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# Association of gender-related factors and household food security in southwest Oromia, Ethiopia: evidence from a cross-sectional study

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## Abstract

**Background** Food insecurity is a major concern across Ethiopia and a long-standing public health problem. Vulnerability to food insecurity varies by several individual and household factors; however, understanding the role of gender-related factors can serve as additional input for designing policy and interventions. A cross-sectional survey was conducted in the Yayu Coffee Forest Biosphere Reserve in southwest Oromia, Ethiopia as part of a baseline assessment for the My Forest, My Livelihood, My Family program. A total of 1.113 households were selected from six woredas (districts) using a two-stage sampling procedure. The outcome variable was measured using the Household Food Insecurity Access Scale, version 3. The association between gender-related factors and household food security was assessed by fitting a logistic regression.

**Results** The prevalence of food insecurity was 62.4%, with 28.1% of households assessed as severely food insecure. Households with both the wife and husband making decisions about major purchases were associated with an increased odds of household food security (adjusted odds ratio [AOR] 1.44, confidence interval [CI] 1.06, 1.96). The odds increased when the woman alone made these decisions (AOR 2.15, CI 1.20, 3.85). Women's formal education was also associated with increased odds of household food security.

**Conclusions** This study adds evidence that policy and programmatic interventions that improve the agency of women to participate in asset ownership and household economic decision making, expand female literacy and education, and diversify income sources to include off-farm wage employment in the Yayu Coffee Forest Biosphere Reserve are important steps for improving household food security.

**Keywords** Food insecurity, Food security, Gender, Oromia, Ethiopia

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## Introduction

Food insecurity results when an insufficient quantity of safe and nutritious food is available to provide for normal growth and development. Food insecurity is a major concern across Ethiopia, with chronic and acute food insecurity being a significant public health problem in the country for decades [1]. The country's high dependence on traditional, small-scale agricultural production has led to food vulnerability through a combination of causes, mainly including natural disasters and climate change, such as drought, crop failure, and livestock disease; population growth; land fragmentation and degradation; lack of secured land tenure; lack of infrastructure; and governance, conflict, and security problems [1, 17]. Most recently, civil unrest in the northern region and the subsequent internal displacement of millions of people, and sustained drought in the southern region have contributed to the ongoing challenges related to agricultural production. In 2022, it was estimated by the World Food Programme that 20.4 million people in Ethiopia required food assistance [23]. As a result of the significance of this issue, much research has been conducted in Ethiopia to assess the prevalence and severity of food insecurity, estimated nationally and subnationally, the drivers and correlates of food insecurity; and the health consequences of undernutrition and reduced economic productivity.

Research published since 2005 showed that vulnerability to food insecurity varied by several individual and household factors. This body of research found that sociodemographic factors related to the head of the household—such as sex, age, education level, and type of employment—and household characteristics, such as the size of the household (number of household members), income, access to credit, ownership of animals, and size of farmland were often significantly related to household food insecurity [4, 5, 8, 13, 14, 19]. For example, a study from the West Abaya district in southern Ethiopia found an increased likelihood of food insecurity for households headed by females, single heads-of-households, older heads-of-households, households with four or more members, and ownership of 1.5 hectares or less of farmland [19]. In addition, the application of fertilizer, improved farm inputs, and access to extension services have also been included in models of food insecurity and were found to be associated with improved food security [2, 5, 8, 10].

As a demographic characteristic, the sex of the head of the household has consistently been included in models of household food insecurity. A recent meta-analysis found that female-headed households had a twofold increased likelihood of being food insecure compared with male-headed households in Ethiopia [15]. However, non-demographic gender-related measures have not typically been included in models of household food insecurity, even though the gendered roles of women can create constraints to resources and food access. Our work expands on previous research by investigating the degree to which gender-related variables are associated with household food security in the Yayu Coffee Forest Biosphere Reserve.

### Area of study

The Yayu Coffee Forest Biosphere Reserve is located in southwest Ethiopia, in Oromia Regional State. The Biosphere Reserve encompasses the Hurumu, Yayo, Bilo Nopa, Alge-Sachi, and Doreni woredas (districts) of Illu-Abba Bora zone and the Chora woreda of Buno Bedele zone. It is comprised of three parts: the core, which is a protected forest area; the buffer, in which certain economic activities, such as coffee and spice production, and forest uses, such as commercial forest plantations and eco-tourism, are allowed; and the transitional area, where a variety of traditional and modern agricultural practices take place [7]. A total population of 476,280 consisting of 52% male and 48% female lives in the biosphere reserve, and the region is described as "resource-rich but livelihood-poor," in which households depend on a combination of small-scale agricultural and forest management systems, dominated by traditional agronomic practices with low inputs and low productivity [7]. About 90% of cash income for households is generated from forest products (e.g., coffee, honey, and spices, coffee alone accounts for 70% [7]. This lack of diversity increases vulnerability to risk factors, such as crop pests, disease, degradation, deforestation, loss of biodiversity, and their consequences, including food insecurity and subsequent poor health outcomes.

Women and girls living in the region face social and cultural barriers that limit their participation in development activities [7]. Barriers, such as limited mobility, especially for married adolescent girls, lack of education, limited financial access and literacy, and limited access to land resources, can preclude engagement in economic activities and contribute to food insecurity among women and girls themselves, and to that of their families.

## Materials and methods

### Data

The data for the analysis came from a cross-sectional survey conducted for the baseline of a mixed methods outcome evaluation of the My Forest, My Livelihood, My Family (FUTURES) program [12]. The FUTURES program is an integrated, multi-sectoral project funded by the David and Lucile Packard Foundation that was developed to address many of the health, agriculture, livelihood, and conservation concerns in the Yayu

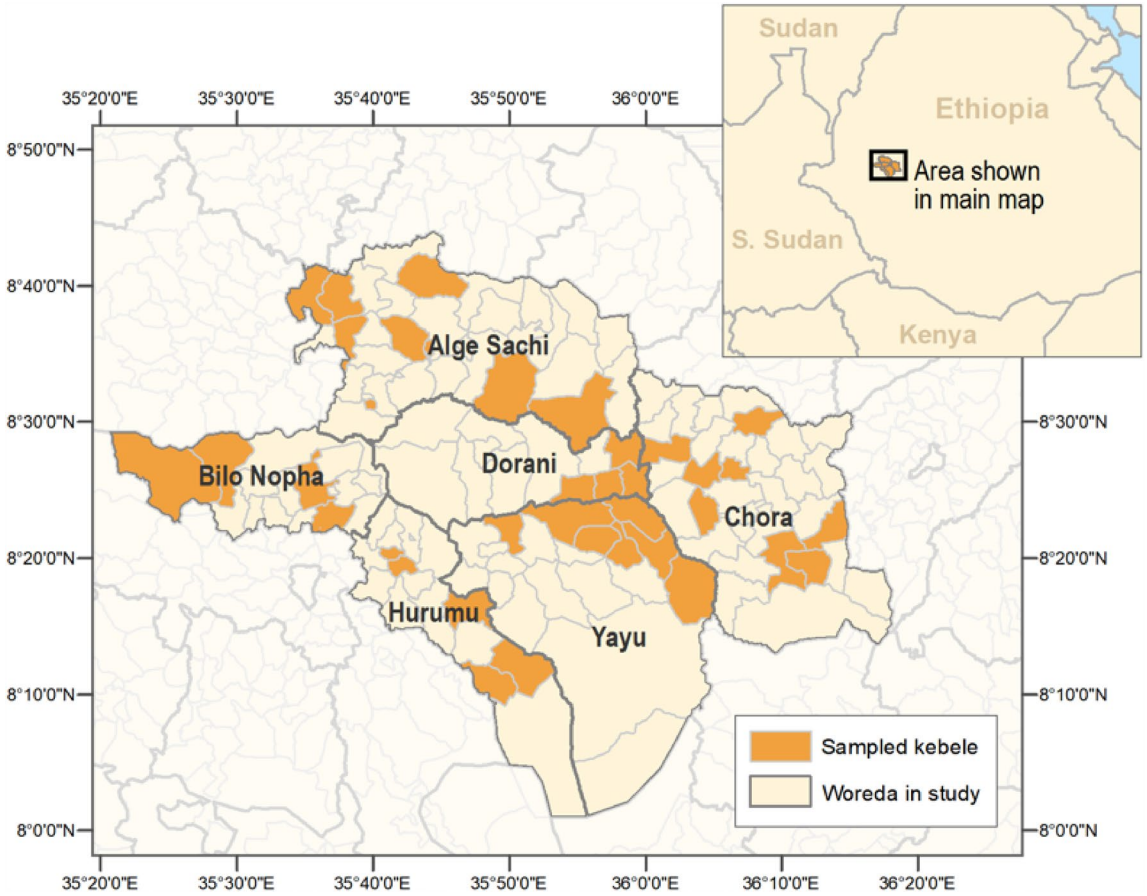


**Fig. 1** Map of study area

Coffee Forest Biosphere Reserve region. The project is implemented by CARE Ethiopia and its three local partners—Oromia Development Association, Environment and Coffee Forest Forum, and Kulich Youth Reproductive Health and Development Organization. It works in 28 kebeles (wards or neighbourhoods) in the towns of Chora, Yayu, and Dorani. The baseline data were collected from 1.113 households sampled from 38 kebeles in 6 woredas in the study area (see Fig. 1 Map of study area). A quasi-experimental design was used to select three intervention and three non-intervention woredas. Nineteen kebeles were then randomly selected from intervention woredas and comparison woredas with the assumption that 30 households per kebele were sufficient to get a sample of 557 households from each arm. Following the selection of kebeles, the respondent households were selected based on probability proportional to size of households in each kebele. Eligible respondents included married and unmarried women ages 15–49 identifying as "head of the household" or "married to the head of the household." A structured questionnaire was developed in English and translated to Afan Oromo, the local language. Before data collection, the questionnaire was pretested in similar households that were not included in the final sample. The survey was implemented by a team of 20 enumerators, four field supervisors, and one coordinator affiliated with Jimma University, who were able to work in both English and Afan Oromo. The survey was implemented using Open Data Kit on tablets and mobile phones [9]. Simultaneous data quality checks were completed using a secure File Transfer Protocol, in keeping with approved data security requirements. Data collection was conducted from November 30 to December 12, 2021. Interviews lasted an average of 1 hour. Further details on the baseline survey are available in [12].

Before data collection, ethics approval was obtained from the Institutional Review Board of the University of North Carolina at Chapel Hill (Study #21-2143, October 14, 2021), the Jimma University College of Agriculture and Veterinary Medicine Research Ethical Review Board (Ref. No. R/GS/S22/2021, October 22, 2021), and the Faculty of Public Health Ethical Review Board (Ref. No IHRPG 1/2021, November 26, 2021).

### Measurements

Women's demographic and gender-related factors for the analysis included age group (15–24, 25–29, 30–34, 35–39, and 40–49); marital status (married or in union vs. not currently married or in union); highest level of education (none, primary, or secondary and higher); employment during the past 12 months (yes/no); compensation for employment in the past 12 months (not employed, employed/not paid in cash, or employed/paid in cash); ownership of a bank account (yes/no); access to credit in the past 12 months (yes/no); participation in women's associations or women's self-help groups (yes/no); and her name on the title/deed among households owning land (yes/no). Gender-related variables of participation in decision making included the person who decides to make major household purchases, how the woman's/wife's cash earnings are used, and how the man's/husband's cash earnings are used, all coded as woman, woman and husband jointly, or husband/other.

Household characteristics included in the analysis were household size (1–2, 3–4, or 5 + members); major livelihood/income earning activities (crop production, livestock production, off-farm self-employment, off-farm wage employment, other); and number of household livelihood/income activities (one vs. more than one). The diversity of livelihood activities was categorized using the most common combinations: only one (crop production); only one (other than crop production); more than one (crop and livestock production); or more than one (any other combination). Additional household characteristics were ownership of farm animals (yes/no); ownership of land (yes/no); farmland size in hectares (no farmland, < = 1 hectare, or > 1 hectare); and number of household shocks experienced in the past 12 months (zero, one, or two or more). The list of potential household shocks included significant rise in food prices; loss of livestock or poultry due to disease or pests; lower crop yield due to drought, flood, crop disease, or pests; disruption of farming or livestock; serious illness or accident of household member(s); business failure; significant fall in sales price of crops or livestock or poultry; end of regular assistance, aid, or remittances; death of income earner(s); conflict/violence; theft/looting of cash or other property; break-up of household (divorce, separation, death, or migration); or damage/destruction of dwelling. Woreda was also included as was a measure of household wealth.

A household wealth index was constructed to measure the relative economic status of households using a principal component analysis method [16]. The variables included were housing material (type of roof), access to utilities (water source, type of fuel, electric power); ownership of household assets (radio, television, telephone, personal computer, refrigerator, table, chair, bed, electric stove, kerosene lamp, watch, mobile phone); number of farm animals (cattle, camel, goat, sheep, chicken, beehive); ownership of transportation means (animal cart, bicycle, motorcycle, cart bajaj [three-wheeled scooter or auto rickshaw], and car or truck); and size of agricultural land owned. Using these variables, households were divided into five wealth quintiles: lowest, second, middle, fourth, and highest.

The dependent variables for the analysis used the Household Food Insecurity Access Scale (HFIAS), version 3 [3]. During data collection, respondents were asked nine questions to measure the occurrence of food insecurity and nine questions on the frequency of food insecurity. Occurrence of food insecurity questions ware recorded with yes or no response, whereas frequency questions were captured as rarely (once or twice), sometimes (three to ten times), or often (more than ten times) in the past 4 weeks. Using these responses, households were categorized into four levels of food insecurity: food secure, mildly food insecure, moderately food insecure, and severely food insecure. See Additional file 1 for details on HFIAS questions, scoring, and categorization.

In addition, data were collected on the prevalence of households experiencing one or more behaviours in each of the three domains reflected in the HFIAS: anxiety and uncertainty, insufficient quality of food intake, and insufficient food intake and its physical consequences. The household food insecurity access-related domains show the percentage of households that responded "yes" to any of the behaviours in a specific domain [3]. Last, household food insecurity access-related conditions present the percentage of households that responded affirmatively to each question on experiences and responses to food insecurity, regardless of the frequency of the experience. They measure the percentage of households experiencing the condition at any level of severity [3].

### Analysis

All analyses were conducted in Stata version 15 [20]. Sample weights and adjustments for the multistage sampling design were used. Specifically, the "surveyset" command was used to account for the complex survey data. In doing so, strata were defined based on the project area (intervention vs. comparison), a finite population correction was applied for the selection of kebele and household, and weights were used to account for unequal probability of selection. Weight was calculated as the inverse of the probability of selection of a household, which was normalized by dividing it by the mean weight. Frequency, percentage, and 95% confidence interval (CI) were used to present demographic characteristics, household characteristics, and assessment of household food insecurity.

The association between gender-related factors and household food security was assessed by fitting a logistic regression. The analysis identified factors associated with "food security", rather than "food insecurity", because our hypothesis was that households with higher levels of gender equality were more likely to be food secure. The unit of analysis was the household. First, the dependent variable—household food security—was recategorized into a binary variable of food secure vs. food insecure (mildly, moderately, or severely food insecure). Next, unadjusted logistic regressions were run with gender-related factors and other individual and household variables. Correlation between significant factors was also checked using a correlation matrix. One of the variables was dropped from further analysis if any two variables showed a high level of correlation (correlation coefficient > 0.8). In addition, when one variable was derived from another, one of them was excluded from further analysis regardless of the correlation value. The excluded variables were marital status, employment pay type, crop production, livestock production, off-farm self-employment, number of livelihood activities, and ownership of farmland. The final model was built by including all uncorrelated gender-related, individual, and household factors that showed statistically significant associations during the binary logistic regressions using a 95% level of confidence.

## Results

Women's demographic and gender-related characteristics are given in Table 1. About half the sample were ages 15–29, and almost all women were married or in union (94.63%). One-third of the survey respondents (33.3%) did not have any formal education. Most women were employed during the past 12 months (85.6%), although more than half of these women were not paid in cash (56.1%). Although 31.8% of women had a bank account, only 16.2% had access to credit in the past 12 months. Participation in a women's association or group was reported by 33.8% of the women. Of the 798 households owning land, 77.3% of the women reported that their names were on the title/deed. When it came to decision making, 25.7% of women reported that their husbands or someone else made decisions about major household purchases. A somewhat smaller percentage of women reported that their husbands or someone else made decisions about how their earnings were used (20.4%) or how their husband's/partner's earnings were used (22.8%).

Table 2 presents the household characteristics. Almost all households had three or more members, with nearly 50% having five or more members. The major livelihood/income earning activities for the households were crop production (73.4%) and livestock production (31.5%), whereas a small percentage

**Table 1** Women's demographic and gender-related characteristics, FUTURES baseline survey, 2021; $N = 1.113$

| Characteristic | Unweighted number | Percentage | (95% CI) |
|---|---|---|---|
| Age group | | | |
| 15–24 | 261 | 22.8 | (21.0, 24.8) |
| 25–29 | 304 | 26.1 | (24.4, 27.8) |
| 30–34 | 170 | 15.1 | (13.7, 16.6) |
| 35–39 | 221 | 21.3 | (19.5, 23.3) |
| 40–49 | 157 | 14.8 | (13.2, 16.4) |
| Marital status | | | |
| Married/in union | 1.049 | 94.6 | (93.6, 95.5) |
| Not currently married/in union | 64 | 5.4 | (4.5, 6.4) |
| Highest level of school attended | | | |
| No formal education | 378 | 33.3 | (28.8, 38.2) |
| Primary | 439 | 37.4 | (34.4, 40.5) |
| Secondary or above | 296 | 29.3 | (24.1, 35.0) |
| Employed in the past 12 months | | | |
| No | 157 | 14.4 | (12.4, 16.7) |
| Yes | 956 | 85.6 | (50.5, 61.6) |
| Employment compensation | | | |
| Not employed | 157 | 14.4 | (12.4, 16.7) |
| Employed, not paid in cash | 656 | 56.1 | (50.5, 61.6) |
| Employed, paid in cash | 300 | 29.5 | (25.5, 33.9) |
| Has bank account | | | |
| No | 766 | 68.2 | (62.3, 73.5) |
| Yes | 347 | 31.8 | (26.5, 37.8) |
| Had access to credit in the past 12 months | | | |
| No | 938 | 83.8 | (81.1, 86.2) |
| Yes | 175 | 16.2 | (13.8, 18.9) |
| Participation in women's associations or women's self-help groups | | | |
| No | 742 | 66.2 | (63.6, 68.8) |
| Yes | 371 | 33.8 | (31.3, 36.5) |
| Name is on title/deed (among households owning land, $n = 798$) | | | |
| No | 186 | 22.7 | (20.9, 24.7) |
| Yes | 612 | 77.3 | (75.3, 79.1) |
| Person who decides on major household purchases | | | |
| Woman | 119 | 10.4 | (9.1, 11.8) |
| Woman and husband jointly | 705 | 64.0 | (61.2, 66.6) |
| Husband or other | 289 | 25.7 | (23.2, 28.3) |
| Person who decides on how the woman's/wife's cash earnings are used (among women who had any earnings, $n = 1.080$) | | | |
| Woman | 122 | 11.5 | (9.9, 13.4) |
| Woman and husband jointly | 730 | 68.1 | (65.1, 70.9) |
| Husband or other | 228 | 20.4 | (17.9, 23.1) |
| Person who decides on how the man's/husband's cash earnings are used (among women whose husbands have earnings, $n = 1.049$) | | | |
| Woman | 46 | 3.9 | (2.8, 5.3) |
| Woman and husband jointly | 742 | 73.3 | (70.8, 75.8) |
| Husband or other | 241 | 22.8 | (20.5, 25.3) |

**Table 2** Household characteristics, FUTURES baseline survey, 2021; *N* = 1.113

| Characteristic | Unweighted number | Percentage | (95% CI) |
|---|---|---|---|
| Household size | | | |
| 1–2 | 72 | 6.6 | (5.5, 7.8) |
| 3–4 | 481 | 43.5 | (41.2, 45.8) |
| 5 + | 560 | 50.0 | (47.6, 52.3) |
| Major livelihood/income earning activities | | | |
| Crop production | | | |
| No | 260 | 26.6 | (19.6, 35.0) |
| Yes | 853 | 73.4 | (65.0, 80.5) |
| Livestock production | | | |
| No | 760 | 68.5 | (63.4, 73.1) |
| Yes | 353 | 31.5 | (26.9, 36.6) |
| Off-farm self-employment | | | |
| No | 1040 | 92.8 | (90.1, 94.7) |
| Yes | 73 | 7.3 | (5.3, 9.9) |
| Off-farm wage employment | | | |
| No | 930 | 83.5 | (81.4, 85.5) |
| Yes | 183 | 16.5 | (14.5, 18.6) |
| Other | | | |
| No | 939 | 82.1 | (76.6, 86.6) |
| Yes | 174 | 17.9 | (13.4, 23.4) |
| Number livelihood/income activities per household | | | |
| Only one | 639 | 57.3 | (51.6, 62.9) |
| More than one | 474 | 42.7 | (37.1, 48.4) |
| Diversity of livelihood activities | | | |
| Only one: crop production | 393 | 31.9 | (28.5, 35.6) |
| Only one: other than crop production | 246 | 25.4 | (18.6, 33.7) |
| More than one: crop and livestock production | 343 | 30.3 | (25.6, 35.6) |
| More than one: any other combination | 131 | 12.3 | (10.6, 14.3) |
| Ownership of farm animals | | | |
| No | 266 | 25.3 | (20.2, 31.1) |
| Yes | 847 | 74.7 | (68.9, 79.8) |
| Ownership of farmland | | | |
| No | 315 | 28.3 | (23.4, 33.8) |
| Yes | 798 | 71.7 | (66.2, 76.6) |
| Farmland size in hectares | | | |
| No farmland | 315 | 28.3 | (23.4, 33.8) |
| = < 1 hectare | 463 | 42.9 | (38.9, 46.9) |
| > 1 hectare | 335 | 28.9 | (26.1, 31.8) |
| No. of experiences of significant shocks in the past 12 months | | | |
| 0 | 437 | 39.3 | (36.0, 42.7) |
| 1 | 363 | 33.5 | (30.6, 36.5) |
| 2 + | 313 | 27.3 | (24.6, 30.1) |
| Woreda | | | |
| Alge Sachi | 322 | 44.4 | (33.3, 56.1) |
| Bilo Nopa | 78 | 10.1 | (5.7, 17.1) |
| Chora | 193 | 8.3 | (4.5, 14.8) |
| Doreni | 86 | 3.7 | (1.5, 9.0) |
| Hurumu | 158 | 21.4 | (12.4, 34.6) |
| Yayu | 276 | 12.1 | (6.7, 20.8) |

**Table 2** (continued)

| Characteristic | Unweighted number | Percentage | (95% CI) |
|---|---|---|---|
| Wealth quintiles | | | |
| Lowest (Poorest) | 224 | 20.0 | (17.9, 22.6) |
| Second | 222 | 20.0 | (17.7, 22.4) |
| Middle | 222 | 20.0 | (17.7, 22.4) |
| Fourth | 223 | 20.0 | (17.8, 22.5) |
| Highest | 222 | 20.0 | (17.7, 22.4) |

**Table 3** Measures of household food insecurity access, FUTURES baseline survey, 2021; $N = 1.113$

| Characteristic | Unweighted number | Percentage | (95% CI) |
|---|---|---|---|
| Prevalence | | | |
| Food secure | 456 | 37.6 | (35.0, 40.3) |
| Mildly food insecure | 119 | 10.8 | (9.4, 12.4) |
| Moderately food insecure | 251 | 23.4 | (21.2, 25.8) |
| Severely food insecure | 287 | 28.1 | (25.6, 30.8) |
| Domains | | | |
| Household with anxiety and uncertainty about food supply | 488 | 46.6 | (43.6, 49.5) |
| Households with insufficient food quality | 626 | 60.1 | (57.4, 62.7) |
| Household with insufficient food intake | 485 | 46.8 | (44.2, 49.4) |
| Conditions | | | |
| Worry about food | 488 | 46.6 | (43.6, 49.5) |
| Unable to eat preferred foods | 536 | 51.8 | (48.8, 54.8) |
| Eat a limited variety of foods | 505 | 49.8 | (47.3, 52.3) |
| Eat foods that you really did not want to eat | 456 | 44.6 | (41.9, 47.2) |
| Eat a smaller meal | 453 | 44.3 | (41.8, 46.8) |
| Eat fewer meals in a day | 397 | 39.2 | (36.6, 41.8) |
| No food to eat of any kind in the household | 245 | 24.0 | (21.6, 26.5) |
| Go to sleep at night hungry | 161 | 15.3 | (13.6, 17.2) |
| Go a whole day and night without eating anything | 104 | 9.1 | (7.8, 10.5) |

were involved in off-farm self-employment (7.3%), wage employment (16.5%), or other activities (17.9%). Fifty-seven percent of households were engaged in only one type of livelihood activity. Most common were households with only crop production for their livelihood (31.9%) and households with both crop and livestock production (30.3%). Most of the households owned farm animals (74.7%) and farmland (71.7%). Forty-three percent of the households owned less than one hectare of farmland. During the past 12 months, some households did not experience any shocks (39.3%), whereas 33.5% experienced one shock, and 27.3% experienced two or more shocks, with the most commonly experienced shocks being a significant rise in food prices ($n = 547$), loss of livestock or poultry to disease or pests ($n = 216$), and lower crop yield due to drought, flood, crop disease, or pests ($n = 134$) (data not shown). Households in the sample were spread across six woredas of the Yayu Coffee Forest Biosphere Reserve, with households in Alge Sachi and Yayu contributing the highest numbers.

The results of household food insecurity measures are presented in Table 3. According to the HFIAS, the prevalence of food insecurity was 62.4%, with 10.8% being mildly food insecure, 23.4% moderately food insecure, and 28.1% severely food insecure. Although slightly fewer than half of the households had anxiety or uncertainty about their food supply (46.6%) or insufficient food intake (46.8%), 60.1% reported insufficient food quality. The most common food insecurity conditions were the inability to eat preferred food (51.8%), eating a limited variety of foods (49.8%), and worry about food (46.6%). Fifteen percent reported going to sleep hungry, and nine percent reported going a whole day and night without eating anything.

The association of gender-related, demographic, and household characteristics with household food security is shown in Table 4. As key gender-related variables, participation in decision making is presented first. After adjusting for other factors, households with both the wife and husband making decisions about major purchases were associated with an increased odds of household food security. Compared with households in which the husband or someone else made these decisions, joint decision making was associated with odds of food security that were 44% higher (adjusted odds ratio [AOR] 1.44, CI 1.06, 1.96). Women making these decisions were associated with odds of food security that were 2.15 times higher (AOR = 2.15, CI 1.20, 3.85). Women's formal education was also associated with increased odds of household food security. Odds of food security were increased by 42% for women with any primary education (AOR = 1.42, CI 1.07, 1.87) and by 65% for women with any secondary or higher education (AOR = 1.65, CI 1.25, 2.20) compared with women having no formal education. Other household factors significantly associated with increased odds of food security in the adjusted model included livelihood activities other than only crop production (with more than one income stream showing the highest odds); ownership of farm animals; having experienced less than two shocks during the past 12 months; and not being in the lowest wealth category. Households located in Chora and Yayu had 2 times the odds of being food secure compared with households located in Alge Sachi (AOR = 2.12, CI 1.26, 3.55 and AOR = 2.02, CI 1.34, 3.06, respectively). As seen in the unadjusted model, households in which women had been employed in the past 12 months had reduced odds of reporting food security (AOR = 0.45, CI 0.34, 0.61). Women who made decisions alone about how to use their cash earnings also showed reduced odds of food security compared with decisions made by a husband or someone else (AOR = 0.34, CI 0.18, 0.64).

## Discussion

Food insecurity is a major public health challenge in Ethiopia. In our study of households living in the Yayu Coffee Forest Biosphere Reserve, food insecurity was identified in almost two-thirds of households, with nearly 30% assessed as severely food insecure. This study adds to the body of literature on factors associated with household food security by introducing gender-related variables. The results from regression analysis showed that egalitarian decision making on major purchases and how cash earnings were used were related to increased odds of being food secure, even after adjusting for other sociodemographic and household factors commonly associated with food security. Households in which the respondent women had any formal education also showed increased odds of food security. These findings support the hypothesis that households that are more gender equitable are more likely to be food secure, and that women's empowerment within a household leads to increased opportunities to contribute to the production and use of agricultural products and income. These findings are similar to those of case studies in other African countries, for instance, Kehinde et al. [11] in Nigeria and Galiè et al. [6] in Tanzania. Results indicated that a reliance on small-scale crop production and a lack of livelihood diversity contributed to the high level of food insecurity in this region, which is a similar finding to previous research in the country (Beyene & Muche [2]; Eneyew & Bekele [5]; Shone et al. [19]). Moreover, household wealth, woreda of residence, and not having experienced recent major shocks, such as rising food prices, loss of livestock or poultry, or low crop yield, were also found to be significantly related to household food security.

Although women's economic empowerment is key to lasting food security [22], the measure of women's employment was not found to be positively related to household food security in this analysis. This finding suggests that the employment variable was not capturing economic agency related to the ability to act, but rather, the economic need of the household to have supplemental income in addition to that of the male head of the household. This thesis is supported by results from an analysis of women's empowerment and household food security in KwaZulu-Natal, South Africa, which found that the income of women's husbands was the most significant determinant of food security among married women's households [18].

A main strength of this analysis is that it considered gender-related variables not included in previous research on food security in Ethiopia, such as women's name on the title or deed of households owning land, participation in decision making about major household purchases and how cash earnings were used, and participation in women's associations or women's self-help groups, which may be used to provide opportunities to learn new livelihood skills, access to credit and banking, and communication or self-advocacy skills. The study provided unique insight on a region that is "resource rich but livelihood poor," and used information collected from women who were positioned to know the situation of the household food security status very well. We also collected and analysed information on the household's experience of significant shocks in the past 12 months.

One limitation of this work is that self-reported measures of the experience or perception of food insecurity,

**Table 4** Association of gender-related, demographic, and household characteristics with household food security, FUTURES baseline survey, 2021; *N* = 1.113

| Characteristic | Food insecure (*n* = 657) | | Food secure (*n* = 456) | | Crude odds ratio (COR) | | | Adjusted odds ratio (AOR) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Freq | (%) | Freq | (%) | COR | (95% CI) | *P* value | AOR | (95% CI) | *P* value |
| Person who decides on major household purchases | | | | | | | | | | |
| Woman | 89 | 77.7 | 30 | 22.3 | 0.71 | (0.50, 1.00) | **0.05**[a] | 2.15 | (1.20, 3.85) | **0.01** |
| Woman and husband jointly | 376 | 56.3 | 329 | 43.6 | 1.91 | (1.51, 2.42) | **< 0.01** | 1.44 | (1.06, 1.96) | **0.02** |
| Husband or other | 192 | 71.2 | 97 | 28.8 | Ref | | | Ref | | |
| Person who decides on how the woman's/wife's cash earnings are used (among women who have earnings, *n* = 1.080) | | | | | | | | | | |
| Woman | 99 | 83.1 | 23 | 16.9 | 0.51 | (0.36, 0.72) | **< 0.01** | 0.34 | (0.18, 0.64) | **< 0.01** |
| Woman and husband jointly | 383 | 55.7 | 347 | 44.3 | 2.00 | (1.60, 2.49) | **< 0.01** | 1.44 | (0.93, 2.24) | 0.10 |
| Husband or other | 152 | 71.5 | 76 | 28.5 | Ref | | | Ref | | |
| Person who decides on how the man's/husband's cash earnings are used (among women whose husbands have earnings, *n* = 1.029) | | | | | | | | | | |
| Woman | 34 | 74.9 | 12 | 25.1 | 0.82 | (0.48, 1.41) | 0.46 | 1.30 | (0.58, 2.92) | 0.52 |
| Woman and husband jointly | 397 | 57.3 | 345 | 42.7 | 1.83 | (1.48, 2.25) | **< 0.01** | 1.09 | (0.69, 1.75) | 0.70 |
| Husband or other | 161 | 71.0 | 80 | 29.0 | Ref | | | Ref | | |
| Age groups | | | | | | | | | | |
| 15–24 | 148 | 62.3 | 113 | 37.7 | Ref | | | | | |
| 25–29 | 180 | 61.9 | 124 | 38.1 | 1.02 | (0.83, 1.25) | 0.87 | | | |
| 30–34 | 93 | 59.3 | 77 | 40.7 | 1.13 | (0.87, 1.49) | 0.35 | | | |
| 35–39 | 140 | 63.4 | 81 | 36.6 | 0.96 | (0.75, 1.22) | 0.72 | | | |
| 40–49 | 96 | 64.8 | 61 | 35.2 | 0.90 | (0.70, 1.15) | 0.39 | | | |
| Marital status | | | | | | | | | | |
| Married/in union | 602 | 60.8 | 447 | 39.2 | 5.26 | (2.89, 9.59) | **< 0.01** | | | |
| Not currently married/in union | 55 | 89.1 | 9 | 10.9 | Ref | | | | | |
| Highest level of school attended | | | | | | | | | | |
| No formal education | 245 | 67.0 | 133 | 32.9 | Ref | | | Ref | | |
| Primary | 257 | 61.5 | 182 | 38.5 | 1.27 | (1.03, 1.58) | **0.03** | 1.42 | (1.07, 1.87) | **0.02** |
| Secondary and above | 155 | 58.2 | 141 | 41.8 | 1.46 | (1.18, 1.80) | **< 0.01** | 1.65 | (1.25, 2.20) | **< 0.01** |
| Employed in the past 12 months | | | | | | | | | | |
| No | 84 | 52.9 | 73 | 47.1 | Ref | | | Ref | | |
| Yes | 573 | 63.9 | 383 | 36.1 | 0.63 | (0.49, 0.82) | **< 0.01** | 0.45 | (0.34, 0.61) | **< 0.01** |
| Employment pay type | | | | | | | | | | |
| Not employed | 84 | 52.9 | 73 | 47.1 | 3.12 | (2.31, 4.23) | **< 0.01** | | | |
| Employed but not paid in cash | 353 | 56.7 | 303 | 43.3 | 2.69 | (2.10, 3.44) | **< 0.01** | | | |
| Employed and paid in cash | 220 | 77.8 | 80 | 22.2 | Ref | | | | | |
| Has bank account | | | | | | | | | | |
| No | 468 | 63.9 | 298 | 36.1 | Ref | | | | | |
| Yes | 189 | 59.1 | 158 | 40.9 | 1.23 | (0.99, 1.53) | 0.07 | | | |
| Had access to credit in the past 12 months | | | | | | | | | | |
| No | 552 | 62.5 | 386 | 37.5 | Ref | | | | | |
| Yes | 105 | 61.7 | 70 | 38.3 | 1.03 | (0.87, 1.23) | 0.72 | | | |
| Participation in women's associations or women's self-help groups | | | | | | | | | | |
| No | 445 | 62.9 | 297 | 37.1 | Ref | | | | | |
| Yes | 212 | 61.4 | 159 | 38.6 | 1.06 | (0.85, 1.33) | 0.57 | | | |
| Woman's name is on title/deed (among households owning land, *n* = 798) | | | | | | | | | | |
| No | 106 | 58.4 | 80 | 41.6 | Ref | | | | | |
| Yes | 354 | 61.4 | 258 | 38.6 | 0.88 | (0.70, 1.11) | 0.27 | | | |
| Household size | | | | | | | | | | |
| 1–2 | 40 | 62.7 | 32 | 37.3 | 1.00 | (0.64, 1.54) | 0.98 | | | |

**Table 4** (continued)

| Characteristic | Food insecure (*n* = 657) | | Food secure (*n* = 456) | | Crude odds ratio (COR) | | | Adjusted odds ratio (AOR) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Freq | (%) | Freq | (%) | COR | (95% CI) | *P* value | AOR | (95% CI) | *P* value |
| 3–4 | 283 | 62.1 | 198 | 37.9 | 1.02 | (0.85, 1.23) | 0.83 | | | |
| 5 + | 334 | 62.6 | 226 | 37.4 | Ref | | | | | |
| Crop production | | | | | | | | | | |
| No | 173 | 68.4 | 87 | 31.6 | Ref | | | | | |
| Yes | 484 | 60.2 | 369 | 39.8 | 1.44 | (1.10, 1.87) | **0.01** | | | |
| Livestock production | | | | | | | | | | |
| No | 472 | 65.7 | 288 | 34.3 | Ref | | | | | |
| Yes | 185 | 55.2 | 168 | 44.8 | 1.55 | (1.20, 2.00) | **< 0.01** | | | |
| Off-farm self-employment | | | | | | | | | | |
| No | 609 | 62.0 | 431 | 38.0 | Ref | | | | | |
| Yes | 48 | 67.2 | 25 | 32.8 | 0.80 | (0.53, 1.19) | 0.26 | | | |
| Off-farm wage employment | | | | | | | | | | |
| No | 558 | 64.2 | 372 | 35.8 | Ref | | | | | |
| Yes | 99 | 53.1 | 84 | 46.9 | 1.58 | (1.15, 2.19) | **0.01** | | | |
| Other | | | | | | | | | | |
| No | 561 | 62.7 | 378 | 37.3 | Ref | | | | | |
| Yes | 96 | 60.8 | 78 | 39.2 | 1.09 | (0.85, 1.39) | 0.50 | | | |
| Number livelihood activities | | | | | | | | | | |
| Only one | 420 | 70.5 | 219 | 29.5 | Ref | | | | | |
| More than one | 237 | 51.5 | 237 | 48.5 | 2.25 | (1.80, 2.81) | **< 0.01** | | | |
| Diversity of livelihood activities | | | | | | | | | | |
| Only one: crop production | 253 | 71.0 | 140 | 29.0 | Ref | | | Ref | | |
| Only one: other than crop production | 167 | 69.8 | 79 | 30.1 | 1.06 | (0.77, 1.44) | 0.73 | 1.12 | (0.72, 1.72) | 0.61 |
| More than one: crop and livestock production | 178 | 54.5 | 165 | 45.5 | 2.04 | (1.53, 2.72) | **< 0.01** | 1.92 | (1.38, 2.67) | **< 0.01** |
| More than one: any other combination | 59 | 44.0 | 72 | 56.0 | 3.11 | (2.18, 4.44) | **< 0.01** | 2.92 | (2.13, 4.01) | **< 0.01** |
| Ownership of farm animals | | | | | | | | | | |
| No | 189 | 73.6 | 77 | 26.4 | Ref | | | Ref | | |
| Yes | 468 | 58.5 | 379 | 41.5 | 1.98 | (1.60, 2.45) | **< 0.01** | 1.87 | (1.41, 2.50) | **< 0.01** |
| Ownership of farmland | | | | | | | | | | |
| No | 197 | 66.4 | 118 | 33.6 | Ref | | | | | |
| Yes | 460 | 60.7 | 338 | 39.3 | 1.28 | (1.04, 1.57) | **0.02** | | | |
| Farmland size in hectares | | | | | | | | | | |
| No farmland | 197 | 66.4 | 118 | 33.6 | Ref | | | Ref | | |
| = < 1 hectare | 287 | 64.9 | 176 | 35.1 | 1.07 | (0.87, 1.31) | 0.50 | 1.03 | (0.76, 1.38) | 0.86 |
| > 1 hectare | 173 | 54.6 | 162 | 45.4 | 1.65 | (1.29, 2.11) | **< 0.01** | 1.35 | (0.96, 1.90) | 0.08 |
| No. of experiences of significant shocks in the past 12 months | | | | | | | | | | |
| 0 | 171 | 41.2 | 266 | 58.8 | 5.77 | (4.37, 7.61) | **< 0.01** | 5.93 | (4.16, 8.44) | **< 0.01** |
| 1 | 243 | 72.3 | 120 | 27.3 | 1.52 | (1.13, 2.04) | **0.01** | 1.88 | (1.37, 2.59) | **< 0.01** |
| 2 + | 243 | 80.1 | 70 | 19.9 | Ref | | | Ref | | |
| Woreda | | | | | | | | | | |
| Alge Sachi | 207 | 64.1 | 115 | 35.9 | Ref | | | Ref | | |
| Bilo Nopa | 47 | 61.0 | 31 | 39.0 | 1.14 | (0.82, 1.58) | 0.42 | 1.15 | (0.78, 1.70) | 0.46 |
| Chora | 105 | 54.4 | 88 | 45.6 | 1.50 | (0.91, 2.46) | 0.11 | 2.12 | (1.26, 3.55) | **0.01** |
| Doreni | 49 | 56.5 | 37 | 43.5 | 1.38 | (0.75, 2.52) | 0.29 | 1.70 | (0.85, 3.40) | 0.13 |
| Hurumu | 111 | 70.3 | 47 | 29.7 | 0.76 | (0.59, 0.96) | **0.03** | 0.87 | (0.62, 1.23) | 0.43 |
| Yayu | 138 | 50.1 | 138 | 49.9 | 1.79 | (1.19, 2.69) | **0.01** | 2.02 | (1.34, 3.06) | **< 0.01** |

**Table 4** (continued)

| Characteristic | Food insecure (*n* = 657) | | Food secure (*n* = 456) | | Crude odds ratio (COR) | | | Adjusted odds ratio (AOR) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Freq | (%) | Freq | (%) | COR | (95% CI) | *P* value | AOR | (95% CI) | *P* value |
| Wealth quintiles | | | | | | | | | | |
| Lowest (Poorest) | 162 | 71.0 | 62 | 29.0 | Ref | | | Ref | | |
| Second | 130 | 62.8 | 92 | 37.2 | 1.45 | (1.05, 2.00) | **0.03** | 1.52 | (1.10, 2.09) | **0.01** |
| Middle | 139 | 65.6 | 83 | 34.4 | 1.28 | (0.87, 1.89) | 0.20 | 1.55 | (1.05, 2.30) | **0.03** |
| Fourth | 115 | 55.8 | 108 | 44.2 | 1.94 | (1.47, 2.55) | **< 0.01** | 1.74 | (1.26, 2.40) | **< 0.01** |
| Highest | 111 | 56.8 | 111 | 43.2 | 1.86 | (1.37, 2.54) | **< 0.01** | 2.22 | (1.57, 3.13) | **< 0.01** |

[a] Statistically significant associations are shown in bold

such as those included in the HFIAS, are subjective and, therefore, susceptible to reporting bias (Tadesse et al. [21]). Recent research from the Amhara region of Ethiopia found that respondents tended to both overstate food availability and understate access (i.e., intensity), providing evidence that biases are non-linear and reflect competing priorities of social and economic desirability, especially in relation to participation in intervention programs (Tadesse et al. [21]). The data for this analysis represent households in program intervention and non-intervention areas, although selection for participation in the survey was not based on current or anticipated program participation. A separate analysis of the food insecurity measures by whether households were in the FUTURES program intervention or non-intervention areas found that households in the intervention areas were significantly more likely to report being food secure (47.5% vs. 34.5%) and were less likely to report anxiety and uncertainty, insufficient quality of food intake, insufficient food intake, or conditions related to food insecurity [12]. Because the intervention and non-intervention areas were located in different woredas, these findings are likely reflected by the significance of woreda in the adjusted model.

Last, the HFIAS measures the status of a household 4 weeks before data collection. The data for this study were collected from November 30 to December 12, 2021, which was the main harvesting season in study area and, therefore, the reported magnitude of food insecurity might be different from assessments conducted during other seasons. Moreover, unmeasured temporal factors, such as weather, may have affected harvesting and food production, and in turn, contributed to household food insecurity.

## Conclusions

This study presents findings from a cross-sectional survey conducted in the Yayu Coffee Forest Biosphere Reserve of Oromia, Ethiopia. The study met its objective to expand on previous research by assessing non-demographic gender-related measures and their association with household food security in this region. The findings indicated a high prevalence of food insecurity in the study area. Households in which the female respondent was engaged in decisions around major household purchases and/or how their earnings were to be spent were more likely to be food secure. Formal education of the lead female, household participation in more than one livelihood activity, asset ownership, and less exposure to recent shocks also had positive associations with household food security.

The findings suggest that enhancing the agency of women to participate in asset ownership and household economic decision making, expanding female literacy and education, and diversifying income sources to include off-farm wage employment in the Yayu Coffee Forest Biosphere Reserve are important steps for improving household food security. Further research on the role of women's economic empowerment, employment, and wage earning in relation to food security in this region may help inform development programs focused on livelihood generation and diversification.

## Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40066-023-00433-5.

**Additional file 1:** Household Food Insecurity Access Scale Score and Categorization

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**Author contributions**
All authors contributed to the study conception and design. All authors participated in material preparation. FM led the data collection. Data analysis was performed by HH. The first draft of the manuscript was written by JB-O'F, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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**Availability of data and materials**
The data sets generated and analysed during the current study will be publicly available in the Dataverse repository (https://dataverse.org/) once all analysis and publication from the data are completed. In the meantime, data sets are available from the corresponding author on reasonable request.

## Declarations

**Ethics approval and consent to participate**
The questionnaire and methodology for this study were approved by the Institutional Review Board of the University of North Carolina at Chapel Hill (IRB# 21-2143), the Jimma University College of Agriculture and Veterinary Medicine Research Ethical Review Board (Ref. No. R/GS/S22/2021), and the Faculty of Public Health Ethical Review Board (Ref. No IHRPG 1/2021). Informed consent was obtained from all individual participants included in the study.

**Consent for publication**
Not applicable.

**Competing interests**
The authors declare they have no competing interests.

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## Publisher's Note

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