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Women's empowerment and household food security in rural Southwest Nigeria: Evidence from dietary diversity and ordered logistic analysis

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Abstract: *Purpose*. This study examines how women's empowerment relates to household food security, using dietary diversity as evidence from rural households in Ekiti, Ondo, and Oyo States in Southwest Nigeria. It examines whether empowered women are better able to secure adequate, diverse diets for their households, thereby reducing food insecurity.

Methodology. A cross-sectional survey was conducted with 441 women aged 25–60 years from rural households selected through a multistage random sampling procedure. Data were collected using structured questionnaires and analysed with descriptive statistics, ordered logistic regression and binary logit models in STATA. Household food insecurity was measured using an adapted Food Insecurity Experience Scale, and dietary quality was assessed using a modified Household Dietary Diversity Score based on six food groups. The study is anchored on Kabeer's Resources–Agency–Achievements framework and the Women's Empowerment in Agriculture Index.

Results. Most households were food insecure, with high prevalence of worry about food insufficiency, meal skipping, and running out of food. Reliance on cereal-based staples was common, while access to meal replacement foods was low. Households where women made decisions alone had significantly higher odds of severe food insecurity, whereas regular consumption of fruits, meal replacement foods and diverse diets was associated with lower food insecurity. Women's ownership and control of assets and time were linked to a reduced likelihood of running out of food, while exposure to gender-based violence increased this likelihood.

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Theoretical and practical contribution. The study shows that empowering women enhances dietary adequacy and reduces hunger, aligning with SDGs 2, 3 and 5, and highlights the need to address barriers to women's agency and household food access in rural Nigeria.

Keywords: food insecurity, dietary intake, household women empowerment, Southwest Nigeria

Sustainable Development Goals (SDGs): SDG 2: Zero hunger; **SDG 3:** Good Health and Well-being, **SDG 5:** Gender Equality, **SDG 10:** Reduced Inequalities

1. Introduction

Food security has gained prominence in economic development, serving as an important pillar for well-being in the Sustainable Development Goals 2030 (SDGs) agenda (Arabska, 2021; Naheed, 2023). In achieving food security across households, the role of women has been recognised and considered crucial as a result of the examination of the role played by gender as a strong pillar of the family, and environmental facets which has broaden the understanding of food security over time (Collins, 2022; Visser & Wangu, 2021). For more than five decades, food security has been a top development objective, with the second goal of the United Nations' 2030 Sustainable Development Agenda to eliminate hunger and ensure adequate food and nutrition security (Varzakas & Smaoui, 2024). Globally, the failure to obtain or enjoy sufficient nutrition or calories of desirable quality, or the lack of a guarantee that an individual will be able to do so, is referred to as food insecurity (Turnbull, Homer & Ensaff, 2021).

Food security is a strong pillar of household well-being in the Sustainable Development Goals 2030 (SDGs) agenda because it is a fundamental component of household well-being and a primary benchmark for the SDGs, particularly SDG 2, which focuses on ending hunger and malnutrition (Mutambara, 2025). It covers the characteristics of availability, accessibility, use, and stability to provide everyone with equal and unfettered access to food worldwide (Ozturk, 2025). Food insecurity is a direct result of poverty across low-income households, where rising living expenses make it difficult to obtain wholesome food, an indication of its connection to SDG Goal 1 on poverty. While SDG 2 (Zero Hunger) is supported by goal 3 (Good Health and Well-Being) on addressing malnutrition and promoting good health, they are inextricably linked to SDG 5 (Gender Equality), since women are the main managers of household nutrition and the backbone of the smallholder agricultural sector (Dunn, 2025; Saharawat & Sahoo, 2025).

In many developing economies, particularly in rural agrarian settings, women face systemic gender gaps in access to land, credit, and digital tools, which directly lower agricultural productivity and, by extension, household food security (Buehren, 2023). Earlier research suggests that granting women equal access to productive resources as men could increase their farm yields by 20% to 30%, thereby lifting millions out of chronic hunger (Neumann et al., 2022; Olawale et al., 2023). Therefore, this signifies the need to include gender in the food security agenda, as food security interventions that ignore the gendered nature of resource distribution often fail to reach the most vulnerable, reinforcing cycles of poverty and malnutrition (Radler, 2026).

The Global Report on Food Crises indicated that over 190 million individuals in 53 nations and regions were severely food insecure and required immediate assistance in 2022, as the COVID-19 pandemic, extreme weather conditions, and regional wars exacerbated the crisis (Ouko & Odiwuor, 2023). The majority of these countries are in Africa, Asia, and Latin America, where the nutritional value of household food intake has declined, with severe implications for child health and outcomes in the least developed countries, with higher levels of children with stunted and wasted growth (Headey & Ruel, 2023). Having a lower quality of life, greater mortality rates, and an increased likelihood of being prone to diseases and health consequences are associated with food insecurity, as it often dictates household dietary intake and habits. Various consumption habits may be the cause of many of these health problems, which are influenced not only by biological factors but also by psychological and socio-environmental factors (Addo & Khan, 2024).

Across households, the empowerment of women plays a pivotal role in ensuring food security in agricultural and rural communities (Aziz et al., 2022). Women's involvement in livestock

ownership provides them with income, which helps them purchase higher-quality food for domestic consumption and participate in decision-making about household spending (SohWenda, 2024). In addition, Women may switch their earnings from farming to other activities to supplement household income. According to empirical literature, women's empowerment and gender equality (SDG 5) are critical to women and are associated with several other SDGs, including eradicating hunger (SDG 1), attaining nutritional and food security (SDG 2), and promoting the overall wellness of women and children (SDG 3)(Mkandawire & du Toit, 2024; Subba, 2022).

Recently, food insecurity has emerged as a global issue. In 2022, a spike in food inflation across food-importing countries globally was attributed to the COVID-19 crisis and food supply shortages caused by the Ukraine/Russia war. In Sub-Saharan Africa (SSA), an average 23.9% increase in staple food prices was recorded between 2020 and 2022 (Okou, Spray & Unsal, 2022). Approximately 40% of Nigerians are food insecure, according to the 2018–2019 household expenditure survey (Mekonnen et al., 2021). Also, the COVID-19 pandemic's negative effects and the 2022 inflation spike further raised food insecurity across households in Nigeria. According to data released by the World Food Program (WFP) in November 2022 for 26 Nigerian states and the Federal Capital Territory (FCT), the number of individuals experiencing severe food insecurity in Nigeria increased from 5.4 million to 17 million in the previous year. The majority of Nigeria's basic foods are produced domestically, but the country's high food import ratio leaves Nigerians at risk of high food prices, reducing their food security (Thomas et al., 2023).

The FAO, under the Voices of the Hungry initiative, developed the Food Insecurity Experience Scale (FIES) frameworks as a standardised experiential metric that captures the behavioural and psychological dimensions of food access (Cafiero et al., 2024). By focusing on compromised dietary quality, meal skipping, and total food deprivation, the scale allows classification of food insecurity into mild, moderate, and severe levels (Amir & Khan, 2024). The FIES offers a micro-level approach to examine the vulnerability of female households by uncovering the nuances of intra-household bargaining power and the gendered dimensions of resource allocation in food access. It positions food security at the intersection of gender inclusion and agricultural productivity (Swangsilp et al., 2025).

This study investigates the intersection of food insecurity, dietary intake, and women's empowerment (SDG 5) across households in Southwest Nigeria, to create more resilient and inclusive development pathways. Nigeria is a crucial country to examine the issues surrounding food insecurity because the recent elimination of oil subsidies has increased the cost of food and oil, impacting many households. Furthermore, a sizeable portion of the nation's population lives in rural areas.

1.1. Research purpose and question

This paper investigates the relationships among household nutrient intake, food insecurity concerns, and women's empowerment in rural communities in Ekiti, Ondo, and Oyo states in the Southwest of Nigeria. Its specific objectives are:

1. To assess the severity of food insecurity among rural households in Southwest Nigeria using the structured Food Insecurity Experience Scale (FIES) and an adapted Household Dietary Diversity Score measurement.
2. To identify the impact of food access on food insecurity, measured by concern about food availability.
3. To examine the correlation between women's empowerment measures and household food insecurity, measured by running out of food.

2. Theoretical framework and literature review

2.1. Theoretical framework

Kabeer's Resources-Agency-Achievements (RAA) Framework: According to Naila Kabeer (1999), the Resources-Agency-Achievements (RAA) Framework conceptualises empowerment as the process by which people who have been denied the capacity to make strategic life decisions acquire the capacity to possess such (Abebe et al., 2025). The prerequisites that boost a person's ability to exercise choice are economic, human, and social resources, such as education, digital connectivity, and access to soft skills (Saleem et al., 2025). However, owning these resources by itself does not guarantee well-being; the goals must be engaged in and implemented through intra-household bargaining and negotiation. (Naguib, 2023). Higher levels of empowerment give women greater control over household budgets, enabling them to prioritise healthy eating even in the

midst of financial crises (Jemaneh & Shibeshi, 2023). The RAA framework illustrates how empowering women in the informal agrarian sector acts as a resilient buffer, protecting household nutritional standards from the inflationary pressures of the national economy and advancing the localised targets of SDG 2 (Zero Hunger) and SDG 5 (Gender Equality). By safeguarding household dietary needs from the rising costs of the national economy and advancing the goals of SDG 2 (Zero Hunger) and SDG 5 (Gender Equality), the RAA framework demonstrates how supporting women in the informal agrarian sector functions as a strong buffer.

The Women's Empowerment in Agriculture Index (WEAI): The Women's Empowerment in Agriculture Index (WEAI) framework builds on agency-oriented emancipation concepts by identifying five distinct areas through which women need to exercise responsibility to improve household well-being (Nacka et al., 2025). It maps specific decision-making powers to food security outcomes: i. the power to make decisions about agricultural production; ii. the sole or joint control over resource acquisition and ownership iii. ownership of assets and access to credit or digital information iv. Leadership role as a group member and ability to speak in the public v. allocation of time to domestic and productive tasks. It also takes into account other metrics of gender equality in household empowerment as compared to men and considers the role of women in agriculture and food security.

2.2. Literature review

2.2.1. Dietary intake and food insecurity

Food security is widely measured through metrics such as food consumption and dietary diversification. Other popular indicators of food security include the Coping Strategy Index (CSI), Dietary Diversity Score (DDS), the Food Insecurity Experience Scale (FIES), and Household Food Insecurity Access. Pursuant to the 1996 World Food Summit, the definition of food security consists of four elements: availability, accessibility, utilisation, and stability (FAO, 2015).

Food insecurity is a serious nutritional problem characterised by lower consumption of meat, dairy products, fruits, and vegetables, according to numerous studies (Aidoo et al., 2013; Ashok, 2022). Jun et al. (2021) found that children experiencing food insecurity have lower intakes of certain micronutrients. Particularly among American adolescent females, the correlations are specific to age and sex. According to the study, these children's diets were of poor quality overall, with intakes of saturated fat, added sugar, and sodium significantly exceeding the recommended levels. Given the significance of childhood for healthy growth and development, which can impact lifelong health, the negative correlation between food insecurity and children's consumption of certain micronutrients is alarming. Previous research in the United States and Canada has found that younger children's nutritional habits are less likely to be influenced by the negative effects of inadequate nutrition than those of adults and adolescents (Hanson & Connor, 2014).

Hutchinson and Tarasuk (2022) found that ultra-processed food intake was higher and diet quality was typically lower among adults and children in a sample of homes in 11 Canadian provinces with more severe household food insecurity. The degree of food insecurity in households was closely correlated with the proportion of energy derived from ultra-processed foods. There was no discernible pattern in the consumption of fruits and vegetables. Additionally, a notable downward trend in protein consumption per 1000 kcal among older children was observed, but there was no difference in carbohydrate, total sugar, fat, or saturated fat intake per 1000 kcal by food insecurity level. In a study using a nationally representative sample of the United States, Leung and Wolfson (2021) found that food insecurity is associated with lower overall nutritional status among older adults. The study recommends health promotion programs to reduce food insecurity and encourage healthy eating habits among older adults, as well as clinical initiatives to identify those at risk of food insecurity.

According to Sims et al. (2021), Indian women consume a diet rich in nutrients and have high rates of overweight and obesity. These authors indicated that this finding can be best understood by considering changes in agriculture, the traditional and rising roles of women in India, and the current nutrition transition. Furthermore, a study by El Bilbeisi et al. (2022) on food insecurity and its correlation with dietary intake among Gaza's under-five children found that approximately 56.0% of food-insecure households lacked nutritional knowledge, 77.6% had poor nutritional attitude, and about 95.2% failed to meet the minimum dietary diversity score. It concluded that wasting, stunted growth, and acute undernutrition were highly prevalent in children from households experiencing food insecurity. Furthermore, high food insecurity among children under five may be caused by a combination of factors such as low economic status, poor nutritional intakes, and a lack of dietary diversity.

2.2. Women's empowerment and food security

The Sustainable Development Goals (SDGs) 2030's "leave no one behind" philosophy specifically states, in Goal 5, the need to achieve gender equality and empower girls and women (Stuart & Woodroffe, 2016). Women's empowerment has been identified as a key factor in advancing gender equality and has been categorised as a tool for doing so through greater power, livelihood control, and possessions (Andriamahery & Qamruzzaman, 2022). Women are also recognised as a tool for fostering social progress and environmental sustainability (Rosca, Agarwal, & Brem, 2020). In West African nations, a significant gender gap persists, with many women having less access to opportunities than men, including decent job offers, salaries and wages, property ownership, and engagement in public life (Jayachandran, 2021).

The various facets of women's empowerment are recognised as essential dimensions of food security, as demonstrated by empirical research. NgaNdjobo (2023) investigated the impact of gender inequality in asset ownership on women's food security in Sub-Saharan Africa (SSA) using data from 31 SSA nations. According to the study, gender inequality and food insecurity in sub-Saharan Africa (SSA) are still significantly influenced by the seemingly unconnected unequal asset rights. It was discovered that gender disparities in asset ownership significantly increase women's probability of experiencing food insecurity. In rural communities with high levels of vulnerability and marginalisation, as well as among the illiterate, this situation was found to have high odds.

Christian et al. (2023) used the Demographic and Health Survey (2015-2018) from 8 Sub-Saharan African nations to examine the relationship between women's empowerment and children's diet, while considering the intermediary effect of household leadership form. Women's empowerment was evaluated using characteristics such as household decision-making, attitudes toward domestic violence, and asset ownership, while dietary intake was assessed by anaemia status and stunting. The study found that increasing women's empowerment considerably reduces anaemia and stunting, as does women's autonomy in asset ownership and decision-making, demonstrating highly significant connections.

Using data from the Ghana Living Standard Survey (GLSS7), Essilfie et al. (2021) examined the effects of violence against women, women's educational attainment, and decision-making autonomy on family food security in Ghana. According to the survey, food security is significantly positively correlated with women who have a reasonably high level of education and excellent decision-making skills. It was discovered that the level of food security in each home was strongly correlated with several aspects of women's empowerment. Wei et al. (2021) used partial least squares structural equation modelling to investigate the association between six aspects of women's empowerment and food security in rural Bangladesh. Results show that women have greater negotiating power over resource use and food choices when they are involved in decision-making in the home, thereby reducing their food insecurity.

In Msinga, South Africa, Sharaunga, Mudhara, and Bogale (2016) examined how the availability of food in rural families is affected by women's empowerment. The Household Food Insecurity Access Scale (HFIAS) was used to quantify food security status, and Principal Component Analysis was employed to determine the dimensions of rural women's empowerment. The Ordered Logit model's findings showed that food security was more likely to exist in female-headed households with greater degrees of economic autonomy, capital, and empowerment of agricultural management skills. Food security in agricultural communities may be improved by redistributing household assets and decision-making authority between men and women in a way that strengthens women's bargaining power, according to several empirical studies. For example, it was found that in Nigeria, smallholder farmers' levels of food insecurity decreased when women were empowered (Kehinde et al., 2021; Mukaila, 2024).

According to a study conducted in Tanzanian pastoral communities, women's control over their income and assets is positively correlated with dietary diversity, as it enables them to produce and purchase a wider variety of nutrient-dense foods (Galiè et al., 2019). Additionally, a Bangladeshi study found that women's empowerment boosts household dietary diversity and calorie availability (Hossain, Asadullah & Kambhampati, 2021). Furthermore, in Ethiopia and Timor-Leste, it was found that women's empowerment enhanced dietary diversity among both mothers and their offspring (Bonis-Profumo, Stacey & Brimblecombe, 2021; Baye, Laillou & Chitekwe, 2024).

2.3. The multidimensionality of food security in the 2030 Sustainable Development Goals agenda

The 2030 Agenda for Sustainable Development, agreed by all United Nations Member States in 2015, views food security as a cross-cutting, multidimensional imperative rather than a technical agricultural concern. It emphasises that achieving zero hunger requires integrated progress in the social, environmental, and economic domains, as well as increased agricultural output. SDG 2 (Zero Hunger), which aims to eradicate hunger and ensure that everyone has year-round access to healthy, wholesome food, is at the centre of this framework. Nonetheless, current research highlights that SDG 2 (Zero Hunger) and SDG 1 (No Poverty) are inherently intertwined (Hettiarchchi et al., 2025). As argued by Pérez-Escamilla (2017), food security is a primary social determinant of health; as such, it must be paired with more environmentally friendly, sustainable farming methods, because households living in food poverty lack the nutritional base needed to overcome financial hardship.

SDGs 3 (health and well-being) and 4 (quality education) are closely linked through the use and sustainability pillars of food security (Haque et al., 2025). Stunting and malnutrition have an accumulating impact when there is persistent food insecurity, especially in rural agrarian areas. Also, the goals of SDG 8 (decent work and economic growth) are directly undermined by the cycle of declining worker productivity.

Integrating SDG 5 (gender equality) into food systems is essential to achieving the 2030 goal. Despite limited access to productive resources, women are frequently the primary managers of home nutrition, and a gender gap in food security is frequently highlighted in the literature (Gebrihet & Gebresilassie, 2025). Ntsoane et al. (2025) contend that increasing women's intra-household bargaining power and digital inclusion is crucial for improving dietary diversity. When female traders in the informal sector are empowered, the resulting stability in food access reduces the inequality gap between rural and urban populations, directly advancing SDG 10 (Reduced Inequalities).

Beyond the immediate nutritional and health outcomes, the integration of food security within the 2030 Agenda highlights a critical intersection with SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action). In the Nigerian context, food security is increasingly threatened by climate-induced disruptions and inefficient supply chains, resulting in high post-harvest losses (Akinkuolie, 2025). These concerns disproportionately affect low-income communities that rely on local food supplies and small farms. Improving farming practices, strengthening rural infrastructure, and implementing transparent government regulations are necessary to protect the food supply and help communities adapt to environmental and climatic changes that are making farming more challenging. For rural agrarian traders in Southwest Nigeria, this necessitates a transition toward climate-resilient farming to optimise food systems, reduce waste, and adapt to environmental shifts.

3. Materials and methods

3.1. Research design and method of data collection

The research design is a survey field study of the responses of 441 household women aged 25-60 in Ekiti, Ondo, and Oyo states in Nigeria. These three states have many rural dwellers with a record of food insecurity, poverty, and inequalities. The group of participants comprises rural inhabitants from six large towns, two from each state: Ado and Ikole in Ekiti, Ibadan and Iwo in Oyo, and Akure and Ikare in Ondo. The towns were chosen based on their large populations, trading volumes, and the rise of urbanisation. Data for this study were collected from the month of September to December 2024. The goal was to investigate the links between nutritional habits and food insecurity among women in households in Southwest Nigeria.

Population Sample Size Measurement: We consider a 95% confidence level and a 5% margin of error, a population proportion of 0.5, and an unlimited population size, with z = 1.96.

$$n = z^2 * \hat{p} * \frac{(1 - \hat{p})}{\varepsilon^2}$$

$$n = 1.96^2 * 0.5 * \frac{(1 - 0.5)}{0.05^2} = 384.16$$

The calculated sample size was 384, but we added 20% to account for expected non-response, giving 460, of which 441 were valid responses used for the analysis.

Measurement of food insecurity: The Food Insecurity Experience Scale (FIES) consists of eight "Yes/No" questions on access to food, using mild, moderate, and severe levels of food insecurity associated with a lack of money or other resources. This study considers these questions to form a structured six-question set, with response options revealing the level of concern as Often worry, Sometimes worry, and Not worry at all, and True/false for binary options on food insecurity, as presented in Table 1. These questions help guide responses into measures of food insecurity, including "worrying over food supply, skipping meals and running out of food," across households, serving as a standard measurement of SDG 2. These measures of food insecurity across households have been widely used globally in surveys such as the Demographic and Health Surveys (DHS) and the Multiple Indicator Cluster Surveys (MICS).

Measurement of dietary habits: Dietary habits were assessed using a validated self-administered dietary recall, which allows participants to select what they consume weekly and the pattern of intake. The structured questions consider the Household Dietary Diversity Score (HDDS), which assesses the quality and diversity of the diet. It tracks how many of the different specific food groups (e.g., cereals, tubers, vegetables, meat, eggs) were consumed by any household member in the last 24 hours. This study adopts this and restructures the twelve specific food groups of HDDS into six food intake groups: Staple foods/Cereal, Vegetables, Fruits, Meat, Meat replacement drinks, and Beverages.

Table 1: Last 12 months recall for participants

Severity Level	Specific Question (During the last 12 months, was there a time when...)	Structured questions for the study
Mild	1. You were worried you would not have enough food to eat?	(Mild) Did you worry that your food might run out?
	2. You were unable to eat healthy and nutritious food?	(Mild) Purchase low-quality food for my family
	3. You ate only a few kinds of foods?	(Moderate) In the past 12 months, have you ever reduced the size of your meals or skipped meals?
Moderate	4. You had to skip a meal?	(Moderate) In the past 12 months, have you ever skipped meals?
	5. You ate less than you thought you should?	(Severe) In the past 12 months, did you ever eat less or lose weight because you didn't have enough money for food?
	6. Your household ran out of food?	(Severe) The food I/we bought ran out quickly, and I/we didn't have enough money to purchase more
Severe	7. You were hungry but did not eat?	
	8. You went without eating a whole day	

3.2. Method of data analysis/ techniques

This study involves both descriptive and statistical methods of analysis. The collated data were statistically analysed using ordered logit and binary logistic regression. to:

i. Identify the impact of food access on food insecurity measured by concern about food availability. The household's food insecurity level (dependent variable) was measured by "worry about food insufficiency" using responses from the question "Did you worry that your food might run out before you had the money to buy more?" classified into 3 forms: "Not worry at all, Sometimes worry and Often worry", thus providing a basis for the use of ordered logit regression.

The ordered logit distribution is built such that:

$$P(Y_i > j) = \frac{\exp\left(\alpha_{j+X_iB_j}\right)}{1 + \left[\exp\left(\alpha_{j+X_iB_j}\right]\right)}$$

where $j = 1,2,3M - 1$. $X_1, X_2..., X_k$ are sets of independent explanatory variables.

ii. Examine the correlation between women's empowerment levels and household food insecurity. The dependent variable (household food insecurity), measured with the question "Ran out of food," takes a binary form (true/false), providing the basis for the use of binary logit regression. This is expressed in the form:

$$Ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots \beta_k X_k$$

4. Results

4.1. Descriptive analysis

Table 2a presented the descriptive statistics for respondents; about 72% were women aged 31-40 years, and about 23% were aged 41-50 years. Up to 87% were married, 59% completed primary or secondary education, 15% completed a diploma or college, 15% have a university degree, and only 8% have a postgraduate degree. 49% have up to 2 children, while about 51% have more than 2. These characteristics reveal that the respondents are largely married and have basic educational knowledge.

Table 2a: Socio-characteristics of respondents

	Variable	Total	Percentage
Socio Characteristics:	≤30	6	1.36%
(Age)	31-40	320	72.56%
	41-50	100	22.67%
	51-above	15	3.41%
Marital Status	Married	384	87.07%
	Single	43	9.75%
	Widowed	5	1.14%
	Divorced/ separated	9	2.04%
Educational level	Primary/SSCE	264	59.86%
(Degree)	OND/NCE	69	15.64%
	BSc	70	15.87%
	Postgraduate/Higher	38	8.62%
No of Children	1-2	218	49.43%
	≥3	223	50.57%

Source: Author's computation from the field survey 2024

As shown in Table 2b, approximately 40% of respondents were self-employed, 41% were government employees, and up to 18% worked in the private sector. Approximately 98% of women make decisions about their health, with up to 89% choosing food provision alone. 13% have experienced gender-based violence, 77% possess assets and properties, and around 87% have complete control over their time. The findings show that the majority of the polled respondents have active jobs and the authority to make decisions and purchase assets in their own names.

Table 2b: Empowerment Measurement

Empowerment Form:	Self	177	40.14%
Type of work	Private	80	18.14%
	Civil service	184	41.72%
Decision making	Decision-making on one's own health	436	98.87%
	Decision-making on food alone	393	89.12%
Gender-based violence	Gender-based violence involvement	60	13.61%
Ownership of property	Asset/Property ownership	343	77.78%
Time management	Time personal management	383	86.85%

Source: Author's computation from the field survey 2024

As presented in Table 2c, only 13% of respondents indicated not being worried about food insufficiency, while 23% are often worried, 63% are sometimes worried, and up to 66% of women experienced running out of food during the survey. On dietary intake, less than 10% of women had access to meal-replaced foods in a week, 32% had regular fruit intake, about 57% had a regular intake of vegetables,32% with intake of meat, chicken, eggs, and fish, while about 80% take in staple food and cereals regularly. These findings revealed that households' daily consumption of staple foods is higher than the consumption of fruits, dairy, and vegetables. This finding relates to

the work of Degfachew et al. (2025) and Scott (2021), which found that in developing countries, food-insecure people often rely on cereals, roots, and tubers as sources of food and nutrition.

Also, the food insecurity level is very high, as only 13% of respondents reported not being concerned about food insecurity, whereas 23% are often or frequently concerned, 63% are concerned sometimes or occasionally, about 75% skipped a meal daily, and up to 66% of women reported running out of food throughout the survey. In terms of nutritional intake, less than 10% of women had access to meal replacements once a week; 32% consumed fruits regularly; 57% consumed vegetables regularly; 32% consumed meat, chicken, eggs, and fish; and almost 80% consumed staple foods and cereals regularly. This study found that households consume more staple foods on a regular basis than intake of fruits, dairy, or vegetables. This finding is consistent with Degfachew et al. (2025) and Scott's (2021) research, which found that in developing nations, food-insecure people frequently rely on grains, roots, and tubers for nutrition.

Table 2c: Assessment of the severity of food insecurity using the Food Insecurity Experience Scale (FIES) and the Household Dietary Diversity Score(HDDS)

Structured Food Insecurity Experience Scale Measurement				%
1. Did you worry that your food might run out before you had the money to buy more?	Worry about food insufficiency	Not worry at all	61	13.83
		Sometimes worry	277	62.81
		Often worry	103	23.36
2. Did you worry that you purchase low quality food for my family		Not worry at all	140	31.67
		Sometimes worry	157	35.52
		Often worry	145	32.80
3. reduced the size of your meals?		Not worry at all	44	9.95
		Sometimes worry	265	59.95
		Often worry	133	30.09
4. You had to skip a meal daily?	Skipped a meal	True	334	75.73
		False	107	24.26
5. You ate less than you thought you should?		True	296	66.9
		False	146	33.03
6.Your household ran out of food?	Ran out of food	True	291	65.99
		False	150	34.01

Structured household dietary diversity intake (> 3 times weekly intake)				
Article I. Food group		Example/class	total	%
Article II.Meal replacement		Energy drink, Lucozade Boost, wine, Coke, soda	43	9.75
Article III.	Fruits intake	Banana, watermelon, apple, carrot, cucumber, walnut, star cherry, garden egg, etc	142	32.20
Article IV. intake	Vegetables	Leafy green, cabbage, pumpkin, carrot, green peas	251	56.92
Article V.Meat Intake		Meat/Chicken/Egg/Fish, Snail	141	31.97
Article VI. intake	Cereal	Staple foods: Rice, Yam, FuFu, Garri, Pupuru, Yam flour, etc	354	80.27
Article VII. intake	Beverages	Milo, Bournvita, Milk, Chocolate Milk, Tea	109	24.66

Source: Author's computation from the field survey 2024

4.2. Statistical analysis: Ordered logistic regression result

Preliminary analysis using Pearson's Chi-square test was performed to examine the bivariate associations between the dependent variable and our measure of food access at home. The results reveal that women with decision-making on food alone, access to meal-replacement foods, local fruit, regular intake of meat, and regular intake of vegetables and staple foods have p-values less than 5%, as presented in Table 3.1; thus justifying their inclusion in the ordered logistic estimation presented in Table 3.2. A marginal association was observed between households with more/less than 3 children, with a p-value slightly above the 5% level of significance. This variable was included as it suggests a trend at the 10% level while controlling for other socioeconomic factors.

Table 3.1: Pearson Chi2 Test

Variables	$pearson\ x^2$	p-value
Decision-making/source for food by a woman alone	28.4541	Pr = 0.000
Women with access to meal-replacement food	258.4077	Pr = 0.000
Women with access to local fruit intake	105.3024	Pr = 0.000
Women's regular intake of meat/chicken/eggs/fish	100.4617	Pr = 0.000
Women with regular intake of vegetables	42.3064	Pr = 0.000
Women with regular intake of staple food: cereal	52.2792	Pr = 0.000
Households with less than 3 children	5.7217	Pr = 0.057
Household with more than 3 children	5.7217	Pr = 0.057

Source: Author's computation from the field survey 2024

Table 3.2 shows that the number of observations is 441, the LR Chi-squared test has a value of 271.5 (p-value=0.000), indicating that the models fit the data, with a Pseudo R2 value of 0.34, suggesting that the model specification is appropriate. All variables in the model, except "women with regular intake of vegetable" are statistically significant. The cut points 1 and 2 indicate where the latent variable is cut to make the three groups observed in the data. For a one-unit increase in households with more than 3 children, the odds of high food insecurity relative to the combined middle and low categories are 9.97 times greater, holding all other variables in the model constant. This result indicates that these groups are about 99% more likely to be food insecure than households with fewer children, implying that household size matters for concerns about food sufficiency and security. This conclusion supports Akello and Mwesigwa's (2023) findings that household size is an important factor in food security. A one-unit increase in households with decision-making by women alone has the odds of high food insecurity versus the combined middle and low categories 5.37 times greater, given that all other variables in the model are held constant. This result indicates that household women who make decisions or source food alone have a significant risk of food insecurity; when women shoulder the burden of food provision at home alone, it causes stress and concern. These findings show that both men and women in households should be responsible for food provision to improve household food security.

For a one-unit increase in households with access to meal replacement foods, the odds of attaining a high food insecurity level decrease by 99%, i.e., they have higher odds of being in the lower categories of food insecurity. Those who regularly take local fruits and meat also exhibit lower odds of high food insecurity than the combined middle and low categories, given that all other variables in the model are held constant. These results are supported by Saediman et al. (2021), who showed that households that rear poultry and practice subsistence farming and home gardening are less likely to experience food insecurity or worry about food insufficiency. These results highlight that eating fruits and meal-replacement products is necessary for healthy nutrition, and households with access are less concerned about food insecurity.

Table 3.2: Impact of food access on food insufficiency (ordered logistic regression)

Food insecure(worry over food insufficiency)	Odds ratio	Std. Err.	P>|z|	[95%	conf. Inter.
Households with less than 3 children	1.00	(omitted)			
Household with more than 3 children	9.97	6.55	0.000	2.752	36.144
Decision making/source of food by a woman alone	5.37	2.36	0.000	2.267	12.703
Women with access to meal-replacement food	0.01	0.01	0.000	0.002	0.052
Women with access to local fruit intake	0.32	0.12	0.000	0.151	0.660
Women's regular intake of meat/chicken/eggs/fish	0.18	0.07	0.000	0.089	0.371
Women with regular intake of vegetables	0.65	0.17	0.100	0.381	1.094
Women with regular intake of staple food: cereal	0.55	0.16	0.040	0.314	0.967
/cut1	-1.32	0.72		-2.73	0.09
/cut2	3.70	0.79		2.15	5.25

Observation: 441, LR chi2(7) =271.5, Prob> chi2= 0.000, log likelihood= -263.527, Pseudo R2 = 0.34
Source: Author's computation from the field survey 2024

Table 4.1 presents the results of the relationship between women's empowerment and food insecurity, measured by running out of food, using a binary logistic regression model. The model

fitness was confirmed as fit with the maximum likelihood result (LR chi2(9) = 281.83, Prob < 0.001), corroborated by McFadden's Pseudo-R2 of 0.498, which indicates that all included variables accounted for about 49% of the model uncertainty. Women with a secondary level of education have an odds ratio of 5.6 for food insecurity, indicating that they have 5 times higher odds of running out of food than those with postgraduate/higher degrees. Those with a diploma have an odds ratio of 1.74, although the result is not statistically significant at the 5% level, but lies within the 10% level. In contrast, those with college and university degrees have an odds ratio of 2.83, indicating a higher probability of experiencing food insecurity than those with postgraduate degrees. This finding suggests that women's educational level contributes to higher-paying employment that allow them to cover the nutrition and basic needs of their households, reducing their chances of regularly running out of food.

In terms of empowerment for women, those who possess assets and properties have a lower odds ratio of about 0.39, indicating that they are 60% less likely to run out of food. Furthermore, women who have control over their time are less likely to run out of food (odds ratio = 0.001), but women who have experienced gender-based violence have an odds ratio of 43.77, which is statistically significant at the 5% level of significance; an indication that women who have experienced gender violence may lack the capacity to feed their family adequately. This result complements Wei et al.'s (2021) empirical research, which found that women's access to familial rights and decision-making responsibilities increases their bargaining power over resource utilisation and food choices, thereby reducing food insecurity. A large number of married women are food insecure, as indicated by the result of married women running out of food as a measure of food insecurity, while women within the ages 31-40 (middle age) have a higher likelihood of running out of food when compared with the younger women with fewer children and those above 40 years.

Post-estimation diagnostic tests were established using the Pearson and Hosmer-Lemeshow test results, as presented in Table 4.2. The Pearson and Hosmer-Lemeshow goodness-of-fit test the null hypothesis that the model fits the data well against the alternative hypothesis that the model does not fit the data. The decision rule is to reject the null hypothesis if $p < 0.05$ and accept it if $p > 0.05$, indicating a good fit. Both results reveal $p > 0.05$, indicating that the model is a good fit and that there is no significant difference between the observed and model-predicted outcomes, confirming adequate specification.

Table 4.1: Impact of women's empowerment on food insecurity (Binary regression)

Food insecure(Ran out of food)	Odds ratio	Std. Err.	P>|z|	[95%	conf. Inter.
Women with up to secondary-level education	5.600	2.649	0.000	2.216	14.152
Women with up to diploma-level education	1.742	1.454	0.660	0.506	8.949
Women with up to university/College Education	2.831	1.402	0.036	1.073	7.470
Women with up to postgraduate-level education	1	(omitted)			
Women with asset/property ownership	0.396	0.160	0.022	0.179	0.876
Women with control of their own time	0.001	0.001	0.000	0.001	0.008
Women with gender violence experience	43.773	50.397	0.001	4.583	418.037
Married	313.89	347.02	0.000	35.953	2740.51
Age 20-30	1	(omitted)			
Age 31-40	4.388	3.192	0.042	1.054	18.263
Age 41-50	0.033	0.032	0.000	0.005	0.223
Age 50+	0.029	0.020	0.001	0.004	0.212
_cons	6.892	10.904	0.022	8.144	687.51

Observation: 441, LR chi2(9) =281.83, Prob> chi2= 0.000, log likelihood= -141.823, Pseudo R2 = 0.4984

Source: Author's computation from the field survey 2024

Table 4.2: The goodness of fit result

Goodness-of-fit test (Pearson goodness of fit test)	Hosmer–Lemeshow goodness of fit test
Number of covariate patterns = 48	Number of observations = 441
Pearson chi2(38) = 65.06	Number of groups = 8
Prob > chi2 = 0.052	Hosmer–Lemeshow chi2(8) = 3.69
	Prob > chi2 = 0.8838

5. Discussion of findings

The findings of this study demonstrate that food insecurity and inadequate dietary intake are common among women in Southwest Nigeria, with the majority of households concerned about food insufficiency and running out of food. These findings show that Nigeria cannot achieve SDG 2

(Zero Hunger) without addressing the structural imbalances outlined in SDG 5 (Gender Equality). This finding is in line with earlier studies such as Nkwonta, Auma, and Gong (2023), which highlighted that Sub-Saharan African countries, especially Nigeria and Uganda, face food and nutrition crises, prior to COVID-19 and the Ukraine-Russia war, having about 25% of the population food insecure, with children and women within the reproductive ages suffering from severe undernutrition and its associated health challenges. Where, prior to, also consistent with this study's findings, a study in Eastern Uganda found greater food insecurity and poorer dietary diversity among households in communities affected by major landslides in 2010 and 2018.

Women's empowerment through asset and property ownership was linked to household food insecurity, with women in the group having a lower odds ratio of 0.33, and women who have control over their time have a lower risk of running out of food (odds ratio of 0.019). This finding suggests that the link between women's empowerment and nutritional outcomes extends beyond the household level; it is a vital driver of macroeconomic stability and global development objectives. The level of education was linked to household food insecurity. Less educated parents typically have lower family incomes and lack the knowledge to address their children's health and nutritional needs.

This study provides evidence of the connection between household nutrient intake, food insecurity concerns and women's empowerment. It demonstrates that while SDG 2 focuses on food availability, it is insufficient without SDG 5 (Gender Equality), because high food insecurity results from a system in which women, as the primary food producers, have the least protection against shocks. To achieve zero hunger, we must address barriers to universal food access and eliminate malnutrition by ensuring nutritional adequacy.

6. Conclusion

This study examined the relationship between women's empowerment, dietary diversity, and household food security among 441 rural women in Southwest Nigeria. Findings confirm that food insecurity is widespread: approximately 86% of respondents expressed concern about food insufficiency, and 66% reported running out of food. Dietary access, particularly to meal replacement products, fruits, and protein-rich foods, was significantly associated with lower food insecurity. Women's ownership of assets (OR = 0.39) and control over personal time (OR = 0.001) were the strongest protective factors against running out of food, while households with more than three children (OR = 9.97) and those in which women bore sole responsibility for food provision (OR = 5.37) faced markedly higher food insecurity risk. This result revealed that families with food insecurity had lower dietary quality and diversity than their food-secure counterparts, and that achieving a minimal dietary diversity level was substantially associated with family food security.

These findings add to the body of evidence from Sub-Saharan Africa (Wei et al., 2021; Essilfie et al., 2021; NgaNdjobo, 2023) and confirm that multidimensional women's empowerment, particularly economic agency and asset rights, is a robust determinant of household food security. It revealed that a poor household's financial condition has a detrimental impact on food consumption, limiting dietary choices to affordable alternatives that may not provide the necessary nutrients for well-being. The study underscores that empowerment dimensions are not equally protective: time autonomy and property ownership outperform educational attainment in predicting food security outcomes among rural Nigerian women, a nuance deserving further theoretical elaboration.

From a sustainability governance perspective, the results directly support the implementation of SDG 5.a (ensuring women's equal rights to land and property) and SDG 2.1 (universal access to safe and nutritious food). Policymakers in Southwest Nigeria should prioritise community-level programs that: (1) facilitate legal access to land and asset ownership for rural women; (2) promote home food gardens and kitchen horticulture as low-cost dietary diversity interventions; and (3) redistribute household food provision responsibilities to reduce the burden borne by women alone.

Limitations and future research

This study is limited by its cross-sectional design and its reliance on self-reported dietary recall over three weeks. Future research should employ panel longitudinal data to capture causal dynamics, apply the FAO-FIES module for international comparability, and extend the sample to Northern Nigerian regions where food insecurity and gender disparities may be even more pronounced.

Informed consent statement

Informed consent was obtained from all subjects involved in the study.

Data availability statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy issues.

Conflicts of interest

The authors declare no conflict of interest.

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the authors used Grammarly to enhance the clarity, grammar, and readability of the English language text. Grammarly was employed solely for language editing purposes, including correction of grammatical errors, improvement of sentence structure, and refinement of word choice.

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