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Food insecurity severity in quilombola communities in Bahia, Brazil: racialized territorial vulnerability and health inequity

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Research Article

Keywords: Food insecurity, Quilombola communities, Racial and ethnic health disparities, Health equity, Structural racism, Brazil

Posted Date: May 27th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9810627/v1

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Additional Declarations: The authors declare no competing interests.

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Article type: Original Research Article

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Acknowledgements

The authors thank the participating quilombola communities, community leaders, and local councils for their trust, collaboration, and shared commitment to community-based research. The authors also acknowledge the broader local partnerships that supported the fieldwork. The first author gratefully acknowledges the Coordination for the

Improvement of Higher Education Personnel (CAPES) for the doctoral scholarship that supported his permanence in the graduate program and made this academic work possible.

Abstract

Background: Food insecurity is a major expression of racialized territorial and ethnic-racial health inequities in Brazil. Quilombola communities, Afro-descendant traditional territories, face persistent land, economic, environmental and institutional disadvantages that may shape household food insecurity severity. Methods: This cross-sectional study analyzed primary household data collected between April 2023 and February 2024 in seven quilombola communities in Bahia, Brazil. The analytic sample included 204 household respondents aged 18 years or older with complete responses to the seven-item Brazilian Food Insecurity Scale adapted for traditional peoples and communities. Food insecurity was classified as food security, mild, moderate or severe food insecurity. Associations were estimated using ordered logistic regression with robust standard errors, and the proportional odds assumption was assessed using the Brant test. Results: Overall, 144 households (70.6%) experienced some level of food insecurity, and 66 (32.4%) were severely food insecure. No paid work or income-generating activity (OR 1.94; 95% CI 1.12-3.37), being single, separated, divorced or widowed (OR 1.73; 95% CI 1.03-2.91), and not reporting a religion (OR 2.12; 95% CI 1.10-4.06) were associated with higher severity. Conclusions: Food insecurity was highly prevalent and patterned by income-generating opportunities, household arrangements and community-related markers. Religion should be interpreted as a possible marker of social connection rather than as a direct causal factor. Policies should strengthen income protection, territorial rights, community-led networks and local food systems.

Keywords: Food insecurity; Quilombola communities; Racial and ethnic health disparities; Health equity; Structural racism; Brazil

Background

Brazil is home to the largest Afro-descendant population outside the African continent, and the 2022 Census identified 1.32 million quilombola people in the country. Bahia has the largest quilombola population among Brazilian states, accounting for nearly one third of the national total [1]. Quilombola communities are Afro-descendant traditional territories whose health conditions are shaped by slavery, incomplete abolition, land dispossession, territorial struggles and uneven state protection. Although official recognition and certification of quilombola communities have expanded over time, territorial regularization, infrastructure and access to public policies remain uneven and politically contested [2].

Food insecurity is not only a nutritional condition. It is also a social, political and racialized expression of unequal access to income, land, public services, healthy food environments and culturally appropriate food systems. For research on racial and ethnic health disparities, quilombola food insecurity is a concrete expression of how racialized territorial arrangements become embodied as health vulnerability. International literature on nutrition and health disparities has emphasized that structural racism, economic exclusion and unequal food environments shape the distribution of food insecurity beyond individual choices [3-5].

In quilombola communities, food insecurity intersects with structural racism, environmental racism, institutional neglect and recent Brazilian debates on food racism and nutricide. These concepts matter because food deprivation is produced through historically unequal systems rather than through individual failure [6-14]. Environmental racism has been used in Brazil and internationally to describe the disproportionate exposure of racialized and traditional communities to inadequate sanitation, territorial dispossession, precarious infrastructure, sacrifice zones and weak state protection [8-11]. In this sense, food insecurity severity can be read as a marker of racialized health inequity and not only as a household economic indicator.

The Brazilian Food Insecurity Scale (Escala Brasileira de Insegurança Alimentar - EBIA) has been widely used to measure household food insecurity and captures a continuum ranging from concern about food access to severe food deprivation and hunger [15,16]. For traditional peoples and communities, adaptations of the EBIA have sought to

incorporate modes of food acquisition, collective practices and territorial specificities that are not fully captured when food access is understood only through monetary income [17-19].

Evidence from quilombola and other rural communities in Brazil shows high levels of food insecurity and strong links with poverty, social vulnerability, territorial exclusion, environmental injustice, housing conditions and structural inequalities [20-25]. However, fewer studies have examined food insecurity as an ordered outcome across severity categories in quilombola territories. Even fewer have connected food insecurity severity to community-related markers while explicitly framing quilombola communities as Afro-descendant populations affected by racialized territorial health disparities.

This study analyzed factors associated with food insecurity severity in households from seven quilombola communities in Bahia, Brazil. Unlike approaches that collapse food insecurity into a binary outcome, this study preserved the ordinal structure of the adapted EBIA, allowing the analysis to identify factors associated with increasing severity rather than only the presence or absence of food insecurity. The study contributes to the racial and ethnic health disparities literature by examining how social vulnerability and community-related markers are associated with food insecurity severity in Afro-descendant traditional territories.

Methods

Study design and reporting

This cross-sectional study was conducted in seven quilombola communities in Bahia, Brazil, between April 2023 and February 2024. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations for observational studies [26].

Setting

The study was conducted in the communities of Dende, Kalemba, Kaonge, Engenho da Praia, Engenho da Ponte and Engenho da Cruz, located in Cachoeira, and Rio dos Macacos, located in Simoes Filho, Bahia. The communities in Cachoeira are situated in the Reconcavo region, an area historically shaped by the sugar economy, slavery, Afro-Brazilian cultural practices, quilombola councils, community-based mobilization and quilombola resistance [27,28].

Rio dos Macacos is located near Salvador and has a long history of territorial conflict, resistance and collective mobilization. Previous research has described this community as a quilombola territory marked by diasporic experiences, struggles for land rights, anthropological disputes and socio-environmental vulnerability [29-31].

Participants and sampling

Eligible participants were household respondents aged 18 years or older who had lived in one of the participating quilombola communities for at least six months. The respondent was identified by household members as the person responsible for the household, usually a mother, father or another adult household member.

In five communities, fieldwork sought to include all eligible households. In Engenho da Cruz, where the available census mesh exceeded the area locally recognized as quilombola territory, a spatially structured pseudo-probabilistic household selection strategy was used. Starting points were defined with the support of local quilombola representatives, and households were selected at regular spatial intervals. This approach introduced systematic geographic coverage while acknowledging the absence of a complete formal household listing and the need for community-guided field procedures. Similar spatial and systematic approaches have been used in development survey contexts when complete lists are difficult to obtain [32].

To reduce selection bias, field procedures sought broad household coverage in the participating communities and used community-guided spatial selection where a complete household listing was unavailable. The sample-size calculation for Engenho da Cruz was performed using StatCalc in Epi Info, considering the estimated finite population, expected food insecurity prevalence, confidence level, margin of error, design effect and allowance for refusals and losses [33].

The final sample size was therefore determined by the number of eligible households reached in the participating communities and by complete responses to the adapted EBIA.

A total of 209 household respondents were interviewed. The final analytic sample included 204 households (97.6%) with complete responses to the adapted EBIA.

Data collection

Data were collected between April 2023 and February 2024 using a structured questionnaire implemented in REDCap electronic data capture tools [34]. The instrument contained 18 thematic blocks and 81 items covering household characteristics, sociodemographic information, health-related behaviors and food insecurity.

Outcome: food insecurity severity

Food insecurity was measured using the Brazilian Food Insecurity Scale adapted for traditional peoples and communities. The adapted scale includes seven dichotomous items referring to the previous three months. Each affirmative response was assigned one point, generating a score used to classify households into four ordered categories: food security (0 affirmative responses), mild food insecurity (1-2 affirmative responses), moderate food insecurity (3-4 affirmative responses) and severe food insecurity (5-7 affirmative responses) [17-19,35]. The ordered outcome was coded from 1 to 4, with higher values indicating greater severity of food insecurity.

Explanatory variables

The explanatory variables were selected based on their distribution in the dataset and previous literature on food insecurity and social vulnerability. They included gender identity, age group, self-declared race/skin color, school attendance, marital status, religion, paid work or income-generating activity, use of medicinal plants, previous COVID-19, tobacco use, alcohol consumption and physical activity/exercise.

Statistical analysis

Descriptive analyses were performed using absolute and relative frequencies. Food security categories were compared across explanatory variables using Pearson's chi-square test or Fisher's exact test, as appropriate.

Because the outcome had a natural order, ordered logistic regression was used to estimate associations with food insecurity severity [36,37]. Robust standard errors were used. Variables with p values below 0.20 in bivariate analyses and variables with theoretical relevance were considered in the initial multivariable model. A backward stepwise procedure was then used to obtain the final model, retaining variables statistically associated with the outcome at $p<0.05$.

Missing data were handled by complete-case analysis for each bivariate comparison. The final ordered logistic regression model included observations with complete information for the variables retained in the model. All analyzed variables had at least 96.4% completeness, which is above the 90% threshold commonly used in Brazilian health surveillance data-quality assessments [38].

Results are presented as odds ratios (ORs), p values and 95% confidence intervals (95% CIs). In this model, ORs greater than 1 indicate higher odds of being in a more severe food insecurity category. For readability, the main regression table presents ORs, 95% CIs and p values; ancillary model thresholds are not presented as substantive epidemiologic estimates. The proportional odds assumption was assessed using the Brant test. Statistical analyses were conducted in Stata/MP version 17.

Ethics

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and with Brazilian National Health Council Resolutions No. 466/2012 and No. 510/2016, which regulate research involving human participants in Brazil. The broader research project, entitled "Living conditions and health of quilombola communities in Bahia and Sergipe", was approved by the Research Ethics Committee of the Institute of Collective Health, Federal

University of Bahia (CEP/ISC/UFBA; CAAE: 53730021.1.0000.5030; Opinion No. 5,809,996). The study was developed in dialogue with quilombola communities and local councils, respecting autonomy, confidentiality, informed consent and the strengthening of community-based social technologies. Written informed consent was obtained from all participants.

Results

Of the 209 household respondents interviewed, 204 (97.6%) completed all adapted EBIA items and were included in the analysis. Overall, 60 households (29.4%) were classified as food secure, 39 (19.1%) as mildly food insecure, 39 (19.1%) as moderately food insecure and 66 (32.4%) as severely food insecure. Thus, 144 households (70.6%) experienced some degree of food insecurity.

Food insecurity was unevenly distributed across communities. The highest proportional burdens of any food insecurity were observed in Engenho da Ponte (84.0%), Dendê (81.8%), Rio dos Macacos (79.3%) and Kalembá (76.5%). Severe food insecurity was proportionally highest in Rio dos Macacos (65.5%), Engenho da Ponte (44.0%), Engenho da Praia (37.5%) and Dendê (36.4%) (Table 1). Community-specific percentages should be interpreted cautiously in communities with small sample sizes, especially Engenho da Praia and Dendê.

Insert Table 1 here

In the descriptive analysis, severe food insecurity was more frequent among cisgender women (56.9%), self-declared Black respondents (76.9%), respondents aged 40-49 years (28.8%), those not living with a partner (60.0%), those not reporting a religion (26.2%) and those reporting no paid work or income-generating activity (69.2%) (Table 2).

Insert Table 2 here

In the final ordered logit model, three variables were associated with food insecurity severity (Table 3). Reporting no paid work or income-generating activity was associated with higher odds of being in a more severe food insecurity category compared with reporting paid work or income-generating activity (OR 1.94; 95% CI 1.12-3.37; p=0.018). Being single, separated, divorced or widowed was associated with higher severity compared with being married, living with a partner or being in a stable union (OR 1.73; 95% CI 1.03-2.91; p=0.036). Not reporting a religion was also associated with higher food insecurity severity compared with reporting a religion (OR 2.12; 95% CI 1.10-4.06; p=0.023).

Insert Table 3 here

The Brant test did not indicate violation of the proportional odds assumption for the final model. The global p value was 0.873, and all variable-specific p values were above 0.05 (Supplementary Table S1).

Supplementary Table S1 is provided after the main tables.

Discussion

This study found a high prevalence and substantial severity of food insecurity among households in seven quilombola communities in Bahia. More than two thirds of households experienced some level of food insecurity, and nearly one third were classified as severely food insecure. By preserving the ordinal structure of the adapted EBIA, the analysis shows that social vulnerability is associated not only with the presence of food insecurity but also with movement toward more severe categories of deprivation. These findings reinforce that food insecurity in quilombola territories is not an isolated household condition, but part of a wider pattern of racialized, territorial and community-level health inequity.

The magnitude observed in this study is consistent with evidence from quilombola and rural communities in Brazil, where household food insecurity has been associated with poverty, social inequalities, precarious housing, low income, limited access to public services and territorial exclusion [20-25]. The findings are also consistent with

broader Brazilian evidence showing that food and nutritional insecurity is closely correlated with socioeconomic vulnerability indicators [5].

The association between the absence of paid work or income-generating activity and greater food insecurity severity is consistent with evidence that income, employment and living conditions are central determinants of household food access in Brazil [5,20-25]. In quilombola territories, however, income must be interpreted together with historical exclusion from land rights, infrastructure, labor opportunities and culturally appropriate public policies. When income is absent or unstable, households may become more dependent on informal support, subsistence activities and community-based coping strategies.

Marital status was also associated with food insecurity severity. Respondents who were single, separated, divorced or widowed had higher odds of being in more severe food insecurity categories than those who were married, living with a partner or in a stable union. This finding may reflect differences in household labor, income pooling, care arrangements and social support. In communities where older adults and women often sustain extended household networks, household composition may influence both material resources and the capacity to respond to food shortages.

Not reporting a religion was associated with higher food insecurity severity. This finding should be interpreted cautiously and should not be read as evidence that religion itself prevents food insecurity. In quilombola communities, religious belonging may operate as a marker of social connection, community participation, mutual aid and shared cultural practices. Religious and community networks can create spaces for food sharing, collective care, emotional support and mobilization in contexts of deprivation. This interpretation is consistent with studies on religious plurality and cultural belonging in quilombola territories, as well as broader literature on religion, spirituality and health-related social support [28,39-42].

At the same time, this interpretation requires sensitivity. Quilombola territories are religiously plural, and many communities maintain Afro-Brazilian, Catholic and evangelical practices within complex histories of cultural resistance and transformation. In the Reconcavo of Bahia, therapeutic knowledge, medicinal plants, food practices and religiosity are often articulated through community-based forms of care that should be recognized without reducing religion to an instrumental policy variable [28,39,40]. From a community health perspective, the key implication is to strengthen community-led networks, cultural practices and territorial forms of care that may sustain households in situations of food insecurity.

The findings speak directly to the broader debate on structural and environmental racism as determinants of racial and ethnic health disparities. Environmental racism has been used in Brazil and internationally to describe the disproportionate exposure of racialized and traditional communities to inadequate sanitation, territorial dispossession, precarious infrastructure, sacrifice zones and weak state protection [8-11,43]. These conditions restrict the ability of quilombola households to produce, access and consume adequate food and contribute to food insecurity as an embodied expression of racialized territorial inequality.

The study has several strengths. It used primary data collected in quilombola territories, applied an adapted food insecurity scale for traditional peoples and communities, preserved the ordinal structure of the outcome, tested the proportional odds assumption and reported the completeness of analyzed variables. It also contributes to the racial and ethnic health disparities literature by considering community-related markers alongside conventional socioeconomic variables, while avoiding a purely binary treatment of food insecurity.

Some limitations must be considered. The cross-sectional design does not allow causal inference. The sampling strategy combined census-like procedures in some communities with spatially structured selection in another, and the results should not be generalized to all quilombola communities in Brazil. Community-specific estimates, particularly in communities with small sample sizes, should be interpreted cautiously. Some variables, including religion and paid work, were measured in broad categories and may not capture the complexity of religious practice, social support, informal labor or household income. Religion was not a direct measure of community belonging and should be interpreted only as a community-related marker that may reflect social connection, participation or support in specific

territorial contexts. Race/skin color was highly homogeneous in the sample, limiting its statistical use in multivariable models despite its theoretical importance. Finally, residual confounding may remain because variables such as household size, land access, social assistance benefits and local food production were not included in the final model.

Despite these limitations, the study highlights policy-relevant pathways for advancing food and health equity. Interventions should not focus only on individual behaviors. They should address income protection, employment opportunities within or near quilombola territories, land and territorial rights, infrastructure, culturally grounded community networks and local food systems. These actions are consistent with the Brazilian policy framework for the health of rural, forest and water populations, with One Health approaches that understand health, food, land, water, animals and community life as interdependent dimensions of care, and with Afro-centered territorial perspectives on development and dignity [44-47].

Conclusions

Food insecurity was highly prevalent in the quilombola communities studied and was associated with social vulnerability and community-related markers. The absence of paid work or income-generating activity, not living with a partner and not reporting a religion were associated with greater food insecurity severity in these Afro-descendant traditional territories.

The association with religion should be interpreted as a possible marker of social support and community participation rather than as a causal effect. Policies to reduce racialized food and health inequities in quilombola territories should combine income protection, territorial justice, local food production, employment opportunities and support for community-led networks of care.

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Statements and Declarations

Funding: This study is part of the broader research project "Living conditions and health of quilombola communities in Bahia and Sergipe", funded by the Fundação de Amparo à Pesquisa do Estado da Bahia (FAPESB), under Grant/Award No. PET0002/2021. The funder had no role in the study design, data collection, data analysis, data interpretation, writing of the manuscript, or decision to submit the article for publication.

Competing interests: The authors declare that they have no competing interests.

Ethics approval: The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and with Brazilian National Health Council Resolutions No. 466/2012 and No. 510/2016, which regulate research involving human participants in Brazil. The broader research project, entitled "Living conditions and health of quilombola communities in Bahia and Sergipe", was approved by the Research Ethics Committee of the Institute of Collective Health, Federal University of Bahia (CEP/ISC/UFBA; CAAE: 53730021.1.0000.5030; Opinion No. 5,809,996).

Consent to participate: Written informed consent was obtained from all participants.

Consent for publication: Not applicable. The manuscript does not contain individual-level identifying information, images or case details.

Availability of data and materials: The datasets used and analyzed during the current study are not publicly available due to ethical and institutional restrictions involving research with traditional communities. They may be made available from the corresponding author on reasonable request and subject to approval by the responsible research team and applicable ethics requirements.

Authors' contributions: WAFN contributed to study conception, data interpretation, manuscript consolidation and drafting. GM, RABL, TPL, LAS, JIMG, JCF and JSN contributed to interpretation of findings and critical revision of the manuscript. JSN coordinated the broader research project. All authors read and approved the final manuscript.

Tables

Table 1. Food insecurity severity by quilombola community, Bahia, Brazil, April 2023 to February 2024 (n=204).

Community	Total n	Food security n (%)	Mild FI n (%)	Moderate FI n (%)	Severe FI n (%)
Overall	204	60 (29.4)	39 (19.1)	39 (19.1)	66 (32.4)
Quilombo Rio dos Macacos	29	6 (20.7)	1 (3.4)	3 (10.3)	19 (65.5)
Quilombo Kaonge	18	11 (61.1)	4 (22.2)	1 (5.6)	2 (11.1)

Community	Total n	Food security n (%)	Mild FI n (%)	Moderate FI n (%)	Severe FI n (%)
Quilombo Dendê	11	2 (18.2)	2 (18.2)	3 (27.3)	4 (36.4)
Quilombo Kalembá	17	4 (23.5)	3 (17.6)	5 (29.4)	5 (29.4)
Quilombo Engenho da Ponte	25	4 (16.0)	6 (24.0)	4 (16.0)	11 (44.0)
Quilombo Engenho da Praia	8	2 (25.0)	3 (37.5)	0 (0.0)	3 (37.5)
Quilombo Engenho da Cruz	96	31 (32.3)	20 (20.8)	23 (24.0)	22 (22.9)

Note: Percentages are row percentages within each community, except the overall row, which refers to the total analytic sample. FI = food insecurity. Community-specific percentages should be interpreted cautiously where sample sizes are small.

Source: Authors' own elaboration based on primary household survey data collected in seven quilombola communities in Bahia, Brazil, April 2023 to February 2024.

Table 2. Core respondent characteristics by food security status, Bahia, Brazil, April 2023 to February 2024 (n=204).

Attributes	Food security n (%)	Mild food insecurity n (%)	Moderate food insecurity n (%)	Severe food insecurity n (%)	p-value
Gender identity					0.382
Cisgender man	24 (40.0)	12 (30.8)	10 (25.6)	27 (41.5)	
Cisgender woman	36 (60.0)	27 (69.2)	28 (71.8)	37 (56.9)	
Trans woman/trans man/other	0 (0.0)	0 (0.0)	1 (2.6)	1 (1.5)	
Age group					0.323
18-29 years	6 (10.0)	13 (33.3)	6 (15.4)	9 (13.6)	
30-39 years	11 (18.3)	4 (10.3)	7 (17.9)	14 (21.2)	
40-49 years	14 (23.3)	7 (17.9)	8 (20.5)	19 (28.8)	
50-59 years	9 (15.0)	5 (12.8)	6 (15.4)	10 (15.2)	
>=60 years	20 (33.3)	10 (25.6)	12 (30.8)	14 (21.2)	
Race/skin colour					0.205
White	0 (0.0)	0 (0.0)	2 (5.1)	3 (4.6)	
Black	44 (73.3)	35 (89.7)	27 (69.2)	50 (76.9)	
Brown/mixed race	15 (25.0)	4 (10.3)	10 (25.6)	10 (15.4)	
Asian/yellow	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.5)	
Does not know	1 (1.7)	0 (0.0)	0 (0.0)	1 (1.5)	
Attended school					0.223
No	4 (6.7)	7 (17.9)	7 (17.9)	10 (15.6)	
Yes	56 (93.3)	32 (82.1)	32 (82.1)	54 (84.4)	
Marital status					0.141
Married/living with partner/stable union	36 (60.0)	21 (53.8)	18 (46.2)	26 (40.0)	
Single/separated/divorced/widowed	24 (40.0)	18 (46.2)	21 (53.8)	39 (60.0)	
Reports a religion					0.151
No	7 (11.7)	7 (18.9)	5 (12.8)	17 (26.2)	
Yes	53 (88.3)	30 (81.1)	34 (87.2)	48 (73.8)	
Paid work/income-generating activity					0.066
No	29 (49.2)	20 (52.6)	26 (68.4)	45 (69.2)	
Yes	30 (50.8)	18 (47.4)	12 (31.6)	20 (30.8)	

Note: p-values were estimated using Pearson's chi-square test or Fisher's exact test, as appropriate. The table presents core variables used to describe social vulnerability and community-related markers; some categories may not sum to 204 because of missing values.

Source: Authors' own elaboration based on primary household survey data collected in seven quilombola communities in Bahia, Brazil, April 2023 to February 2024.

Table 3. Ordered logistic regression for food insecurity severity, Bahia, Brazil, April 2023 to February 2024.

Variables	OR	95% CI	p-value
No paid work/income-generating activity	1.94	1.12-3.37	0.018
Single/separated/divorced/widowed	1.73	1.03-2.91	0.036
Does not report a religion	2.12	1.10-4.06	0.023

Note: OR = odds ratio; CI = confidence interval. ORs greater than 1 indicate higher odds of being in a more severe food insecurity category. The reference categories were paid work/income-generating activity, married/living with partner/stable union, and reporting a religion. Model cut points are not shown because they are ancillary thresholds rather than substantive epidemiologic estimates.

Source: Authors' analysis based on primary household survey data collected in seven quilombola communities in Bahia, Brazil, April 2023 to February 2024.

Supplementary Table S1. Brant test for the proportional odds assumption in the final model.

Exposure variables	**Prob > chi-square**
No paid work/income-generating activity	0.631
Single/separated/divorced/widowed	0.917
Does not report a religion	0.552
Overall test	0.873

Note: A p-value above 0.05 suggests that the proportional odds assumption was not violated.

Source: Authors' analysis based on primary household survey data collected in seven quilombola communities in Bahia, Brazil, April 2023 to February 2024.