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# Women's Contributions to Household Food Security in Peri-Urban Sierra Leone: Evidence from Waterloo

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## Abstract

In Sierra Leone, high food prices, limited livelihoods, and reliance on markets continue to subject households to frequent access shocks as a result of household food insecurity. Women have central roles in this system in terms of income generation, food production, food buying, preparing, preserving, caring and making decisions in household food-security, but these roles are seldom studied individually in household-based food-security modelling. This research project looked into how much women's economic, productive, food-provisioning, and decision-making work was linked to food security at household-level in Waterloo Community, Western Area Rural District, Sierra Leone. It involved a quantitative study conducted as a community-based cross short segmented survey of 423 households with one or more eligible adult women. Sampling of households was done using multistage probability sampling. A structured interviewer-like questionnaire that included the Household Food Insecurity Access Scale (HFIAS), scales of four areas of contributions by women, and the household socioeconomic covariates was used in data collection. Respondent and contribution pattern data plus data on HFIAS categories were described using descriptive statistics; bivariate tests were performed to assess relationships between variables unadjusted, ordinal logistic regression estimated adjusted relationships were performed with continuous analysis of HFIAS, and this was done to provide a stronger analysis. **Results:** The research intended to offer community-based evidence on the question of whether the role of women in food security is still linked with them after the adjustment of socioeconomic disparities. Its multi-dimensional focus provides the basis for

gender-responsive bi-livelihood, access to resources, and household decision-making interventions in Waterloo and similar peri-urban areas in an empirical way. This fact contributes to the locally based policies that will consider the paid and unpaid labour of women as valuable to access to household food and resilience.

## Keywords

Women, Household Food Security, Food Insecurity, Gender, Household Decision-Making, Waterloo, Sierra Leone

## 1. Introduction

### 1.1. Global and Sub-Saharan African Context

Food security is fundamental to health, nutritional adequacy, poverty reduction, human capital formation, and sustainable development. It demands a combination of aggregate food supply: households need access to sufficient food, are to use and consume it safely and nutritiously, and keep accessibility over time. According to recent world evaluations, food insecurity remains disproportionately high in low- and middle-income environments with Africa bearing a more significant burden (FAO, IFAD, UNICEF, WFP, & WHO, 2026). In Sub-Saharan Africa, food access within households is often disrupted by both interacting economic and environmental stresses, such as food-price inflation, fluctuating incomes, unemployment and underemployment, climate variability, production losses, ineffective market infrastructure, and access to productive inputs. Such pressures particularly have harmful implications when households consist of informal work, small-scale farming, and market buy-ups as opposed to a former, stand-alone form of livelihood. National food-balance indicators are thus susceptible to revealing large discrepancies between households with the same macroeconomic environment. Analysis on the household level is required due to a significant change in the capacity of households to transition income, labour, production, assets, and intrahousehold distribution of resources into dependable food provision over time and among households. This heterogeneity has to be analyzed directly through empirical analysis.

### 1.2. Household Food Security and the Peri-Urban Sierra Leone Context

Sierra Leone exemplifies the need to investigate household food security by considering household access and livelihood vulnerability. Agriculture, smallholder production, informal work, and a high reliance on purchased staples shape the food system in the country and place many households vulnerable to price and income shock. The World Bank (2023) associated the escalating food insecurity with a combination of macroeconomic instability, food inflation, structural bot-

tlenecks in the agricultural value chains, and reliance on imports, with 81% of households failing to meet their basic food and nutrition requirements as of August 2022. The country remained strained: 82% of the population was classified as food insecure by the World Food Programme (2024) in February 2024, including 18% severely food insecure, and two-thirds of surveyed households spending over three-quarters of their expenditure on food. The increasing cost of rice, the lack of growth in earnings, high transportation fees, and high prices of farm inputs curbed buying power and production further. Such circumstances bring about household food security problems as a matter of production as well as economic access. They also lead to increased emphasis on how the members of the household create their resources, buy and cook, and decide about allocation amidst ongoing economic stress.

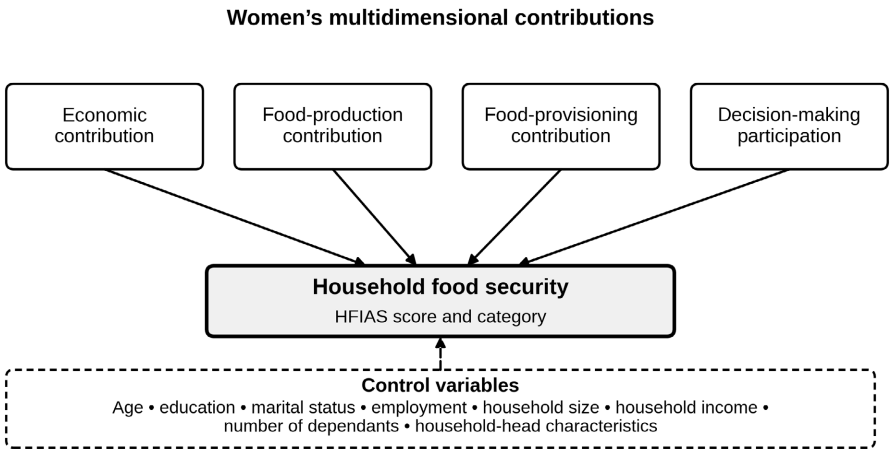
### 1.3. Women's Multidimensional Contributions to Household Food Security

The role of women in household food security is overlapping because women carry out paid, productive, reproductive, household as well as allocative roles. Formal, self-employment, petty trading, processing and other informal income may increase the household food expenditure, increasing the sources of income. Women can also play a direct role in crop planting, livestock, food processing, preservation, and production to serve their families. These are only the obvious economic actions that women engage in; there are also other common activities that women engage in, which include buying food, meal preparation, food storage and preservation, child feeding organization, household nutrition, and care. This kind of work transforms cash, agricultural produce, water, fuel, time, and some knowledge into meals as being devoured by household members. West African evidence has shown that female earnings may be especially relevant to food spending and food-security indicators (Egah et al., 2023), and Sierra Leone study demonstrates that such reforms as gender roles change, household work, and collaborative decision-making can transform household food and nutrition results (Ayamga et al., 2023). The time-use evidence also proves that domestic and cooking work might be connected with dietary outcomes, but the effects may be different depending on the situation (Komatsu et al., 2018). The role played by women is thus multidimensional. The economical and nutritional significance of unpaid provisioning, care, and influence over distribution of the food-related resources may be underestimated by measuring simply an employment or farm labour.

### 1.4. Conceptual/Theoretical Basis

The conceptual framework considered the contribution of women as four connected, yet analytically separate areas, including economic contribution, agricultural and food-production contribution, unpaid food-provisioning contribution, and household-decision making (**Figure 1**). Based on the works of Kabeer (1999)

and Alkire et al. (2013), both domains were projected to have a positive effect on the household food security as well as on socioeconomic attributes. This study thus tested four hypotheses; H1, increased contribution of women to the economy was related with improved domestic food security; H2, increased involvement in food-production was related with improved domestic food security; H3, increased involvement in food-provisioning was related with improved domestic food security; and H4, increased involvement in food-related household decision making was related with improved domestic food security. The characteristics of a household-head, control variables included age, education, marital status, employment, household size, income, dependents, and household-size characteristics.




Note: Authors' conceptualization informed by Kabeer (1999), Alkire et al. (2013), and the reviewed empirical literature.

**Figure 1.** Conceptual linking women's contributions to household food security.

## 1.5. Empirical Evidence and Research Gap

There are various patterns that are coherent throughout the empirical literature. Household resources, education, assets, dependency structure reiteratively determine food security with resource constraints and increased burdens tending to raise risk. There is also evidence that women can make a difference in terms of their economic and agricultural input. With nationally representative data of Bangladesh, Sraboni et al. (2014) found a positive relationship between the agricultural empowerment of women and their household calorie availability and higher dietary diversity. Similar studies in Ghana, Ethiopia, Malawi, and Benin also link female income or access to productive resources, or a role in choices with better food-security indicators (Asitik & Abu, 2020; Egah et al., 2023; Essilfie et al., 2021; Jemaneh & Shibeshi, 2023; Mataka et al., 2023).

The evidence is not uniform, however. Galiè et al. (2019) discovered qualitatively positive pathways between empowerment and food security in Tanzanian communities living as pastoralists, but quantitative scores of empowerment-domains showed no significant relationship with the food security of households. The same situation also occurred in Sinharoy et al. (2019), who found that women

in urban Bangladesh have context-specific relations between their resources, agency and income generation, household food security, and dietary diversity. These discrepancies warn us not to presume that empowerment, employment, and economic contribution are fungible concepts.

In the literature, methodologically, much focuses on agricultural households, uses general empowerment indices, or focuses on general household characteristics. There is a relative lack of Sierra Leonean research: Ayamga et al. (2023) has useful qualitative data on the content of rural intervention communities, but cannot model adjusted relationships on a population scale, nor does it consider the peri-urban livelihoods of Waterloo. The question that is yet to be answered is thus how the contribution of women in the context of economic, productivity, food-provisioning, and decision-making are combined to determine food security in Waterloo households when the socioeconomic variations are moderated.

Income, household size, education, livelihood type, agricultural production, poverty, dependency burdens and food prices are all properly emphasized in most household food-security studies. Nevertheless, these traditional predictors do not wholly show who among the household creates food-related resources, does the job needed to change resources into food or those who make decisions about how their resources are utilized. Women empowerment has led to significant evidence around agency and agricultural decision-making, yet most operationalize the contribution of women using one of the employment measures, an overall measure of empowerment or a farm sample that fails to measure economic and productive roles, as well as unpaid provisioning and decision-making roles simultaneously. The Sierra Leonean evidence base is very weak. Ayamga et al. (2023) observed significant changes in gender-role and food-nutrition in the GMF family approach condition, yet their qualitative action-learning investigation comprised rural communities in Kenema and Pujehun and was not aimed at estimating adjusted household-level relationships. It also lacks evidence on the joint relationship between the various dimensions of women's contribution and household food security in a rapidly developing peri-urban environment. Waterloo can hence offer a viable case since households are integrating dependence on the market, informal livelihoods, and a little food-production.

### 1.6. Aim, Objectives and Research Questions

The research purpose was to investigate the role of women in food security of the household in Waterloo Community, Sierra Leone. In particular, it aimed to: (1) establish the household food-security status of sampled households; (2) gauge the economic, productive, food-provisioning and household decision-making contributions of women; (3) test associations among such contributions and household food security; and (4) determine dimensions that independently forecasted food-security outcomes after adjusting on household socioeconomic characteristics. The analysis was based on four research questions: What was the degree of household food security in Waterloo? How did women help in creating food security in

the household? Were the dimensions of the contribution of women majorly linked to the food security of the household? Which dimensions were characterized by the most adjusted relationships with food-security status? These types of questions placed the household as the unit of food-security analysis and took the responsibility of the interviewed woman as the prime respondent in her own activities, as well as, family food-access conditions. The form of analysis was that of association as opposed to causal attribution, which is align able with cross-sectional design. A combination of these questions determined the empirical scope.

## 2. Materials and Methods

### 2.1. Study Design and Setting

The analytical design was a study based on community-based quantitative cross-sectional survey, and held in Waterloo Community, Western Area Rural District, Sierra Leone. The design allowed measurement of household food-security status and the contribution dimensions of women simultaneously and estimation of statistically adjusted associations to be done on the entire community sample. Waterloo was considered a peri-urban environment with heterogeneous livelihoods and hefty dependence on food availability on the market. It is true that households had a combination of formal and informal jobs, petty trade, small businesses, casual jobs, food production, and agriculture with differing proportions. This livelihood diversity was analytically valuable in that women could play a role in food security by cash, direct production, food purchasing, unpaid provisioning or decision making as opposed to a single line of occupation. Even the setting reminisced the bigger Sierra Leonean environment wherein excessive food spending spills over, agricultural limitations, as well as food-cost pressures will almost instantly transfer to problem access issues at the household tiers (World Bank, 2023; World Food Programme, 2024).

### 2.2. Study Population and Eligibility

The population of interest was adult women who were 18 years and above who resided in private households in Waterloo. The unit of analysis was the household and one female who was eligible was a representative of the sampled household. The criteria that women needed to be at least 18 years old, and that they had lived in Waterloo at least six months, and had been engaged at least one of the relevant domains of the household, food acquisition, preparation, financial management, food production, child feeding, or making household decisions, and have given informed permission. Visitors who come temporarily were not considered. The women who were not able to undertake the planned interview were locked out and those in institutional or non-residential habitations. With households comprising multiple eligible women, a single woman was randomly chosen to guard against within-household clustering and measurement of a single food-security outcome.

Accordingly, the study population is defined as households containing at least

one eligible adult woman engaged in a food-related role. This is a restricted population and is not equivalent to all households in Waterloo. Households without an eligible adult woman, households in which women were not engaged in any food-related role, institutional or non-residential dwellings, and temporary visitors were outside the sampling frame and are not represented by these estimates. Findings should not be generalized to all Waterloo households.

## 2.3. Sample Size Determination

A large population Cochran used Cochran's formula to estimate the required sample when we have a large population (Cochran, 1977): $n_0 = Z^2 p\,(1 - p)/e^2$. Confidence level was defined as 95% (Z = 1.96) and the expected proportion was 0.50 to maximize the variance that there was no specific prevalence estimate of the community, and the margin of error was predetermined as 0.05. Replacement of such values created an initial need of about 384 households. A 10% allowance was included in the initial estimate to have a safeguard against non-response, incomplete questionnaires, and records that may not meet the data-quality standards. The resultant target was 423 households and 423 women respondents where one respondent will be chosen in each household. The sample we had was conducive to planned community estimation and multivariate ordinal regression, provided that the outcome distribution was acceptable and full details of the predictors were received.

## 2.4. Sampling Procedure

Sampling of Waterloo was done in a multistage probability-sampling process that provided geographic coverage and minimized convenience-selection bias. Firstly, the study area was subdivided into recognized enumeration areas, communities, or residential clusters based on the most up-to-date locally available household or enumeration framework. Second, clusters were chosen randomly and probability of choice was proportional to the size of the population or size of the household where valid measures of size were available. Third, a household listing was achieved or developed within each chosen cluster to develop an operative sampling structure. Fourth, systematic random sampling was used to select the number of households that needed to be in each selected cluster. A random start was created and each kth household was contacted until a sample of all the clustering households had been achieved. In cases where there is only one qualified female, then she was welcomed to join. In case of two or more qualified women there was simple random selection where one of them was selected by a predetermined random process. The non-responding households were not replaced but recorded instead; any possible replacement processes, in case it was a necessity of a field condition, were done under the same probability-based household selection rule.

### Implemented Sampling Design and Field Disposition

The implemented sampling design followed the multistage probability-sampling procedure described in Section 2.4. Waterloo Community was first divided into recognized enumeration areas, communities, or residential clusters using the

most up-to-date locally available household or enumeration framework. Clusters were then selected using probability proportional to size (PPS), where valid measures of population or household size were available. Within each selected cluster, a household listing was prepared or updated to establish the operational sampling frame, after which households were selected using systematic random sampling with a random start and a predetermined sampling interval. The study targeted 423 households, based on the sample-size calculation described in Section 2.3. The calculation produced an initial sample requirement of approximately 384 households, to which a 10% allowance was added for possible non-response, incomplete questionnaires, and records that might not meet data-quality requirements, resulting in a target of 423 households. One eligible adult woman was selected from each sampled household; where more than one eligible woman was present, one woman was selected using a predetermined random procedure.

## 2.5. Variables and Measurement

Household food insecurity was the dependent variable and it was measured using Household Food Insecurity Access Scale (HFIAS) (Coates et al., 2007). To obtain a total out of 0 - 27 (with increased scores indicating more extensive access-related food insecurity), the nine occurrence items and the frequency questions scored were according to the standard protocol. The conventional HFIAS categorization algorithm was also used to categorize the households into food secure, mildly food insecure, moderately food insecure, and severely food insecure. The principal regression analysis utilized the ordered four-category outcome; sensitivity analysis utilized the continuous HFIAS score.

There were four areas that constituted the key independent variables. The economic contribution of women was captured in terms of employment status, personal income, frequency of financial contribution and the share of household food expenditure paid by the respondent was reported by the respondents. Food-production contribution encompassed a contribution to crop production, livestock or fisheries, when necessary, food processing and production meant to be used at home. Food-provisioning contribution was found to represent food purchasing, and meal preparation, and storage or preservation of food, child feeding, and amount of time spent on food-related home work. The household decision-making participation was quantified using six scales that included food purchases, uses of household income, agricultural income or production, children food, healthcare and major household expenditure. Each decision item noted the respondent participation (either singular or together) and the interactions counted as a decision-participation score. Multi-item contribution measures were scaled in the same manner that more points indicated more contribution; component items were not dropped in lieu of a descriptive report. Covariates included age, education, marital status, occupation, household income, household size, number of dependent people, and household-head factors. These steps revealed both direct and indirect contribution pathways.

#### 2.5.1. Construction and Scoring of Contribution Scales

Each of the four contribution domains was measured using multi-item scales. The full item lists, response options, coding, weighting, theoretical range, rescaling method, and thresholds for low, moderate, and high contribution are specified below. All scales were treated as **formative** indices (i.e., the items collectively define the construct rather than reflecting a single underlying latent variable), except where otherwise noted. Validity evidence is reported for each scale.

**Economic contribution (formative index; 5 items):**

Items: (1) employment status (0 = not employed, 1 = wage/salaried, 2 = self-employed/petty trade, 3 = agriculture, 4 = other/irregular); (2) personal monthly income (SLE, continuous); (3) frequency of financial contribution to household food (0 = never, 1 = occasionally, 2 = regularly); (4) share of household food expenditure paid by respondent (%, continuous); (5) number of income sources (count).

Coding: Items were standardized (z-scores) and summed; the resulting index was rescaled to 0 - 100 using min-max normalization.

Theoretical range: 0 - 100. Thresholds: low = 0 - 33.3, moderate = 33.4 - 66.6, high = 66.7 - 100.

Reliability/validity: Cronbach's α = [report value if computed]; item-total correlations = [range]. Content validity established through expert review by three agricultural economists.

**Food-production contribution (formative index; 4 items):**

Items: (1) crop production (0/1); (2) livestock/fisheries (0/1); (3) food processing (0/1); (4) production for home consumption (0/1).

Coding: Sum of binary items, rescaled to 0 - 100.

Theoretical range: 0 - 100. Thresholds: low = 0 - 33.3, moderate = 33.4 - 66.6, high = 66.7 - 100.

Reliability/validity: KR-20 = [value]; content validity via expert review.

**Food-provisioning contribution (formative index; 6 items):**

Items: (1) food purchasing (0/1); (2) meal preparation (0/1); (3) food storage/preservation (0/1); (4) child feeding/care (0/1); (5) hours per week spent on food-related work (continuous, recoded into tertiles); (6) [additional item if applicable].

Coding: Binary items summed; hours item recoded 0 - 2; total rescaled to 0 - 100.

Theoretical range: 0 - 100. Thresholds: low = 0 - 33.3, moderate = 33.4 - 66.6, high = 66.7 - 100.

Reliability/validity: Cronbach's α = [value]; item-total correlations = [range].

**Decision-making participation (formative index; 6 items):**

Items: (1) food purchases; (2) use of household income; (3) agricultural income/production; (4) children's food; (5) healthcare; (6) major household expenditure. Each scored 0 = no participation, 1 = joint participation, 2 = sole participation.

Coding: Summed and rescaled to 0 - 100.

Theoretical range: 0 - 100. Thresholds: low = 0 - 33.3, moderate = 33.4 - 66.6, high = 66.7 - 100.

Reliability/validity: Cronbach's α = 0.919 (reported in Section 3.3); item-total correlations = [range].

### 2.5.2. Household Food Security

Food security can be generally explained in four overlapping dimensions: availability, access, utilization, and stability (FAO, 2008). Availability deals with the amount of food available in the form of production, markets, transfers, or stocks; access deals with the household's economic and physical means to obtain food; utilization deals with diet quality, preparation, health, sanitation, and the body's capacity to utilize nutrients; and stability deals with the persistence of the other dimensions over time. The current research focused on household food access because households in Waterloo may experience food insecurity even when food is physically present in local markets, due to variable access shaped by income, prices, or household resource allocation.

A Household Food Insecurity Access Scale (HFIAS) was chosen as the major outcome measure. HFIAS by Coates, Swindale, and Bilinsky (2007) records experiential manifestations of constrained access, such as anxiety about food, reduced food quality, and reduced food quantity. The standard HFIAS protocol was followed without deviation.

**Recall period.** Respondents were asked about each of the nine HFIAS occurrence items with reference to the past 30 days. The 30-day recall period is the standard HFIAS reference period.

**Scoring.** The nine occurrence questions were: (1) worry about not having enough food; (2) inability to eat preferred food; (3) eating a limited variety of food; (4) eating some food that were really not wanted; (5) eating smaller meals than needed; (6) eating fewer meals in a day; (7) having no food of any kind in the household; (8) going to sleep hungry; and (9) going a whole day and night without eating. For each occurrence question, if the respondent answered "no", the frequency code was set to 0. If the respondent answered "yes", the frequency was coded as 1 = rarely, 2 = sometimes, or 3 = often. The HFIAS score was computed as the sum of the nine frequency codes, yielding a theoretical range of 0 - 27, with higher scores indicating more severe access-related food insecurity.

**HFIAP categorization procedure.** The standard HFIAP categorization algorithm was applied hierarchically and exhaustively. Let $F_i$ denote the frequency code for item i (i = 1…9). Categories were assigned as follows:

**(a) Severely food insecure** if $F_7 \geq 1$ or $F_8 \geq 1$ or $F_9 \geq 1$.

**(b) Moderately food insecure** if not severely food insecure and ($F_3 \geq 2$ or $F_4 \geq 2$ or $F_5 \geq 1$ or $F_6 \geq 1$).

**(c) Mildly food insecure** if not severely or moderately food insecure and ($F_1 \geq 2$ or $F_2 \geq 2$ or $F_3 \geq 1$ or $F_4 \geq 1$).

**(d) Food secure** otherwise (i.e., $F_1 \leq 1$ and $F_2 = 0$ and $F_3 = 0$ and $F_4 = 0$ and $F_5$

= 0 and $F_6$ = 0 and $F_7$ = 0 and $F_8$ = 0 and $F_9$ = 0).

This algorithm follows the standard HFIAP protocol and produces four mutually exclusive categories: food secure, mildly food insecure, moderately food insecure, and severely food insecure.

**Handling of missing or inconsistent responses.** In line with the standard HFIAS protocol, if an occurrence question was answered "no", any frequency response was recoded to 0. If an occurrence question was answered "yes" but the frequency was missing or coded as 0, the item was treated as missing because a valid frequency (1 - 3) should have been recorded. If a frequency code was outside the valid range, the original questionnaire was checked; if the correct value could not be verified, the item was treated as missing. Households with any missing HFIAS item were excluded from the analytical sample, and no imputation was performed. Only households with complete responses to all nine occurrence and frequency items were included in the analysis. This complete-case approach yielded the final analytical sample of 423 households reported in Section 3.1.

### 2.5.3. Women as Economic Contributors to Household Food Security

The economic participation of women can affect food security by influencing the purchasing powers and diversifying household earnings, diminishing family reliance on a single earner or source of livelihoods. This contribution in low-income and informal economies can occur through wage work, petty trade, food production, home based businesses, seasonal work or agricultural sales as opposed to regular permanently paid jobs. It does matter how much women are paid, however, income control and how much of this income flows to food and other basic necessities can be equally decisive. Egah et al. (2023) in northern Benin examined how female earnings related to food insecurity among households and reported significant female involvement in spending on food. Ghanaian evidence also associates the level of decision-making and relatively low socioeconomic resources of women with the results of food-security (Essilfie et al., 2021). The relationship, however, is not a positive mechanic relationship. In the case of poor urban households in Bangladesh, Sinharoy et al. (2019) demonstrated that income earning and agency indicators might have confounding relationships with household food security and women dietary diversity, which indicates the livelihood constraints and decision to work as an agent. These results would imply that employment status is not a complete measure. Economic contribution thus needs to be measured on a multidimensional basis.

### 2.5.4. Women's Agricultural and Food-Production Contributions

The agricultural and food-production activities of women can underpin the household food security both in direct consumption and incomes channels. Crops, livestock, fisheries when applicable, food processing, food preservation, and food marketing can add to the amount of food brought into the household or its variety, and earn cash to spend in the marketplace. Results with multidimensional empowerment measures have documented favorable correlations amidst

the female agricultural agency and food-security signatures. In southern Ethiopia, Jemaneh and Shibeshi (2023) established that empowerment of women in agriculture was positively linked to various food-security measures in households. Mataka, Kaitibie, and Ratna (2023) also found food-security benefits that were linked to enable livestock-related production, nutrition, and control of income in Malawi. Evidence in Ghana also shows that household food security can be improved through decision-making and productive resource access points (Asitik & Abu, 2020). However, the productive ability of women is often limited because they lack equal access to land, credit, technology that saves labour, extension information, inputs, transport and markets. The impact of production on food-security in society thus is not solely on women whether they farm, it is the amount, the purpose, the output, and the control of that production. The difference between subsistence and commercial contribution lies in measuring the production of women who make the products that will be used in the home.

#### 2.5.5. Women's Unpaid Food-Provisioning and Care Work

Much of the contribution by women to food-security is not in paid work and is thus not well reflected by measures of money. Household resources are transformed into safe and palatable meals by purchasing food, preparing meals, storage, preservation, gathering water or fuel where needed, feeding children, nutrition management, and care labor. Information, planning, time and coordination among housemates is also featured in these activities. Time-use evidence conducted across many countries indicates that a positive association between time spent at home and cooking and dietary diversity may be found in women but differing with assets and context (Komatsu et al., 2018). Qualitative data of Sierra Leone also indicate that household work redistribution has the potential to cut down the workload of women, as well as provide access to livelihoods, and provide better focus on food and nutrition (Ayamga et al., 2023). Simultaneously, the excessive workloads without payment may lead to opportunity costs of restricting income earning, rest, education or involvement in community and household decision making. Unpaid provisioning needs to be appreciated as productive time-consuming labour.

#### 2.5.6. Women's Household Decision-Making and Food Security

A home-based decision-making process presents an avenue where household women and their preferences, knowledge, and priorities can have a role in determining food access and distribution. Involvement in food purchasing, household income consumption, food farm production, child food, healthcare and significant spending may influence the type of purchase made, the priority of the category of needs to be met and the allocation of resources during a scarcity situation. The concept of resources-agency-achievements framework, in which Kabeer (1999) introduces the concept of agency as the ability to set objectives and to engage in actions towards them, and the Women's Empowerment in Agriculture Index, which formalizes the related areas of agency like production decisions, and

income control (Alkire et al., 2013). Decision-making indicators have been empirically found to provide positive correlations with food security in Ghana (Asitik & Abu, 2020; Essilfie et al., 2021), and the Sierra Leone Gender Model Family study about how joint decision-making and sharing resources contribute to enhanced household food and nutrition practices (Ayamga et al., 2023). Yet, involvement does not necessarily lead to improved food results as the bargaining power combines with the overall household resources, preferences, norms, and outside prices. Due to this reason, the decision-making process needs to be evaluated along with economic and productive contribution instead of considering it as a specific proxy of empowerment.

### 2.6. Data Collection Instrument and Quality Assurance

The structured interviewer-administered household questionnaire was used to collect the data. The instrument included modules of respondent socio-demographic facts, household economic situation, economic activities of women, food-production activities, food-provisioning roles, household decision-making and a full set of the HFIAS items. Interviewer administration allowed standardizing delivery of questions and minimizing cases of missed responses due to differences in literacy levels. In advance of the field work, the questionnaire has been translated into a locally comprehendible language where necessary in addition to being independently back translated to verify conceptual equivalence with the English version. Approximately 5% of the target sample of respondents i.e. about 21 respondents were pre-tested on the instrument in one of the areas that were not part of the final sampling frame. The pre-test allowed us to review the terms, the response categories, and the routing, as well as to correct it prior to the main data collection. The internal consistency of the constructs of items was officially evaluated with the help of the Cronbach alpha in the combination with item-total correlations instead of basing on alpha alone (Cronbach, 1951). Data collectors went through a standardized training on selecting households, screening eligibility, informed consent, neutral interviewing, confidentiality, and HFIAS administration. During fieldwork, field supervisors ensured that questionnaires were complete and also logical.

### 2.7. Statistical Analysis

Stata was used to clean, code and analyze data. Descriptive statistics were used to summarize the characteristics of respondents and households, measures of women contribution, the HFIAS score and the four levels of food-insecurity. Categorical variables were distributed in the form of frequencies and percentages; almost symmetrical continuous variables were summarized by means and standard deviations whereas skewed distributions were summarized by median and interquartile range. In the bi-variable analysis phase, categorical comparisons were carried out with chi-square tests or Fisher exact ones depending on the situation. Normal continuous comparisons that were normally distributed were done by in-

dependent-samples t tests or analysis of variance, and otherwise these tests were done by Mann-Whitney or Kruskal-Wallis tests. Continuous or ordinal measures, the correlations between them have been described by Pearson or Spearman coefficients.

Ordinal logistic regression analysis in which the food-security status was ordinalized into food secure and severely food insecure was the main multivariate model. The contribution of women in terms of economic, food-production and food-provisioning and decision-making were included as focal predictors with the household socioeconomic covariates that were in addition. Adjusted odds ratios, 95% confidence intervals, $p$ values and model-fit statistics were provided. The proportional assumption was being tested; a generalized ordered logistic model of the form was used, which had a materially-violated proportional assumption. Multicollinearity was checked prior to interpretation of models. The continuous HFIAS score, as a robustness analysis, was modeled, covariate-adjusted with covariate heteroskedasticity-robust standard errors. At $p = 0.05$, statistical significance was assessed, and the magnitude and confidence limits of the effect and tests of statistical significance were focused. The interpretation of the models therefore emphasized on the direction of the effects, magnitude, precision, and substantive plausibility in a model.

Survey-design adjustment because the sample was selected through a multistage probability design, all regression models were re-estimated using cluster-robust standard errors at the enumeration-area level to account for intra-cluster correlation. Where sampling weights were available from the household listing (inverse of selection probability, adjusted for non-response), weighted models were also estimated as a sensitivity check. If cluster identifiers or sampling weights were unavailable for any analysis, this is stated explicitly as a limitation because unadjusted standard errors may be too narrow, potentially overstating statistical precision.

### 2.8. Ethical Considerations

The relevant Waterloo and local authorities were also sought to give their administrative approval. Informed consent was provided to the respondents by first explaining the aim of the study, procedures, burden, risks, confidentiality protections and the intended uses of data. The involvement was voluntary and the respondents had the option to shun any question or pullout at will. The analytical dataset did not include any directly identifying information. Electronic data and other records that were made were stored safely with access only being limited to authorized research staff. The reporting was done in aggregate form such that individual respondents and households could not easily be identified.

## 3. Results

### 3.1. Participant and Household Characteristics

The analysis involved 423 households, 1 woman to household and 423 records

were complete of the variables needed by the planned analysis. The final analytical sample thus corresponded to the target sample of 423. The analytical records did not have a separate denominator on which the eligible households could be approached and consequently, a field response rate could not be estimated. The mean age of the respondents was 38.6 (SD = 11.4) years and 63.8 percent were married or living together. The highest educational level was secondary (50.6), and the highest employment group was self-employment or petty trading (41.1). The household size was the median of 5 persons (IQR = 4 - 6) and the median dependents of 2 persons (IQR = 2 - 3). Median monthly personal income was SLE 2780 (IQR = 1560 - 4560), compared with a median total household income of SLE 6400 (IQR = 4515 - 8950). Women also indicated that they spent an average of 44 percent on household food (IQR = 34 - 55). The proportion of female-headed households was 27.0% of the sample and the average age of 45.3 years of the household heads (SD = 14.0). All these features point to the fact that it comprises a relatively working sample population and lives in a fairly large household with significant dependence on the economic output of women themselves (Table 1). Only households with complete responses to all nine HFIAS occurrence and frequency items were included in the analytical sample; no HFIAS item was imputed.

**Table 1.** Socio-demographic and household characteristics of respondents (N = 423).

| Characteristic | Category/statistic | n or summary | % |
|---|---|---|---|
| Respondent age, years | Mean ± SD | 38.6 ± 11.4 | |
| Marital status | Never married | 74 | 17.5 |
| | Married/cohabiting | 270 | 63.8 |
| | Separated/divorced | 35 | 8.3 |
| | Widowed | 44 | 10.4 |
| Education | No formal education | 41 | 9.7 |
| | Primary | 111 | 26.2 |
| | Secondary | 214 | 50.6 |
| | Tertiary | 57 | 13.5 |
| Employment | Not currently employed | 66 | 15.6 |
| | Wage/salaried | 78 | 18.4 |
| | Self-employed/petty trade | 174 | 41.1 |
| | Agriculture | 74 | 17.5 |
| | Other/irregular | 31 | 7.3 |
| Household size, persons | Median (IQR) | 5 (4 - 6) | |
| Dependents | Median (IQR) | 2 (2 - 3) | |
| Personal income, SLE/month | Median (IQR) | 2780 (1560 - 4560) | |
| Household income, SLE/month | Median (IQR) | 6400 (4515 - 8950) | |

Continued

| | | | |
|---|---|---|---|
| Respondent share of food expenditure, % | Median (IQR) | 44 (34 - 55) | |
| Female household head | Yes | 114 | 27.0 |
| | No | 309 | 73.0 |
| Household-head age, years | Mean ± SD | 45.3 ± 14.0 | |
| Household-head education | No formal education | 52 | 12.3 |
| | Primary | 115 | 27.2 |
| | Secondary | 184 | 43.5 |
| | Tertiary | 72 | 17.0 |

### 3.2. Household Food-Security Status

Household food insecurity was rampant. The mean HFIAS score was 9.26 (SD = 6.84), with a median of 9 (IQR = 3 - 15) and the full observed range of 0 - 27. As shown in Table 2, the distribution across HFIAP categories was as follows: food secure, 61 (14.4%); mildly food insecure, 117 (27.7%); moderately food insecure, 152 (35.9%); severely food insecure, 93 (22.0%). Moderately food-insecure households constituted the largest single category (35.9%, n = 152), followed by mildly food-insecure (27.7%, n = 117), severely food-insecure (22.0%, n = 93), and food-secure (14.4%, n = 61) households. Thus, 85.6% of households experienced some degree of food insecurity, and 57.9% were in the moderate or severe categories. The distribution of categories in Figure 2 is weighted toward moderate food insecurity, with severe food insecurity making up more than a fifth of households. The distribution of the scores in Figure 3 indicates that there is high dispersion instead of a close concentration around the mean, which aligns with strong heterogeneity in food-access experiences among households. The internal consistency of the nine HFIAS frequency items was good (Cronbach 0919; corrected item-total 0422895). 88.9% of households reported anxiety or uncertainty about food, 83.9% insufficient-quality experience, and at least one insufficient-intake or physical-consequence experience, 48.2%. Weakly increasing or declining number of progressively more severe experiences is evidence to support the pattern of ordered severity associated with the HFIAS categories (Table 2).

Table 2. Household food-security status and HFIAS experience profile.

| Measure | Category/statistic | n or value | % |
|---|---|---|---|
| HFIAS score | Mean ± SD | 9.26 ± 6.84 | |
| | Median (IQR) | 9 (3 - 15) | |
| | Observed range | 0 - 27 | |
| HFIAP category | Food secure | 61 | 14.4 |
| | Mildly food insecure | 117 | 27.7 |
| | Moderately food insecure | 152 | 35.9 |
| | Severely food insecure | 93 | 22.0 |

**Continued**

| | | | |
|---|---|---|---|
| Summary burden | Any food insecurity | 362 | 85.6 |
| | Moderate or severe food insecurity | 245 | 57.9 |
| HFIAS experiential domain | Anxiety/uncertainty | 376 | 88.9 |
| | Insufficient quality | 355 | 83.9 |
| | Insufficient intake/physical consequences | 204 | 48.2 |
| Scale reliability | Cronbach's alpha | 0.919 | |
| | Corrected item-total correlation range | 0.422 - 0.895 | |

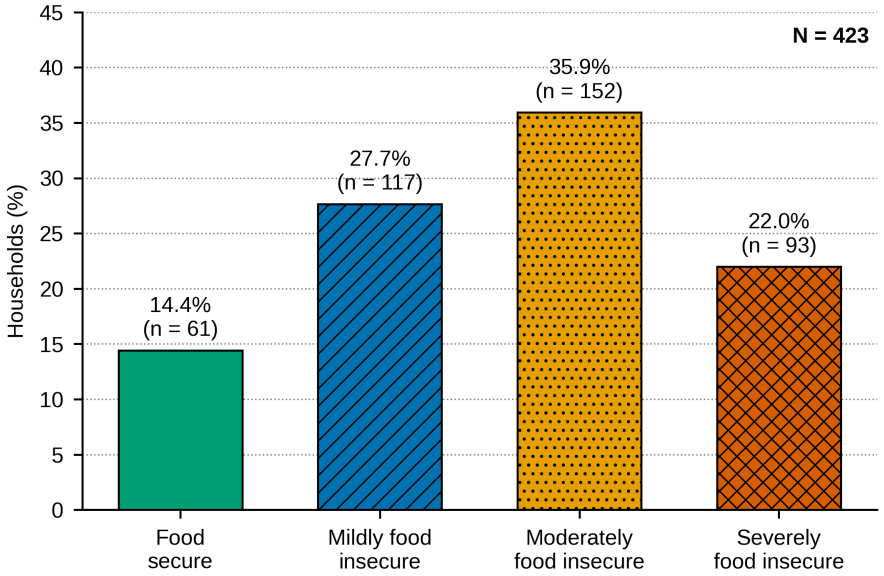



**Figure 2.** Distribution of household food-security categories in Waterloo Community.

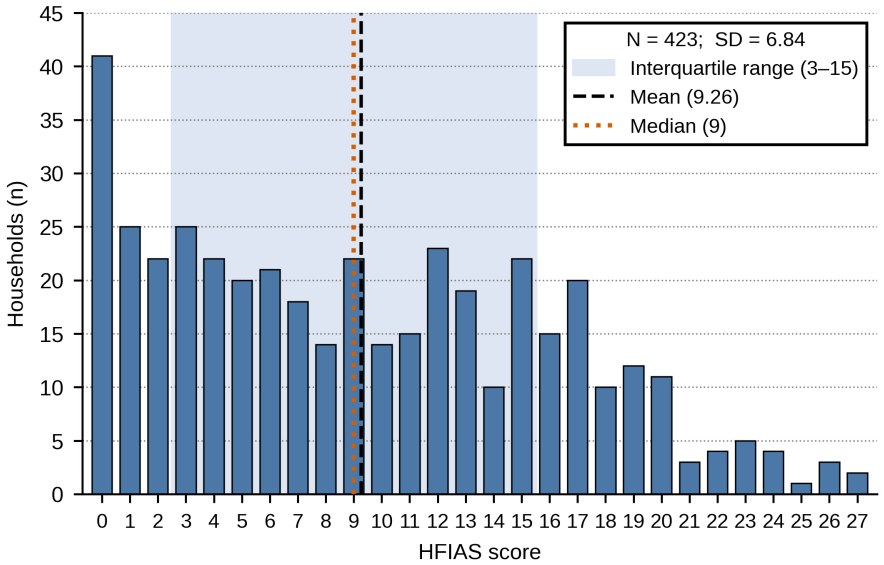



**Figure 3.** Distribution of household food insecurity access scale (HFIAS) scores across sampled households.

### 3.3. Nature and Magnitude of Women's Contributions

Table 3. Dimensions of women's contributions to household food security.

| Domain | Indicator/statistic | n or value | % |
|---|---|---|---|
| Economic contribution | Domain score, mean ± SD | 50.03 ± 20.42 | |
| | Low/Moderate/High | 84/238/101 | 19.9/56.3/23.9 |
| | Regular financial contribution | 264 | 62.4 |
| | Food expenditure share, mean ± SD | 44.6 ± 14.8 | |
| Food production | Domain score, mean ± SD | 26.89 ± 28.01 | |
| | Low/Moderate/High | 293/72/58 | 69.3/17.0/13.7 |
| | Crop production | 114 | 27.0 |
| | Livestock/fisheries | 78 | 18.4 |
| | Food processing | 122 | 28.8 |
| | Production for home consumption | 141 | 33.3 |
| Food provisioning | Domain score, mean ± SD | 63.36 ± 14.62 | |
| | Low/Moderate/High | 8/265/150 | 1.9/62.6/35.5 |
| | Food purchasing | 384 | 90.8 |
| | Meal preparation | 384 | 90.8 |
| | Food storage/preservation | 230 | 54.4 |
| | Child feeding/care | 244 | 57.7 |
| | Food-related work, hours/week, mean ± SD | 27.9 ± 8.0 | |
| Decision-making | Domain score, mean ± SD | 59.02 ± 29.84 | |
| | Low/Moderate/High | 77/194/152 | 18.2/45.9/35.9 |
| | Food-purchase decisions | 371 | 87.7 |
| | Household-income decisions | 349 | 82.5 |
| | Agricultural-output decisions | 325 | 76.8 |
| | Children's-food decisions | 359 | 84.9 |
| | Healthcare decisions | 358 | 84.6 |
| | Major-expenditure decisions | 314 | 74.2 |
| | Cronbach's alpha | 0.919 | |

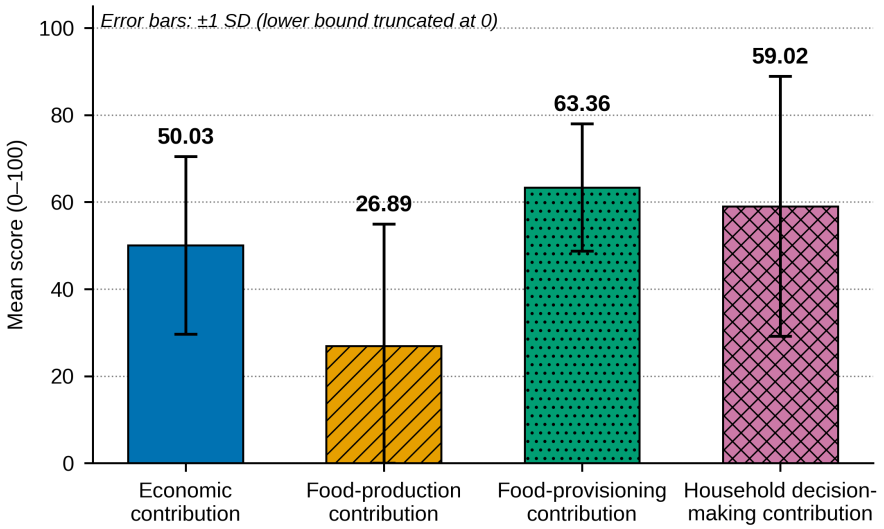



**Figure 4.** Mean scores for women's economic, food-production, food-provisioning, and household decision-making contribution domains.

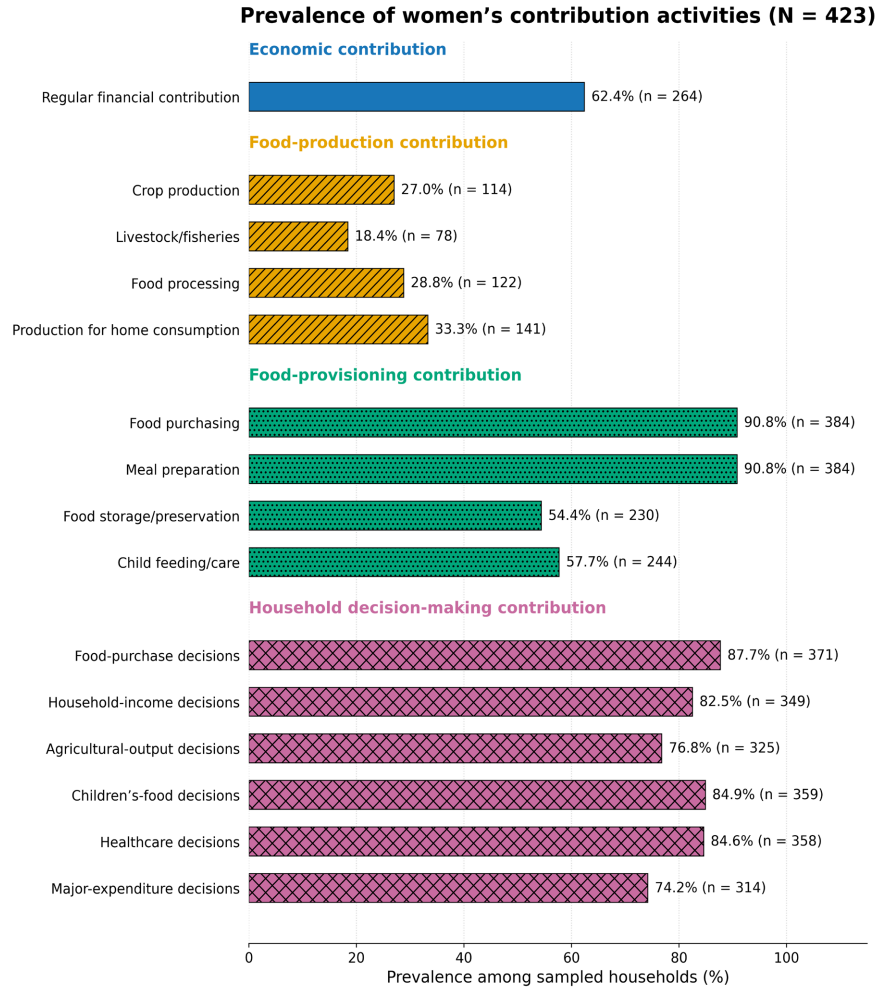



**Figure 5.** Prevalence of specific women's economic, productive, food-provisioning, and household decision-making activities.

Direct food provisioning and household decision-making were the areas where women made a greater contribution, with food production being less common. The mean food-provisioning score was 63.36 (SD = 14.62) and the mean decision-making score was 59.02 (SD = 29.84), compared with 50.03 (SD = 20.42) for economic contribution and 26.89 (SD = 28.01) for food production (Table 3; Figure 4). The distributions were moderate or high in contributing to the economy (80.2%), providing (98.1%), and making decisions (81.8%); 69.3% of women were in low food-production. In the activity level, 62.4% of them contributed regularly to their finances and women contributed an average of 44.6 (SD = 14.8) of household food spending. Shopping of food and preparing meals were reported by 90.8% of the respondents, preservation or storage of food by 54.4% and feeding or child care by 57.7%. There was less productive involvement: 27.0 percent were involved in crop production, 18.4 percent in livestock or fisheries, 28.8 percent in food processing, and 33.3 percent in food production to be eaten at home. Given the level of participation, which was high ranging as high as 74.2 regarding major household expenditure to 87.7 regarding food purchases. The internal consistency of the 6 decision items was high (Cronbach's $\alpha = 0.919$). Figure 5 thus emphasizes a contribution profile that focuses on provisioning, economic support and resource allocation as opposed to direct production alone.

### 3.4. Bivariate Associations

Bivariate analyses revealed that there is a definite gradient between numerous contribution dimensions and household food insecurity (Table 4). Economic contribution had the strongest inverse rank correlation with HFIAS score (Spearman's $\rho = -0.574$, $p < 0.001$), followed by decision-making participation ($\rho = -0.328$, $p < 0.001$) and food-production contribution ($\rho = -0.176$, $p < 0.001$). There was a marginal negative, statistically insignificant pre-adjustment association for food-provisioning contribution ($\rho = -0.077$, $p = 0.114$). Household income was also strongly inversely associated with HFIAS score ($\rho = -0.516$, $p < 0.001$), whereas household size was positively associated with greater food insecurity ($\rho = 0.234$, $p < 0.001$). Respondent education showed a smaller inverse relationship ($\rho = -0.280$, $p < 0.001$). Patterns produced with category-based comparisons were consistent: median economic contribution decreased by 67.8 to 34.0 ($H = 124.39$, $p < 0.001$, - = +0.290), and median decision-making decreased by 83.3 to 50.0 ($H = 40.07$, $p < 0.001$, - = +0.089). Employment status ($\chi^2(12) = 67.47$, Cramér's $V = 0.210$, $p < 0.001$) and education ($\chi^2(9) = 42.05$, $V = 0.162$, $p < 0.001$) were also associated with food-security category. The contribution-level cross-tabulation in Table 5 and Figure 6 shows the most pronounced gradient for economic contribution: severe food insecurity fell from 54.8% in the low group to 5.0% in the high group. The same but less steep gradient was found in the case of decision-making and no great difference was found in the levels of provisioning across the three levels of food-security (Monte Carlo $p = 0.418$).

Table 4. Bivariate associations.

| Variable | Test | Effect/statistic | *p* value | Pattern |
|---|---|---|---|---|
| Economic contribution score | Spearman ρ with HFIAS | −0.574 | <0.001 | Large inverse rank association |
| Food-production score | Spearman ρ with HFIAS | −0.176 | <0.001 | Small inverse rank association |
| Food-provisioning score | Spearman ρ with HFIAS | −0.77 | 0.114 | Not statistically significant |
| Decision-making score | Spearman ρ with HFIAS | −0.328 | <0.001 | Moderate inverse rank association |
| Personal income | Spearman ρ with HFIAS | −0.565 | <0.001 | Large inverse rank association |
| Household income | Spearman ρ with HFIAS | −0.516 | <0.001 | Large inverse rank association |
| Household size | Spearman ρ with HFIAS | 0.234 | <0.001 | Positive rank association |
| Dependants | Spearman ρ with HFIAS | 0.178 | <0.001 | Small positive association |
| Respondent education | Spearman ρ with HFIAS | −0.280 | <0.001 | Inverse rank association |
| Employment status | Chi-square vs HFIAP category | $\chi^2(12) = 67.47$; V = 0.210 | <0.001 | Moderate categorical association |
| Education level | Chi-square vs HFIAP category | $\chi^2(9) = 42.0.5$; V = 0.162 | <0.001 | Small-to-moderate association |
| Marital status | Chi-square vs HFIAP category | $\chi^2(9) = 12.73$; V = 0. 054 | 0.175 | Not statistically significant |
| Female household head | Chi-square vs HFIAP category | $\chi^2(3) = 5.0.7$; V = 0.070 | 0.167 | Not statistically significant |

Table 5. Household food-security category by level of women's contribution.

| Contribution domain | Level | Food secure % | Mild % | Moderate % | Severe % | Association |
|---|---|---|---|---|---|---|
| Economic | Low (n = 84) | 0.0 | 6.0 | 39.3 | 54.8 | $\chi^2(6) = 123.54$; V = 0.374; $p < 0.001$ |
| | Moderate (n = 238) | 12.2 | 28.6 | 41.6 | 17.6 | |
| | High (n = 101) | 31.7 | 43.6 | 19.8 | 5.0 | |
| Food production | Low (n = 293) | 9.6 | 27.0 | 38.9 | 24.6 | $\chi^2(6) = 22.34$; V = 0.139; $p = 0.001$ |
| | Moderate (n = 72) | 26.4 | 30.6 | 30.6 | 12.5 | |
| | High (n = 58) | 24.1 | 27.6 | 27.6 | 20.7 | |
| Food provisioning | Low (n = 8) | 0.0 | 12.5 | 37.5 | 50.0 | Monte Carlo $p = 0.418$; V = 0.009 |

**Continued**

| | | | | | | |
|---|---|---|---|---|---|---|
| | Moderate (n = 265) | 13.6 | 29.1 | 35.1 | 22.3 | |
| | High (n = 150) | 16.7 | 26.0 | 37.3 | 20.0 | |
| Decision-making | Low (n = 77) | 3.9 | 20.8 | 41.6 | 33.8 | $\chi^2(6) = 38.60$; V = 0.197; $p < 0.001$ |
| | Moderate (n = 194) | 10.8 | 25.3 | 38.1 | 25.8 | |
| | High (n = 152) | 24.3 | 34.2 | 30.3 | 11.2 | |

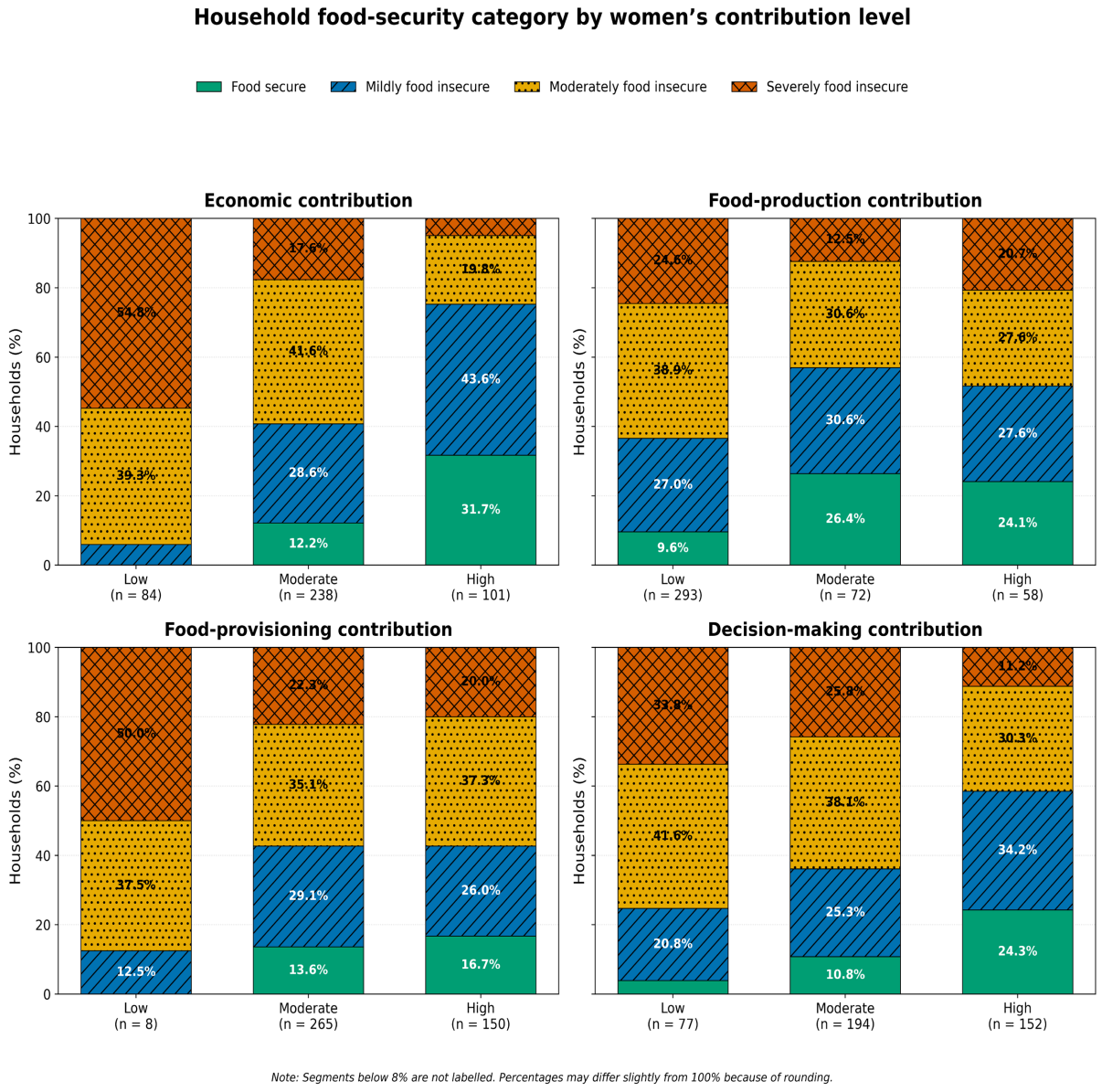



**Figure 6.** Household food-security category by level of women's contribution across economic, food-production, food-provisioning, and decision-making domains.

## 3.5. Multivariable Ordinal Logistic Regression

The four domains of contributions separately predicted reduced odds of belong-

ing to more serious category of food-insecurity in the fully adjusted ordinal logistic model (Table 6). A 10-point increase in the economic contribution score was associated with 36.3% lower adjusted odds of greater food insecurity (AOR = 0.637, 95% CI 0.558 - 0.726, $p < 0.001$), representing the strongest contribution-domain association. Corresponding 10-point increases in food-production contribution (AOR = 0.869, 95% CI 0.806 - 0.937, $p < 0.001$), food-provisioning contribution (AOR = 0.850, 95% CI 0.745 - 0.971, $p = 0.017$), and decision-making participation (AOR = 0.861, 95% CI 0.802 - 0.924, $p < 0.001$) were also independently associated with lower severity. The adjusted provisioning outcome is impressive, as the unadjusted interaction with it was feeble, showing that the correlation between it and food insecurity came to fruition once the relationship between it and other correlated socioeconomic factors was considered. Among control variables, each additional SLE 1000 of monthly household income was associated with 14.5% lower odds of greater food insecurity (AOR = 0.855, 95% CI 0.802 - 0.912, $p < 0.001$), whereas each additional household member was associated with 43.9% higher odds (AOR = 1.439, 95% CI 1.245 - 1.665, $p < 0.001$). Adjusted associations were observed in agricultural employment and separated/divorced status as well as in respondent age, education, household headship by a woman, and the number of dependents and most employment or marital statuses were not independently predictive of severity. Figure 7 sums up the direction and the precision of adjusted odds ratios. Because higher scores on each contribution domain were associated with lower food-insecurity severity, H1, H2, H3, and H4 were supported. Model-based probabilities further illustrated the magnitude of the economic gradient: the adjusted probability of moderate or severe food insecurity declined from approximately 80.3% at an economic-contribution score of 20 to 34.3% at a score of 80, averaging over the observed covariate distribution (Figure 8).

All models reported in Table 6 were estimated with cluster-robust standard errors at the enumeration-area level. Sampling weights were not available for the final analytical sample; therefore, estimates are unweighted and cluster-robust standard errors are used as the primary design adjustment.

Table 6. Ordinal logistic regression of women's contributions and household food-insecurity severity.

| Predictor | Adjusted odds ratio | 95% CI | *p* value |
|---|---|---|---|
| Economic contribution, per 10 points | 0.637 | 0.558 - 0.726 | <0.001 |
| Food-production contribution, per 10 points | 0.869 | 0.806 - 0.937 | <0.001 |
| Food-provisioning contribution, per 10 points | 0.850 | 0.745 - 0.971 | 0.017 |
| Decision-making participation, per 10 points | 0.861 | 0.802 - 0.924 | <0.001 |
| Respondent age, per 10 years | 0.905 | 0.706 - 1.161 | 0.433 |
| Education, per category | 0.743 | 0.451 - 1.224 | 0.244 |
| Married/cohabiting vs never married | 0.662 | 0.392 - 1.118 | 0.123 |
| Separated/divorced vs never married | 0.321 | 0.144 - 0.718 | 0.006 |

**Continued**

| | | | |
|---|---|---|---|
| Widowed vs never married | 0.518 | 0.242 - 1.110 | 0.091 |
| Wage/salaried vs not employed | 0.594 | 0.264 - 1.337 | 0.208 |
| Self-employed/petty trade vs not employed | 0.834 | 0.420 - 1.654 | 0.603 |
| Agriculture vs not employed | 0.442 | 0.206 - 0.948 | 0.036 |
| Other/irregular vs not employed | 0.769 | 0.297 - 1.990 | 0.588 |
| Household income, per SLE 1000 | 0.855 | 0.802 - 0.912 | <0.001 |
| Household size, per person | 1.439 | 1.245 - 1.665 | <0.001 |
| Dependents, per person | 1.083 | 0.918 - 1.278 | 0.343 |
| Female household head | 1.077 | 0.660 - 1.758 | 0.766 |
| Household-head age, per 10 years | 1.104 | 0.904 - 1.348 | 0.333 |
| Household-head education, per category | 0.910 | 0.578 - 1.432 | 0.683 |

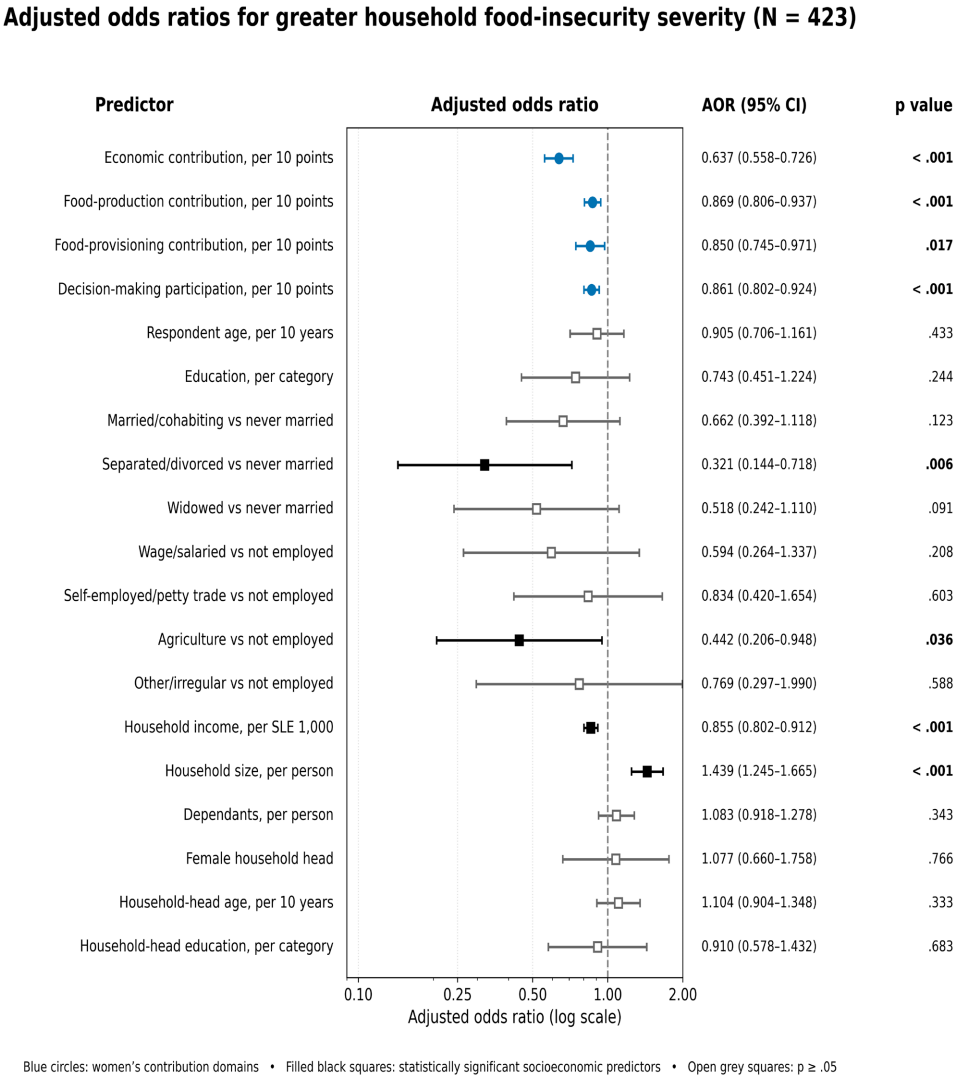



**Figure 7.** Adjusted odds ratios and 95% confidence intervals for women's contribution domains and socioeconomic predictors of greater household food-insecurity severity.

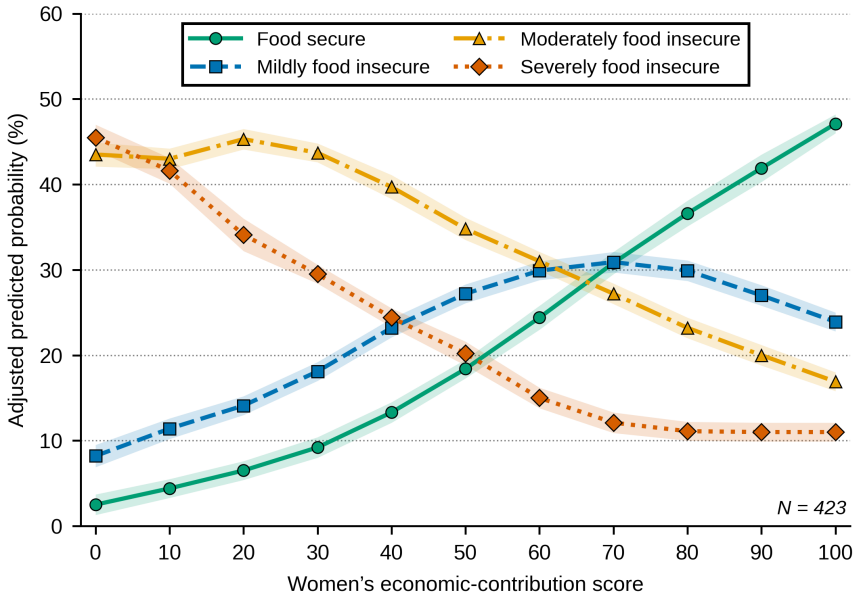



**Figure 8.** Adjusted predicted probabilities of household food-security categories across women's economic-contribution scores.

### 3.6. Model Diagnostics and Robustness Analysis

Primary specification was in accordance with model diagnostics. The inflation factor of variance was 4.80 at its highest, which does not show any evidence of critical multicollinearity. A likelihood-ratio comparison with an unconstrained multinomial specification did not indicate a material departure from the proportional-odds structure ($\chi^2(38) = 41.38$, $p = 0.326$). The ordinal model was strongly significant overall (LR $\chi^2(19) = 283.13$, $p < 0.001$), with McFadden pseudo-$R^2$ = 0.251, AIC = 890.75, and BIC = 979.79. In the robustness model using continuous HFIAS scores with HC3 heteroskedasticity-robust standard errors, the model explained 53.3% of score variance (adjusted $R^2 = 0.511$). Economic, production, provisioning, and decision-making scores were all significantly associated with lower HFIAS scores, and household income remained protective against food insecurity. In contrast, larger household size remained associated with greater food insecurity (Table 7). The ordinal and continuous outcome specifications had similar substantive conclusions.

**Table 7.** Model diagnostics and continuous-HFIAS robustness analysis.

| Component | Statistic/predictor | Estimate | 95% CI | *p* value |
|---|---|---|---|---|
| Ordinal model fit | Log likelihood | −423.37 | | |
| | LR $\chi^2(19)$ | 283.13 | | <0.001 |
| | McFadden pseudo-$R^2$ | 0.251 | | |
| | AIC/BIC | 890.75/979.79 | | |
| Assumptions | Maximum VIF | 4.80 | | |
| | Proportional-odds specification test | $\chi^2(38) = 41.38$ | | 0.326 |

**Continued**

| | | | | |
|---|---|---|---|---|
| Continuous HFIAS model | $R^2$/adjusted $R^2$ | 0.533/0.511 | | |
| | Robust F statistic | 30.98 | | <0.001 |
| Robust coefficient | Economic contribution, per 10 points | −1.200 | −1.496 to −0.903 | <0.001 |
| | Food-production contribution, per 10 points | −0.357 | −0.537 to −0.177 | <0.001 |
| | Food-provisioning contribution, per 10 points | −0.391 | −0.728 to −0.054 | 0.023 |
| | Decision-making participation, per 10 points | −0.439 | −0.620 to −0.259 | <0.001 |
| | Household income, per SLE 1000 | −0.427 | −0.573 to −0.281 | <0.001 |
| | Household size, per person | 0.936 | 0.600 to 1.272 | <0.001 |

## 4. Discussion

### 4.1. Principal Findings

The results point to the high household food insecurity burden and widespread use of women in the economic and domestic mechanisms that households gain access to and utilize food. A greater proportion of the households (more than four fifths) were experiencing some degree of food insecurity and more than half of the households became moderately and severely food insecure. The most common activities that women engaged in involved purchasing and preparing meals, and when it came to food-production, they did not have as many participatory follow-ups. Following socioeconomic adjustment, the four domains of contributions were linked to reduced severity of food-insecurity, with the economic contribution with the strongest impact. Food production, food provisioning and decision-making all had independent protective association, but provisioning did not play a significant role in the unadjusted analysis. Independently, household income was protective, but high household size augmented the degree of food-insecurity. The four focal association being consistent throughout analysis of the HFIAS continuous shows solid internal consistency of the results and fits the multidimensional explanation of the contribution of women as opposed to an employment-only or agriculture-only explanation.

### 4.2. Women's Economic Contribution and Food Security

Women contribution was seen as the best contribution-domain correlate of household food security. Women in a peri-urban environment because families purchase much of their food have the potential to get more purchasing power, income diversification and less reliance on one earner due to earnings and the regularity of financial transfers. This meaning aligns with the evidence of the north Benin, where the income of women was related to reduced household food insecurity and large shares of food spending by women (Egah et al., 2023), and Ghanaian evidence that relates the socioeconomic resources and decision position of women to food security in the home (Essilfie et al., 2021). The current outcome relates to the general economic-contribution score and not just employment status. Not all categories of employment were equally important once adjusted, indi-

cating that formal-employment classification might be a less important indicator of the resources that women actually supply and the frequency with which they supply those resources can meet the needs of the household. This difference is particularly applicable in informal economies, where petty trade and home-based ventures, processing and odd jobs are all common income generating activities.

### 4.3. Women's Food-Production Contribution and Food Security

Culturally, food-production contribution was solely connected with the reduced extent of food-insecurity despite rather a low level of engagement in crop, livestock, and other activities. Direct production can then have a direct buffer effect by way of food stored to be used at home, sale of food, or less reliance on buying food. It aligns with the findings of studies associating agricultural female empowerment and participating in productive-resource endowment with increased food-security in Ethiopia, Malawi, and Bangladesh (Jemaneh & Shibeshi, 2023; Mataka et al., 2023; Sraboni et al., 2014). The small, unadjusted effect also complies with the peri-urban structure of Waterloo, one food-access pathway of which is production. Provisioning of food took another trend, with acquiring food, preparing meals, food preservation and food care being commonplace, but it was only after modification that dietary provisioning garnered significance. This is an indication that household resource constraints are in play in provisioning. Unpaid food work transforms money, time, and knowledge and available food into food, making it economically and nutritionally valuable (without necessarily earning money). Evidence across countries also indicates that domestic and cooking time in women is correlated to dietary outcomes and opportunity costs of overwork (Komatsu et al., 2018).

### 4.4. Women's Decision-Making and Food Security

There was a positive relationship between increased household participation in decisions and reduced severity of food-insecurity. Decision-making may influence the kind of food bought, distribution of scarce income and enduring production as well as priorities between kids' food and medical demands. The outcome is an agreement with the resources-agency-achievements framework introduced by Kabeer (1999) and the multidimensional empowerment strategies that involve both production and income-control decisions (Alkire et al., 2013). Women in Ghanaian research have also been associated with enhanced food-security due to their decision-making or empowered status (Asitik & Abu, 2020; Essilfie et al., 2021). The Gender Model Family study in Sierra Leone outlined joint decision-making and joint management of resources as a mechanism helping to enhance the practice of food and nutrition (Ayamga et al., 2023). The relation should however not be understood that the participation itself generates food security. In other contexts, such as Tanzanian pastoral communities, quantitative impacts of empowerment have been ambivalent (Galiè et al., 2019), which suggests that indirect effects of agency on available resources, gender norms, prices, and liveli-

hood opportunities, interact. When it comes to making decisions though, it is the most informative when taken with economic and productive capacity.

### 4.5. Findings in the Waterloo/Sierra Leone Context

The Waterloo situation also serves to account for the greater importance of economic contribution in comparison with direct production and for the continuing core role of provisioning unpaid. Peri-urban households are characterized by informal employment, petty trading, casual work, a little agriculture and a large reliance on the market; thus, a lack of food can decline rapidly as incomes diminish or prices increase. Affordability pressures have been reported to be severe in Sierra Leone, characterized by high shares of food spending and food insecurity (World Bank, 2023; World Food Programme, 2024). These indicators at the national level are not directly comparable to HFIAS/HFIAP estimates and cannot be numerically compared to the community results but they will give the relevant context. In Waterloo, the results indicate that the contribution of women in terms of money, provisioning of the household and control of resources are significant factors of the family adjusting to market dependence. The findings are contextual and cannot be automatically extended to all the Sierra Leonean households.

### 4.6. Contribution to Knowledge

Research is beneficial to knowledge in three senses. It offers empirically analytically a household-level framework, concentrating on Waterloo, a peri-urban area not represented in as much as rural agricultural areas in the Sierra Leonean gender-and-food-security literature. In conceptual terms, women's contribution is regarded as multidimensional: economic resources, food production, non-paid provisioning, and decision-making is differentiated as opposed to being converted into employment status or a single measure of empowerment. These dimensions are analyzed as given in the same manner in conjunction with the socioeconomic attributes of households and conclusions are verified against the categories of ordered food-security and continuous HFIAS scores. The observation of independent relationships among all four domains, even in the situation of provisioning, not until adjusted, demonstrates the ability of multidimensional measurement to demonstrate relationships unnoticed using single-indicator measurement models. The analysis thus builds on existing evidence by finding the contribution of women in paid and unpaid work in the same household food-access paradigm.

### 4.7. Limitations

This study has several limitations that should be acknowledged. First, the cross-sectional design precludes causal inference; the associations reported are correlational and cannot establish directionality. Second, a single woman per household reported both her own contributions and the household's food insecurity, raising the possibility of common-method variance and self-report bias. Third, eligibility required involvement in a food-related role, which may have selected women with

higher food-related engagement and limits generalizability to households without such a woman. Fourth, men's contributions to household food security were not measured, so the analysis provides a partial account of household food provisioning. Fifth, although cluster-robust standard errors were used to account for the multistage design, sampling weights were not available for the final analytical sample; consequently, confidence intervals may be narrower than under full design-based estimation. Sixth, Cochran's formula was used for sample size determination and does not account for the design effect of cluster sampling, which may affect precision. Finally, the formative indices were assessed with reliability statistics (Cronbach's α, KR-20) that assume reflective measurement; this constitutes a limitation, and future work should report validity evidence suited to formative indices.

The study population was restricted to households containing at least one eligible adult woman engaged in a food-related role. Estimates are therefore not representative of all Waterloo households, including households without such a woman or households in which women were not engaged in food-related roles. This limits the generalizability of the findings to the broader Waterloo population and should be considered when interpreting the results.

### 4.8. Conclusion

This study examined women's multidimensional contributions to household food security in peri-urban Waterloo, Sierra Leone. The findings reveal a high burden of food insecurity, with 85.6% of households experiencing some degree of food insecurity and 57.9% moderately or severely food insecure. Women's contributions were concentrated in food provisioning and household decision-making, with lower engagement in direct food production. After adjusting for socioeconomic covariates, all four contribution domains economic, food-production, food-provisioning, and decision-making were associated with reduced severity of household food insecurity, with economic contribution showing the strongest association. Household income was inversely associated with food insecurity, while larger household size was associated with greater food insecurity. These findings support the conceptualization of women's contributions as multidimensional and suggest that interventions aimed at improving household food security in peri-urban Sierra Leone should consider supporting women's economic activities, food provisioning roles, and decision-making participation. The results also underscore the need for policies that recognize and value both paid and unpaid work of women in food systems.

### 4.9. Implications

**Managerial implications:** Organizations working on food security and gender in peri-urban Sierra Leone should design interventions that strengthen women's economic contributions, particularly through support for petty trade, food processing, and informal income-generating activities while also recognizing and re-

ducing the time burden of unpaid food provisioning. Programs should integrate decision-making components that engage both women and men in joint household resource management.

**Policy implications:** Policymakers should prioritize gender-responsive food security strategies that address the structural barriers limiting women's access to productive resources, credit, and markets. Given the inverse association of household income, policies that stabilize incomes and reduce food price volatility are critical. The high prevalence of food insecurity in Waterloo calls for targeted social protection and food access programs in peri-urban areas, which are often overlooked in favor of rural-focused interventions.

**Recommendations for future research:** Future studies should employ longitudinal designs to establish causality, include both women's and men's contributions, use objective measures of food security where possible, and incorporate sampling weights and design effects in sample size calculations. Qualitative research could explore the mechanisms linking women's decision-making to food security outcomes. Comparative studies across different peri-urban contexts in Sierra Leone would help assess generalizability.

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## Author Contributions

**Siddy Kallay:** Data collection, data analysis, literature review, interpretation of findings, and manuscript preparation. **Mohamed S. M. Feika and Osman Michael Mansaray:** Research conceptualization, development of study objectives, research problem formulation, and study design. **Martha Fanta Mansaray and Jusufu Abdulai:** Conceptual framework design, restructuring of research objectives and questions, and manuscript review. **Abdulai Dauda Kargbo and Sylvester Sulaiman Aruna:** Conceptual framework refinement, alignment of research objectives, and manuscript review.

All authors: Reviewed and approved the final manuscript.

## Conflicts of Interest

The authors declared no conflicts of interest regarding this research, authorship, or publication of this article.

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