



# No land for food: prevalence of food insecurity in ethnic communities enclosed by sugarcane monocrop in Colombia

Leidy Johanna Hurtado-Bermúdez<sup>1</sup> · Irene Vélez-Torres<sup>2</sup> · Fabián Méndez<sup>1</sup>

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## Abstract

**Objectives** To evaluate how the food systems in areas close to sugarcane monocrops influence the prevalence of food insecurity (FI) among three ethnic communities in the upper Cauca River basin of Colombia.

**Methods** We developed a mixed methodology study at three rural zones located in the departments of Cauca and Valle del Cauca, Colombia, using a household survey to establish the level of FI, and semi-structured interviews with key community actors.

**Results** These three ethnic communities have a high prevalence of FI (> 70%) that was found to be associated with economic income, social security, gender, the presence of minors in the home, refrigerator in operation and ownership of the land. Loss of food sovereignty was associated with the sale and rental of land.

**Conclusions** The sugarcane monocrop has contributed to environmental crises, spatial confinement and sociocultural disruption in ethnic territories; by renting, selling or leasing their land to the industrial production of sugarcane, traditional practices of food production and self-consumption have been profoundly transformed. Ethnic cultures are endangered, while food security and sovereignty of indigenous and black communities have been negatively affected.

**Keywords** Food security · Food system · Food patterns · Agro-industry · Sugarcane monocrop

## Introduction

According to the last national census in Colombia, only 23% of the population lives in rural areas, which reflects an accelerated urbanization process. In particular, in recent decades, the mestizo farmer population, indigenous communities and Afro-descendant residents have been displaced from their lands, one reason among others for a

transition to industrial agriculture (Friedemann 1976); this is the emblematic case of rural communities displaced by oil palm monocrops in Magdalena Medio (Arias Vanegas and Caicedo Fernández 2017; Ojeda 2017) and sugarcane in the flat valley of upper Cauca (Vélez et al. 2012; Perafan Cabrera 2005).

The appropriation of territories and land grabbing by cattle ranchers, paramilitaries, guerrillas, and national and foreign private investors have also served as expulsion factors towards cities. The hoarding of water for the benefit of large economic sectors (mining, agro-industry, public services, mega-projects), through the exploitation and privatization of rivers and watersheds (Velez and Velez 2012), has affected access to these common goods, which are necessary for the survival of rural communities (Jaramillo Marín et al. 2015). In fact, Colombia has one of the highest rates of inequality regarding land ownership, with a Gini coefficient of 0.85 (Walsh and Sanchez 2008) and a water concentration of 0.9 (Roa-García and Brown 2015), where few are the owners of land and of the water concessions.

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✉ Fabián Méndez  
fabian.mendez@correounivalle.edu.co

Leidy Johanna Hurtado-Bermúdez  
leidyjohanna20@yahoo.com

Irene Vélez-Torres  
irene.velez@correounivalle.edu.co

<sup>1</sup> Escuela de Salud Pública, Universidad del Valle, Cali, Colombia

<sup>2</sup> Escuela de Ingeniería de los Recursos Naturales y del Ambiente, Universidad del Valle, Cali, Colombia

In the particular case of the territories in the upper Cauca River basin, the processes of land dispossession emerged with the formation, spreading and consolidation of sugarcane plantations in the region since 1950, a process that gradually restricted family agricultural production, local economic prosperity and the communities' autonomy (Hurtado and Urrea 2004). The studies that address sugarcane and the impact on family agricultural production are mainly based on historical, ethnographic or narrative perspectives (Friedemann 1976; Jaramillo Marín et al. 2015; Hurtado and Urrea 2004; Vélez et al. 2013), and affirm that this agro-industrial corporate model has resulted in (1) the impoverishment of Afro-descendant and indigenous households, (2) an increase in outsourcing and informal work, (3) socio-environmental transformations and (4) loss of autonomy of communities over the territory in relation to productive and cultural processes (Vélez et al. 2013; Taussig and Rubbo 2011).

The processes of social exclusion that shape the corporate agrarian model are rooted in the transformations of food systems. A food system is made up of the environment, people, institutions, policies and processes through which food is produced, processed and brought to the consumer (Hundertwasser 2013). Thus, to study social exclusion, we use the food system as an integrative and comprehensive paradigm that allows the analysis of health inequities and their relationship with food (Neff et al. 2009; Weiler et al. 2015).

This conceptualization of food production allows, in addition to identifying key actors and processes, analysing the power relations that generate inequality in the production, access and consumption of food at the local and global scale. That is, it allows us to observe not only the ability of societies and communities to access food (food security) or the right of peoples to produce food (food sovereignty) but also the effect of the corporate agricultural model on wellbeing and the health of a population (Majowicz et al. 2016; Jones et al. 2015; Pinstrup-Andersen 2012). In particular, we analyse, in terms of the eco-social model described by Krieger (2011), health inequities as the result of historical processes of discrimination and segregation based on ethno-racial, social position and gender variables that are "embodied" throughout the life course of the most vulnerable populations (Krieger 2011).

In the context of health inequities, food insecurity (FI) was incorporated into the analysis as a dynamic condition resulting from the interaction of multiple historical, social, political, economic, ecological and cultural factors (Power 2008). These vary from one region to another, from one country to another, and even between communities in the same territory (Pascual 2014). It is estimated that in Latin America and the Caribbean, hunger affected more than 34 million people in 2015 (FAO 2015). In Colombia, the

prevalence of FI in rural households was 57.7% in 2010 (MSPS, OPS, ICBF 2015) and 54.2% in 2015 (MSPS, OPS, ICBF 2015). As a result of this situation, 17% of children in rural areas have growth delays, and children under 5 years have nearly double the global malnutrition compared to those in urban areas (4.7% vs. 2.9%) (Instituto Colombiano de Bienestar Familiar-ICBF 2015; Castellanos and Morales 2013). Although these figures constitute an advance in the differentiated understanding of the food and nutritional status of rural family members, little attention has been paid to ethno-racial groups. This analytical vacuum affects these populations to the extent that there is less reflection and opportunities for improvement to overcome problems such as gender inequality and structural racism (Weiler et al. 2015).

To contribute to overcoming this gap, in this research we ask how the food systems of three ethnic territories influence the prevalence of FI in households located in areas close to sugarcane monocrops in the upper Cauca River basin. We address this concern with a mixed methodological approach that involves qualitative and quantitative strategies to address a complex problem, that is, the production and consumption of food and its impact on food security and sovereignty of indigenous and Afro-descendant households. This comprehensive analysis provides a new perspective in the scientific community on alternative approaches to epidemiological problems (Silva 2012), examining their general impact on Afro-Colombian and indigenous communities (quantitative) and analysing the historical processes that lead to the appearance of the phenomenon studied (qualitative).

## Methods

### Study design

A sequential mixed study was developed (Creswell 2014). The quantitative component was a cross-sectional observational study with a survey to evaluate FI and socio-demographic characteristics. A stratified random sampling design was carried out with proportionate allocation per territory and including one out of 8 households as the observation units. The state of food security was assessed in 367 households, and a total of 743 individuals were interviewed, taking into account the following inclusion criteria: (a) Afro-descendant and indigenous households that agreed to participate in the study, (b) inhabitants who had lived in the area for at least 5 years, and (c) one household member older than 18 years. Subsequently, in the qualitative component, the narrative analysis of semi-structured interviews with key actors was conducted, investigating changes in the territories of study with respect

to food systems. The sampling was purposive, non-probabilistic, selecting 8 community members to interview: community mothers, community leaders and food producers; all were older than 40 years and had lived for more than 10 years in the study territories.

### Area and study population

The study area comprises three rural zones located in the departments of Cauca and Valle del Cauca, Colombia: El Hormiguero (Santiago de Cali–Valle del Cauca), El Tiple (Candelaria–Valle del Cauca) and López Adentro (Caloto–Cauca). These populations are characterized by living close to sugarcane plantations and yet defend traditional forms of food production for self-consumption. The study population for this project comprised households with an indigenous community, located in López Adentro, and Afro-descendants, located in El Tiple and El Hormiguero. It is worth knowing that indigenous communities in Colombia have been constitutionally granted collective ownership over land since 1991. Afro-descendant communities from the inter-Andean valley have not been assured the same right as within the State it has prevailed an orthodox understanding leading to restrict the right to collective land to black communities located on the Pacific and Atlantic coasts. As a result, among the communities under study, only the indigenous from Lopez Adentro hold a collective land title.

### Cross-sectional survey

For the measurement of FI, the Home Food Security Scale (ELCSA, for its initials in Spanish) was used, adapted for Latin American countries and validated for Colombia in 2004. The scale consists of 15 items, all with a dichotomous response. In households where there are adults and those under 18, the maximum score is 15, and in households where there are only adults (18 years or older), the maximum score is 8. Households with a score of 0 are classified as households with food security. The FI categories are mild FI, moderate FI, severe FI, or no FI. The scale measures the concern about obtaining food during the last 3 months and was answered by the head of household or another household member over 18 years of age who signed an informed consent form (FAO 2012).

In addition, the survey contains social, demographic and economic covariables, measured at the household level: gender, age, marital status, income, social security, education level, occupation, race/ethnicity, number of members of the household, the presence of underage, the number of underage, refrigerator in operation, time living on the site and state of land ownership. The main factor for assessing FI was the state of land ownership.

### Semi-structured interviews

To carry out the interviews with key social actors, informant selection was conducted through leaders of the Community Councils of Black Communities and the Indigenous Council. Once a list of community mothers and food producers was agreed upon, appointments were set, and interviews were conducted individually in each study territory.

The interviews were guided by a set of questions; however, the opportunity was given to people to discuss topics and expand on experiences that they considered relevant to understanding local food systems. The key issues addressed in the interviews were family economics, access to land, social organization, past and current production of food, sugarcane and pesticides and changes in food consumption. The interviews were recorded with an electronic device and subsequently transcribed for analysis.

### Statistical analysis

Univariate analyses with 95% confidence intervals (CI) were estimated for all variables. In the case of continuous variables, measures of central tendency and variability (mean, median, standard deviation) were obtained. Likewise, proportions and frequency tables were determined for the categorical variables.

The comparison between groups was performed with the Chi square test or Fisher test for categorical variables and with parametric statistics (*t* test) for continuous variables in the case of normality or with nonparametric tests (Mann–Whitney or Kruskal–Wallis) when a normal distribution of the variables could not be assumed.

Finally, for the multiple regression analysis of determinants of FI, ordinal logistic regression was performed using the model of partial proportional opportunities (Hosmer and Lemeshow 2013; Williams 2016). Ordinal logistic regression was considered because FI has four response levels measured on an ordinal scale (no FI, mild FI, moderate FI and severe FI). The following cut-off points were obtained for the four response categories: Panel I (no FI) versus (mild, moderate, or severe FI); panel II (no or mild FI) versus (moderate or severe FI) and panel III (no, mild or moderate FI) vs (severe FI). Odds ratios (ORs) were calculated with their respective CIs. The covariates included in multiple regression model were: income, occupation, social security regime, presence of children < 18 years, land ownership, time living in place, refrigerator in operation, gender and number of minors. For the construction of this model were considered the covariables that were significant at  $P < 0.10$  in the

bivariate analysis. The data were analysed in the statistical package Stata 14.0.

## Qualitative analysis

The qualitative analysis was performed in three phases. First, the principal investigator reviewed the transcripts to confirm that the information collected was related to the objectives of the research and was sufficient to answer the research question. An important aspect related to the substitution of fresh foods with industrially processed foods was found in this review.

The second phase consisted of coding the information based on the categories of analysis: family economy, access to land, social organization, past and current production of food, sugar cane and pesticides, and changes in food consumption. Each interview was analysed by looking for specific references on these topics; for this, colours and post-its were used for classification and comments. In general, the most relevant information, due to its complementarity with quantitative techniques, had to do with reflections on access to land.

The last phase consisted of using the information from each interview to construct tables in which responses from different people could relate to the same category. Here, belonging to different ethnic communities was the most important variable for contrasting the information. This methodology allowed verification of the shared identity between the two Afro-descendant communities, not only on cultural aspects but also on issues of access to land, occupation and modes of production.

## Results

### Socio-demographic characteristics

A total of 367 households were included in the study: 233 (63.5% of the sample) in El Hormiguero, 69 (18.8%) in El Tiple and 65 (17.7%) in López Adentro. The non-response rate was low and varied between 2 and 5%.

Table 1 presents main socio-demographic characteristics of the three territories. The largest proportion of respondents was women (80.7%), the average age was 44 years, the predominant marital status was married/consensual union (62.1%), the predominant education level was middle school (44.1%), followed by elementary school (36.2%), and the predominant occupation was housewife (47.9%), followed by informal work and farm work. Seventy-three percent of the households had incomes below the minimum wage (equivalent to US\$230 dollars at 2016); 55% had more than three people in the household; 65.9% had homes with underage; on average, the

respondents had lived in the same location more than 20 years. In the black territories, private land ownership was predominant (El Hormiguero, 88.8%; and El Tiple, 97.1%), while in the indigenous territory of López Adentro, collective ownership was common (66.1%).

### Factors related to food insecurity

Of the total sample, 73.6% of households had some level of FI (mild, moderate or severe). In the black territories (El Hormiguero and El Tiple), there was a higher proportion of households with mild FI (40.8% and 42.0%, respectively), and in the indigenous territory (López Adentro), there was a higher proportion of moderate and severe FI; FI was severe in 29.2% of households, more than double that in the other two territories (13.3% in El Hormiguero and 11.6% in El Tiple).

The multiple regression analysis identified the factors associated with the prevalence of FI in the territories (Table 2). Panel I indicates that households without underage were 53% less likely to have mild, moderate or severe FI and this difference was statistically significant (OR 0.47; 95% CI 0.26–0.76). In other words, the odds of food security among households without underage were 2.22 times that of households that did have underage.

The result for panel II indicates that male-headed households were 56% less likely to have moderate or severe FI than were female-headed households (OR 0.44; 95% CI 0.21–0.93). Likewise, it showed that households belonging to the contributory/special health care regimen were 52% less likely to present moderate or severe FI than those households that reported belonging to the subsidized health regime, when adjusting for the other variables; this difference was statistically significant (95% CI 0.28–0.82).

Finally, in panel III, households that claimed to have collective land ownership were 3.91 times more likely to present severe FI than were those households that claimed to have individual land ownership, when adjusting for the other variables considered in the model; this difference was statistically significant (95% CI 1.06–14.4).

### Qualitative results on ownership regimes

The most significant finding from the acquired analysis has to do with ownership relationships in each of the areas of interest, especially when analysing that black communities hold a private ownership model over land, and, on the other hand, the indigenous community holds collective property through the *resguardo*. Since the private property model allows the purchase and sale of land, its greatest vulnerability is the loss of property through the sale. On the other hand, collective property compasses a legal sale's restriction, with which its greater vulnerability consists in the loss

**Table 1** Socio-demographic characteristics of households at the study sites: El Hormiguero, El Tiple and López Adentro; Colombia, 2016

Socio-demographic variables	Town			
	El Hormiguero <i>n</i> = 233 % (95% CI)	El Tiple <i>n</i> = 69 % (95% CI)	López Adentro <i>n</i> = 65 % (95% CI)	All households <i>n</i> = 367 % (95% CI)
<i>Sex of household head</i>				
Female	81.5 (76.0–86.0)	85.5 (74.9–92.1)	72.3 (60.1–81.9)	80.7 (76.2–84.3)
Male	18.5 (13.9–23.9)	14.5 (7.9–25.0)	27.7 (18.1–39.8)	19.3 (15.6–23.7)
<i>Race/ethnicity</i>				
Black	64.8 (58.4–70.7)	76.8 (65.3–85.3)	3.1 (0.7–11.6)	56.1 (50.9–61.1)
Indigenous	6.0 (3.5–9.9)	1.4 (0.2–9.7)	87.7 (77.1–93.8)	19.6 (15.8–24.0)
Other	29.2 (23.7–35.4)	21.7 (13.5–33.1)	9.2 (4.2–19.2)	24.2 (20.1–28.9)
<i>Marital status</i>				
Single	27.0 (21.7–33.1)	33.3 (23.2–45.3)	13.8 (7.3–24.7)	25.9 (21.6–30.6)
Married	61.4 (54.9–67.4)	55.1 (43.1–66.4)	72.3 (60.1–81.9)	62.1 (57.0–66.9)
Divorce/widowed	11.6 (8.0–16.4)	11.6 (5.8–21.6)	13.9 (7.3–24.7)	12.0 (9.0–15.7)
<i>Education level</i>				
Primary	36.9 (30.4–43.3)	40.6 (29.6–52.6)	29.2 (19.4–41.5)	36.2 (31.4–41.3)
Secondary	45.1 (38.8–51.5)	43.5 (32.3–55.4)	41.5 (30.1–53.9)	44.1 (39.1–49.2)
Technician	13.7 (9.8–18.8)	10.1 (4.8–19.9)	10.8 (5.1–21.1)	12.5 (9.5–16.3)
College	0.4 (0.05–3.0)	1.4 (0.2–9.7)	7.7 (3.2–17.3)	1.9 (0.9–3.9)
None	3.0 (0.1–6.2)	4.4 (1.4–12.7)	10.8 (5.2–21.1)	4.6 (2.8–7.3)
Do not know	0.9 (0.2–3.3)	0 (0)	0 (0)	0.54 (0.1–2.1)
<i>Occupation</i>				
Formal work	15.4 (11.3–20.7)	5.8 (2.1–14.6)	6.1 (2.3–15.4)	11.9 (9.0–15.7)
Informal work	21.9 (17.0–27.7)	26.1 (17.0–37.8)	20.0 (11.9–31.6)	22.3 (18.3–26.9)
Farmer	2.6 (1.1–5.6)	1.5 (0.1–9.7)	36.9 (26.0–49.3)	8.4 (5.9–11.7)
Housewife	50.6 (44.2–57.0)	52.2 (40.3–63.7)	33.9 (23.3–46.2)	47.9 (42.8–53.0)
Retired	2.6 (1.1–5.6)	7.2 (3.0–16.3)	0 (0)	3.0 (1.6–5.3)
Other	6.9 (4.2–10.9)	7.2 (3.0–16.4)	3.1(0.7–11.6)	6.2 (4.1–9.2)
<i>Monthly income<sup>a</sup></i>				
Less than half a minimum wage	21.9 (17.0–27.7)	23.2 (14.6–34.7)	55.4 (43.1–67.1)	28.1 (23.6–32.9)
Half to a minimum wage	45.5 (39.2–51.9)	53.6 (41.7–65.1)	33.8 (23.3–46.2)	44.9 (39.9–50.1)
1–2 minimum wages	23.6 (18.5–29.5)	17.4 (10.1–28.3)	6.2 (2.3–12.4)	19.3 (15.6–23.7)
More than 2 minimum wages	5.1 (2.9–8.8)	4.4 (1.4–12.7)	3.1 (0.7–11.6)	4.6 (2.8–7.3)
Do not know/no answer	3.9 (2.0–7.3)	1.4 (0.2–9.7)	1.5 (0.2–10.3)	3.0 (1.6–5.3)
<i>Health insurance status</i>				
Contributory/private	42.1 (35.8–48.5)	55.1 (43.1–66.4)	9.2 (4.2–19.2)	38.7 (33.8–43.8)
Subsidize/public	52.8 (46.3–59.1)	43.5 (32.2–55.4)	87.7 (77.1–93.8)	57.2 (52.1–62.2)
Special	0.4 (0.06–3.0)	0	1.5 (0.2–10.2)	0.5 (0.1–2.1)
Do not have	4.7 (1.1–5.6)	1.4 (0.1–9.7)	1.5 (0.3–10.3)	3.6 (0.3–4.6)
<i>Family size</i>				
1–3	45.1 (38.7–51.5)	50.7 (38.9–62.4)	38.5 (27.4–50.8)	44.9 (39.9–50.1)
> 3	54.9 (48.4–61.2)	49.3 (37.6–61.1)	61.5 (49.1–72.6)	55.0 (49.9–60.1)
<i>Presence of underage</i>				
Yes	64.8 (58.4–70.7)	59.4 (47.3–70.4)	76.9 (65.0–85.6)	65.9 (60.9–70.6)
No	35.2 (29.3–41.6)	40.6 (29.6–52.6)	23.1 (14.3–34.9)	34.1 (29.3–39.1)
<i>Number of underage</i>				
None	35.2 (29.3–41.5)	40.1 (29.6–52.6)	23.1 (14.3–34.9)	34.1 (29.4–39.0)
One	35.2 (29.3–41.5)	34.8 (24.4–46.8)	40.0 (28.7–52.4)	35.9 (31.2–41.0)
Two or more	29.6 (24.1–35.8)	24.6 (15.8–36.2)	36.9 (26.0–49.3)	29.9–(25.5–34.8)

**Table 1** (continued)

Socio-demographic variables	Town			
	El Hormiguero <i>n</i> = 233 % (95% CI)	El Tiple <i>n</i> = 69 % (95% CI)	López Adentro <i>n</i> = 65 % (95% CI)	All households <i>n</i> = 367 % (95% CI)
<i>Land ownership</i>				
Private	88.8 (84.0–92.3)	97.1 (88.9–99.3)	30.8 (20.7–43.1)	80.1 (75.6–83.8)
Do not have	8.6 (5.6–12.9)	2.9 (0.7–11.0)	3.1 (0.7–11.6)	6.5 (4.4–9.5)
Collective	2.6 (1.1–5.6)	0	66.1 (53.7–76.7)	13.4 (10.2–17.2)
<i>Time living in town</i>				
10 years or less	36.5 (30.5–42.8)	46.2 (34.4–58.4)	46.1 (34. 58.4)	40.3 (35.4–45.4)
11–20 years	15.4 (11.3–20.7)	14.5 (7.9–25.0)	15.4 (8.0–26.4)	15. 3 (11.9–19.3)
More than 20 years	48.1 (41.7–54.4)	37.7 (26.9–49.7)	38.5 (27.4–50.8)	44.4 (39.4–49.5)
<i>Water service</i>				
Yes	13.3 (9.5–18.3)	11.6 (5.8–21.6)	86.2 (75.3–92.7)	25.9 (21.6–30.6)
No	86.7 (81.7–90.5)	88.4 (78.4–94.1)	13.8 (7.3–24.7)	74.1 (69.3–78.3)
<i>Fridge</i>				
Yes	96.1 (92.7–97.9)	95.7 (87.2–98.6)	56.9 (44.6–68.4)	89.1 (85.4–91.9)
No	3.9 (2.0–7.2)	4.3 (1.4–12.7)	43.1 (31.5–55.4)	10.9 (8.0–14.5)
<i>Age</i>				
Minimum–maximum	18–93	18–90	18–81	18–93
Mean (95% CI)	43.6 (35.8–44.9)	47.3 (42.8–51.8)	40 (38.8–44.9)	43.7 (41.9–45.5)
Median (IQR)	40 (26)	46 (30)	35 (24)	40.0 (28)

*IQR* interquartile range

<sup>a</sup>Colombia's legal minimum wage in 2016 was \$689.455 Colombian pesos equivalent to 230 US dollars

of control in terms of (1) what is cultivated, (2) under what agrarian model, (3) by whom and (4) with what objectives of accumulation and/or reproduction. Below is shown a selection of exemplary testimonies of property relations and then a diagram that systematizes the findings in this regard.

According to the testimonies from interviews in Afro-descendent communities of El Tiple and El Hormiguero, the individual property regime constitutes a factor of social vulnerability because as land has been sold, space available for life is reduced. By losing productivity, the capacity of communities to self-sustain has also been reduced.

[...] “well, people took to selling. All this was a hamlet, and if the mom or dad died, people would sell the inheritance and leave. They sold them to the rich, and they planted cane, (...) and with the loss of property, the capacity to produce was lost, and we also lost the ability to conserve our customs and traditions” (Afro-descendant woman from El Tiple, food producer)

In contrast, the indigenous people of López Adentro have achieved, through mobilization, collective access to land, which constitutes a pillar of productive and political

autonomy. Despite this advantage, indigenous people say that the available productive area is not sufficient and, above all, that there are pressures from business actors who show interest in their lands. In this sense, from a self-critical perspective, they state that due to a lack of resources to develop alternative productive projects, communities have agreed to plant sugarcane:

[...] “As I said to you, they are the ones who have the power, the money, and we, as we do not have money because we work for them, and to this day, they have us here like this [...] Here, companies already control us, they tell us to sow cane, and we give it so much because then they want to get money at our expense” (Indigenous man of López Adentro, food producer)

Figure 1 outlines the causes and consequences in correlation to the differences between the property regimes of black and indigenous communities. Private and collective property regimes by black and indigenous communities, respectively, have historically lacked the institutional support by the State, while the corporate sugarcane model consolidated. Such contrasting agrarian realities suggest a profound relationship between the inequalities discussed and the shaping of structural violence in rural Colombian.

**Table 2** Factors associated with the prevalence of food insecurity among households in ethnic territories: results of ordinal logistic regressions using the partial proportional odds model; Colombia, 2016

Variable	Panel I Food security versus mild, moderate and severe FI OR (95% CI)	Panel II Food security and mild FI versus moderate and severe FI OR (95% CI)	Panel III Food security, and mild and moderate FI vs severe FI OR (95% CI)
≤ 20 years time living at the site	1.0	1.0	1.0
> 20 years	1.57 (0.95–2.61)*	0.97 (0.60–1.55)	0.88 (0.46–1.65)
Female	1.0	1.0	1.0
Male	0.96 (0.47–1.94)	0.44 (0.21–0.93)**	0.53 (0.18–1.57)
El Hormiguero	1.0	1.0	1.0
El Tiple	0.83 (0.45–1.54)	0.79 (0.43–1.49)	0.77 (0.32–1.85)
López Adentro	0.93 (0.27–3.12)	2.32 (0.88–6.13)*	0.72 (0.19–2.73)
<1 minimum wage <sup>a</sup>	1	1	1
> 1 minimum wage	0.59 (0.34–1.00)*	0.59 (0.33–1.05)*	0.38 (0.14–1.03)*
Subsidized health care	1.0	1.0	1.0
Contributory/special paid occupation	0.45 (0.26–0.76)**	0.48 (0.28–0.82)**	0.53 (0.24–1.14)*
Unpaid occupation	1.0	1.0	1.0
Other	0.97 (0.51–1.77)	1.06 (0.60–1.85)	1.21 (0.56–2.60)
Private ownership	1.67 (0.54–5.23)	0.74 (0.25–2.14)	1.0 (0.23–4.27)
Collective	1.0	1.0	1.0
Does not have	0.97 (0.28–3.32)	0.76 (0.28–2.06)	3.91 (1.06–14.4)**
Minors (yes)	0.66 (0.25–1.73)	0.78 (0.28–2.17)	0
No	1.0	1.0	1.0
Zero/one minors	0.47 (0.25–0.88)**	1.11 (0.61–2.03)	1.93 (0.81–4.60)
2 or more	1.0	1.0	1.0
Fridge (yes)	0.83 (0.41–1.65)	1.43 (0.77–2.68)	1.22 (0.49–3.06)
No	1.0	1.0	1.0
	3.90 (1.02–14.8)**	1.05 (0.45–2.44)	1.69 (0.62–4.60)

\*0.05 < *P* value < 0.10\*\**P* value < 0.05<sup>a</sup>Colombia's legal minimum wage in 2016 was \$689.455 Colombian pesos equivalent to 230 US dollars

Environmental pollution, induced water floods and other strategies to manipulate families' prosperity have resulted in the selling and renting of land. The loss of ownership over land through sale (in El Hormiguero and El Tiple), and the loss over land control through rent (particularly in the case of López Adentro) have generated environmental crises, spatial confinement, sociocultural disruption, and profound changes to the traditional practices of food production and consumption.

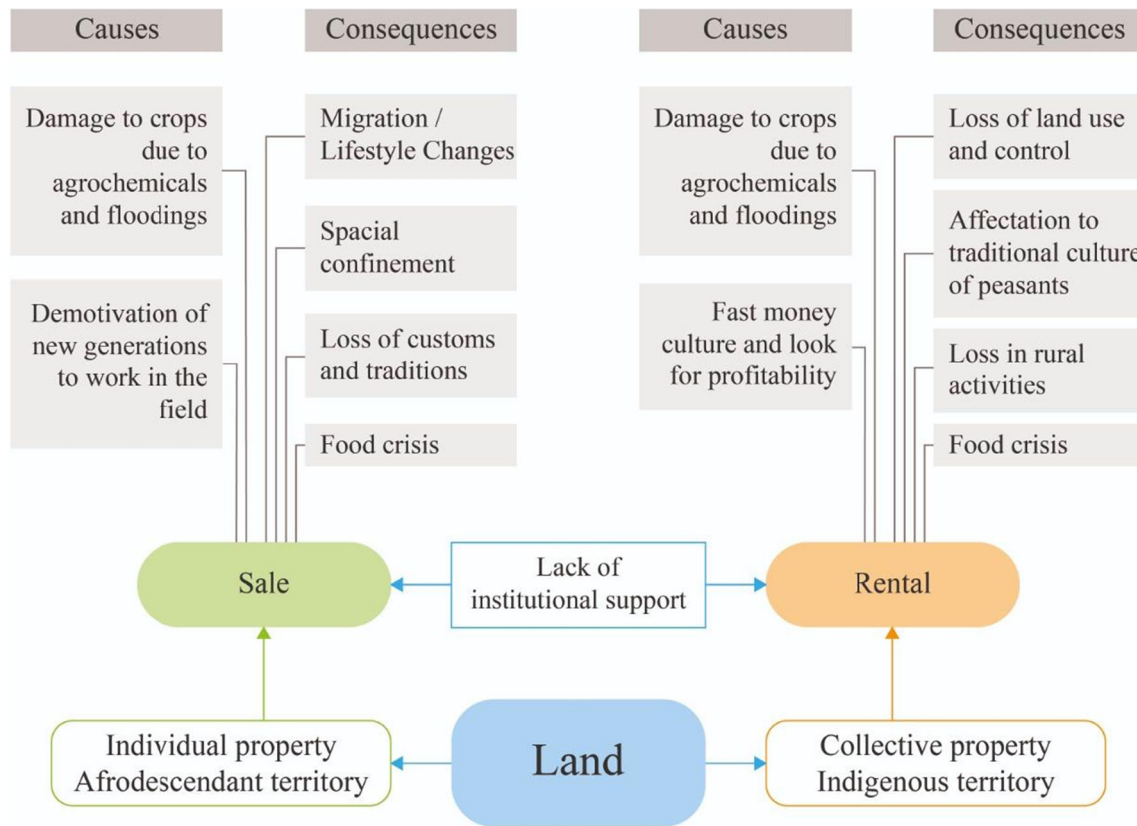
## Discussion

This study was conducted with a comprehensive mixed methodological design that allowed quantitatively examining FI in Afro-Colombian and indigenous households, and qualitatively explaining the historical processes that

lead to the emergence of this phenomenon. In these rural ethnic communities of Colombia, we found a much higher prevalence of FI (El Hormiguero, 71%; El Tiple, 70%; and López Adentro, 85%) as compared to the national prevalence of FI (54.2%) estimated at the latest National Survey of Nutritional Situation (MSPS, OPS, ICBF 2015).

Based on the results obtained from the multiple logistic regression model, the social, economic and demographic factors that influenced the prevalence of FI in the households studied were economic income, social security, gender, the presence of underage in the home, land ownership and refrigerator in operation (all significant at  $P < 0.05$ ).

In particular, households in the study that had underage were at an increased risk of presenting mild, moderate or severe FI. This finding is consistent with other studies that suggest that the greater the number of members in the



**Fig. 1** Causes and consequences of land loss in the three ethnic territories, Calombia, 2018

home, especially those under 18 years of age or older adults, the greater the risk is of developing FI (Gazuma 2018; Tiwasing et al. 2018). Thus, there is a higher risk of FI due to increased demand for food in the home and the presence of individuals who do not contribute to the household economy.

Although the prevalence of FI was high in all three territories, there was a significant difference between the black communities and the indigenous community. This situation is explained by the fact that in black households (El Hormiguero and El Tiple), income mainly comes from salaried jobs in sugar mills, poultry farms, artisanal sand extraction and domestic tasks as well as from informal employment. In indigenous households, income comes from activities related to the field, in which economic retribution is zero or low. A lower economic income, and subsequently a subsidized health care regime, was associated with a higher prevalence of FI in any of its forms (mild, moderate or severe). These results coincide with studies conducted in Iran, India, Bangladesh, the USA and Mexico, where low economic income has a notable role in the high prevalence of FI in rural households (Motbainor et al. 2016; Mohamadpour et al. 2012; Harris et al. 2015; Gholami et al. 2013; Abdullah Zhou et al. 2017).

Regarding gender, male-headed households had a decreased risk, by 56%, of presenting moderate or severe FI with respect to female-headed households (OR 0.44,  $P < 0.05$ ). Several studies have found a strong association between female headship and an increased risk of developing FI (Abdullah Zhou et al. 2017; Fonseca et al. 2013; Shone et al. 2015). Households headed by women, especially ethnic groups, do not earn enough money because of the strong gender inequality in wages in the labour market and because of the type of work they access. In the case of this study, the qualitative component showed that young female heads of household were generally employed as domestic workers in neighbouring cities, while adult women were responsible for the household and therefore preferred not to acquire any employment.

To complement this analysis, we discuss the relationship between land ownership as a source of food production and its impact on FI prevalence in households. In an apparently paradoxical way, it was found that having collective ownership of land, as in the case of the indigenous community, was strongly associated with severe FI (OR 3.90,  $P < 0.05$ ). No studies have addressed whether having different ownership regimes in rural households is a risk factor for a higher prevalence of FI. With the surveys, it was found that although the prevalence of FI was higher in



the indigenous population, their food autonomy with respect to the acquisition of food in markets was also higher: 50% autonomy in the case of indigenous people and 2% in the case of Afro-descendants. In other words, this study has shown that autonomy with respect to food markets is greater in those families that have collective territory; however, their food supply is insufficient and inferior with respect to the Afro-descendant population, from which its greater FI derives.

From a historical perspective, it is worth recognizing that the described food systems have interconnected with the internal armed conflict, prolonged for more than six decades. Direct, structural (Galtung and Tord 1971) and slow (Nixon 2009) forms of violence have affected rural ethno-racial groups, for whom the land is not only a means of livelihood and a source of food but also a reference point of identity (Forero 2003). In this context, the expulsion of rural communities is also explained in relation to processes such as (1) the confinement of the population in areas where food is not grown or collected; (2) violently forced displacement (Velez et al. 2013), calculated as more than 7 million, with a greater proportion of Afro-descendant and indigenous populations in rural areas; and (3) weakened socio-economic relationships in these regions due to the lack of attention of the Colombian state to rural development (Friedemann 1976).

## Conclusions

The ethnic communities in the three territories have a high prevalence of high FI, greater than 70%; in the case of the indigenous population, this prevalence is 85%. In addition, there is evidence of a huge loss of food sovereignty associated with the sale and rental of land, which has transformed the practices of food production and self-consumption. This has generated not only a food crisis but also a social, cultural and political crisis related to migration, uprooting and the loss of control over the territory.

The sugarcane monocrop, as an industrial model of agriculture and as an economic system, has undoubtedly contributed to the effects on the food security and sovereignty of ethnic communities. It is not enough to have land; there are structural flaws in tenure and control that are not allowing their maximum *use* to ensure the production and consumption of food. Indigenous households from López Adentro, which hold collective land ownership, have high levels of severe AI, but, in turn, in this community the food autonomy is greater with respect to the food acquisition in food markets (being approximately 50%, which represents a significant contrast with respect to the black communities that sustain only 2% autonomy in food acquisition). In other words, this study has shown that autonomy with

respect to food markets is greater in those indigenous families that have collective territory; however, their food supply is insufficient and inferior with respect to the Afro-descendant population. As a result, by analysing in a comparative way the ownership regimes of black and indigenous communities, it is possible to conclude that collective land tenure is not sufficient to reduce the prevalence of FI. Despite having ownership over the land, not all indigenous households cultivate food. In fact, some rent the land to sugar mills, yielding corporate capital and losing control over it; the income obtained by indigenous families from the sale of some food produced or the rent of land is not enough to satisfy the food demand of all household members.

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## Compliance with ethical standards

**Conflict of interest** The authors declare no conflicts of interest.

**Ethics approval** All procedures performed were in accordance with the ethical standards of the Universidad del Valle institutional research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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