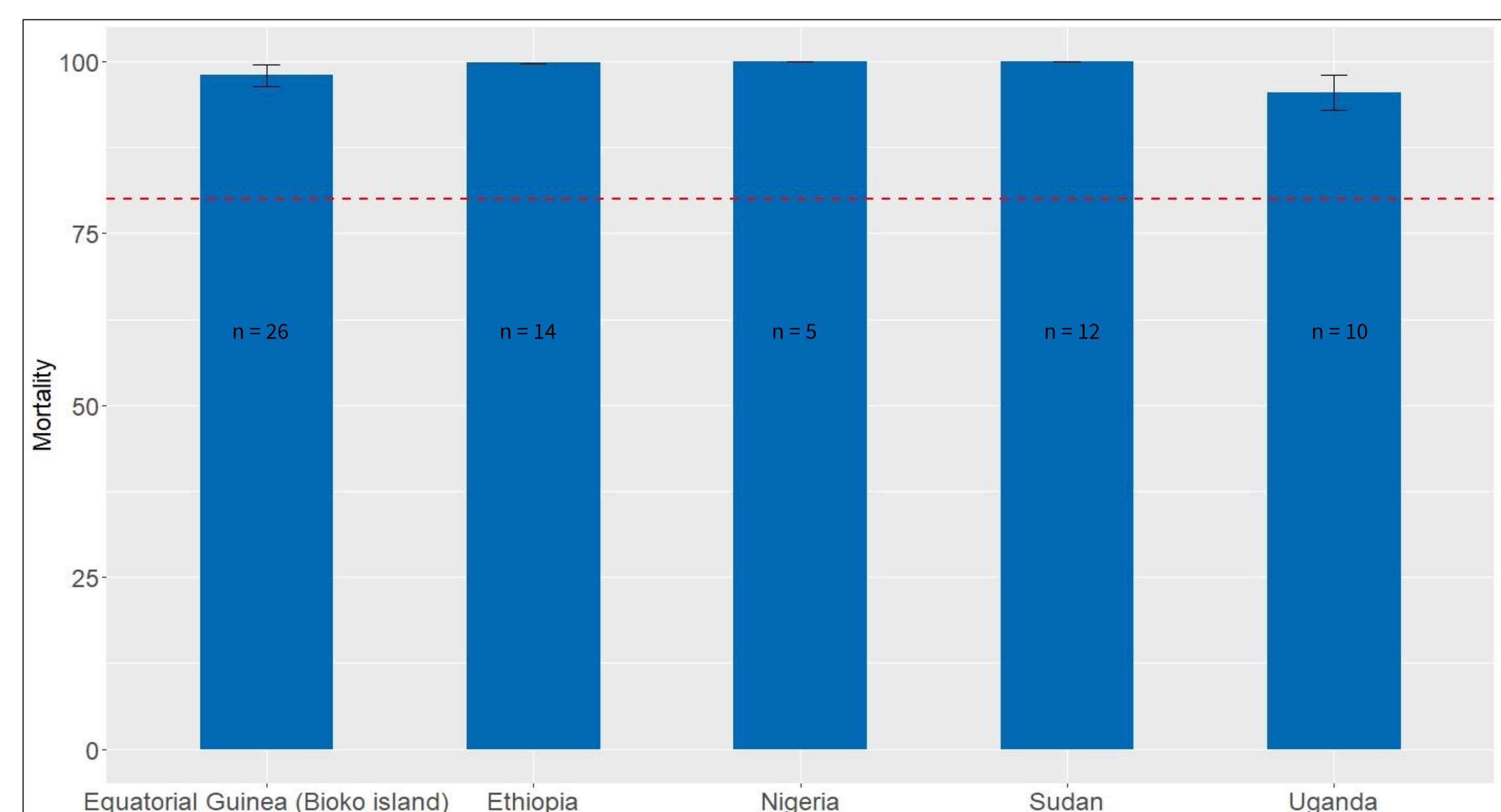


Figure 2: PermaNet® 3.0 roof mortality on pyrethroid susceptible *An. gambiae* s.s. Kisumu. The red dashed line indicates the optimal effectiveness cut off for mortality (80% mortality). Error bars represent 95% CI

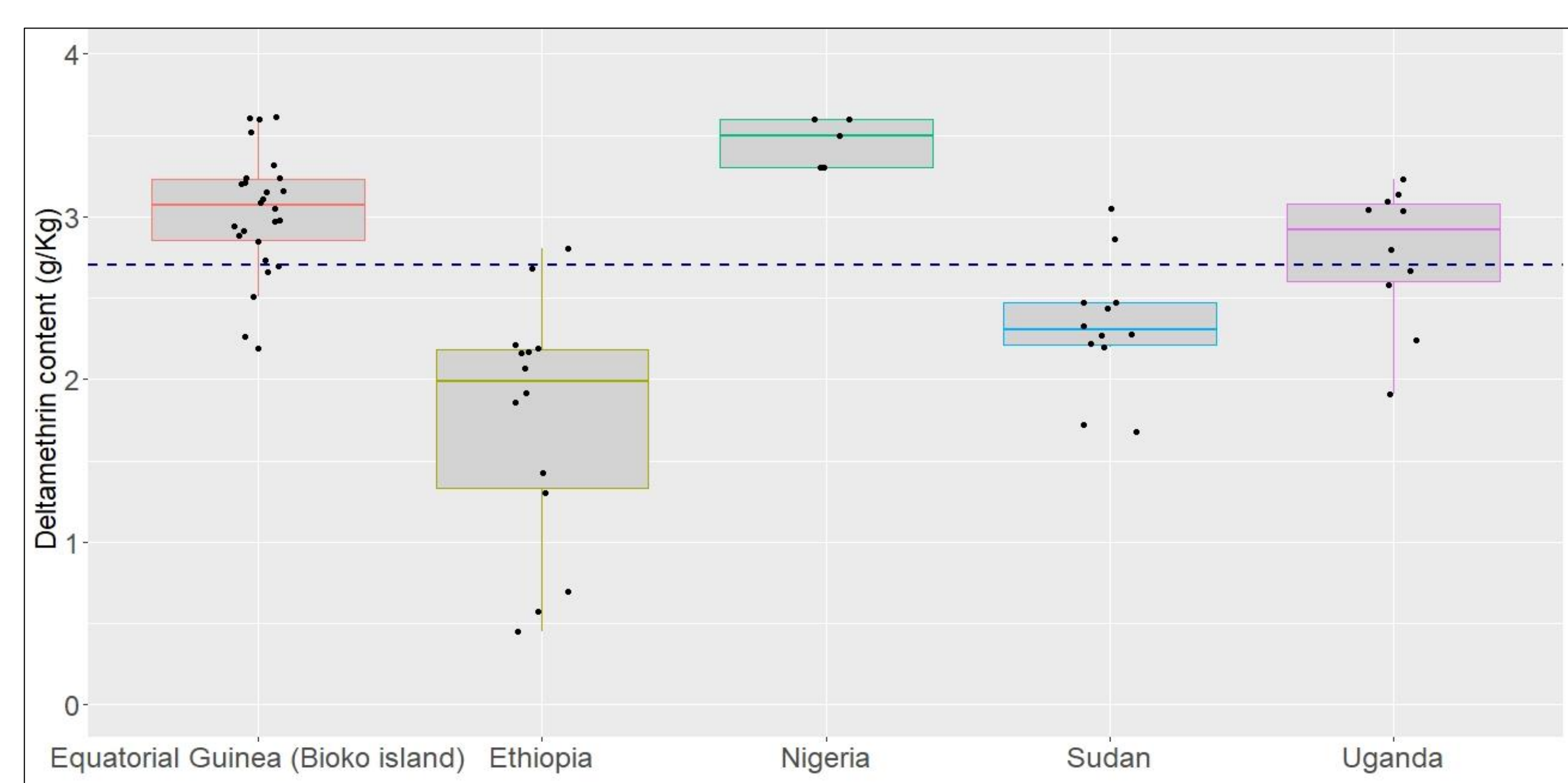


Figure 3: Deltamethrin content on PermaNet® 3.0 roof samples. Blue dashed line shows mean content from multi-country Phase III data (generated under WHOPES)

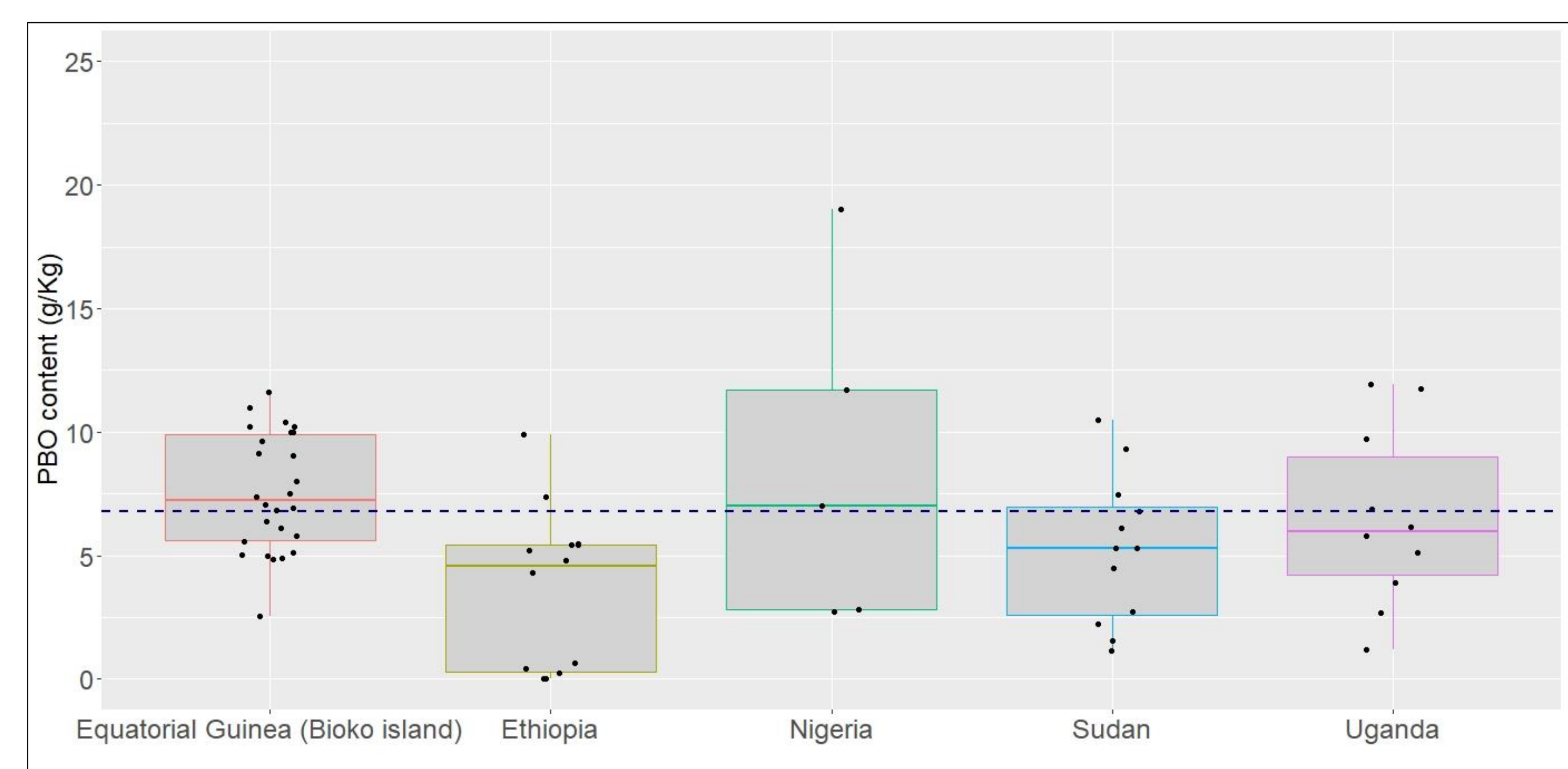


Figure 4: PBO content on PermaNet® 3.0 roof samples. Blue dashed line shows mean content from multi-country Phase III data (generated under WHOPES)

Discussion

- Vestergaard's post market surveillance activities produced a snapshot of PermaNet® 3.0, throughout the product lifetime in operational, real world use
- Convenience sampling is a limitation of this type of surveillance
- Testing of the collected PermaNet® 3.0 samples against pyrethroid resistant laboratory colonies is ongoing
- For products with efficacy claims against resistant mosquitoes, there is need to expand the current WHO guidelines (2013) to include guidance for testing with well characterised pyrethroid resistant strains, which can also guide additional testing in post market surveillance of vector control tools

Conclusion

- Chemical content and bioefficacy data from post market surveillance were in line with long term (Phase III) studies conducted in Ghana, India, and Kenya under the former WHOPES scheme.
- Long term monitoring / post market surveillance is essential to ensure quality products and in the case of PBO LLINs, to confirm the availability of PBO throughout the lifetime of a PBO LLIN.