

Women empowerment and food security among urban crop farmers in Ekurhuleni, South Africa



 **Raisibe Pretty Ntsoane¹**

 **Sibongile Sylvia Tekana²**

 **Tulisiwe Pilisiwe Mbombo-Dweba³⁺**

^{1,2,3}*Department of Agriculture and Animal Health, College of Agriculture and Environmental Sciences, University of South Africa, Florida Campus, Roodepoort, South Africa.*

¹*Email: 10431764@mylife.unisa.ac.za*

²*Email: tekanss@unisa.ac.za*

³*Email: mbombtp@unisa.ac.za*



(+ Corresponding author)

ABSTRACT

Article History

Received: 11 June 2025

Revised: 17 October 2025

Accepted: 29 October 2025

Published: 14 November 2025

Keywords

Food consumption score

Food insecurity

Homestead food gardens

Urban household

Women empowerment.

Eating habits

Gendered food security

Food insecurity and gender inequality are the major threats to achieving the United Nations Sustainable Development Goals (SDGs) 2 and 5. A cross-sectional study was conducted to assess the empowerment of women, food security, and the relationship between women empowerment and food security in the City of Ekurhuleni Metropolitan Municipality, Gauteng Province, South Africa. Quantitative data were acquired from 216 randomly sampled urban crop farmers using a survey. Food Consumption Score (FCS) was employed to measure food security, and women's empowerment in agriculture was measured using Women's Empowerment in Agriculture Index (WEAI). Data were analysed using descriptive statistics and an ordered logistic regression model. The results showed that the majority of the households (89.4%) had an acceptable FCS, 9.3% had a borderline FCS, and only 1.3% had a poor FCS. The results also revealed that over half of the women (57.9%) were empowered. Age, educational level, employment status, business, garden size, autonomy in production, access to and decisions on credit, control over use of income, and workload were significantly associated with food security. In conclusion, the results show that an increase in women empowerment indicators, such as access to and decisions on credit, control over use of income and workload, and food security, reflects a profound relationship, influenced by socio-demographic factors. The results propose the urgency of concerted policy implications to address the synergies between women empowerment and household food security. Addressing gender gaps in agriculture and improving women's financial autonomy is recommended to improve household food security.

Contribution/ Originality: This study is among the few that have investigated the relationship between women's empowerment in agriculture and food security among urban women. The findings provide specific recommendations for government and policymakers to support women's empowerment and enhance food security in urban communities.

1. INTRODUCTION

Global food insecurity has been debated as an increasing developmental issue. As reported by the [FAO, IFAD, UNICEF, WFP, and WHO \(2024\)](#), the hunger situation is predicted to worsen by 2030, making it difficult to achieve Sustainable Development Goal (SDG) 2. This raises concerns about future food security, particularly in developing countries such as those in the South African Development Community (SADC) regions. Reports indicate that SADC countries are at a higher risk of experiencing food insecurity due to factors such as rapid population growth, recurring

natural disasters, and lack of development (Muzhinji & Ntuli, 2020). Similarly, evidence from South Africa indicates that several households remain food insecure. In South Africa, this is attributed to slow economic growth, which has resulted in moderate and severe food insecurity affecting approximately 19.7% and 8.0% of households, respectively (Statistics South Africa, 2025). Furthermore, evidence suggests that food insecurity is even higher among farming households in South Africa (Sambo, Oguttu, & Mbombo-Dweba, 2025; Shelembe, Hlatshwayo, Modi, Mabhaudhi, & Ngidi, 2024). For instance, Shelembe et al. (2024) found food insecurity ranging from mild (34.2%) to moderate (36.2%) and severe (15.8%), while Sambo et al. (2025) reported mild (56.62%) to moderate (6.06%) food insecurity.

In Gauteng Province, where the study was conducted, results from the General Household Survey (GHS) indicate that a large proportion (75.9%) of households in Gauteng had adequate food security compared to most provinces (Statistics South Africa, 2025). However, results of other studies conducted in Gauteng have shown that the number of food-insecure households is higher than the figures reported in the GHS, especially in townships. For instance, a study conducted in Tembisa by Nenguda and Scholes (2022) found that 71% of households in urban areas experienced food insecurity. Likewise, in the City of Tshwane, Mazenda, Manzi, Mushayanyama, and Ngarava (2022) reported that only 39.2% of households were food secure, with 16.6%, 12.1%, and 32.1% being mildly, moderately, and severely food insecure, respectively.

Globally, women are generally considered to be more vulnerable to food insecurity than men (FAO et al., 2024). Similar trends have also been observed in South Africa. The 2023 GHS report revealed that 21.5% and 8.0% of female-headed households experienced moderate and severe food insecurity, respectively, compared to 18.4% and 7.9% of men (Statistics South Africa, 2025). This disparity is attributed to gender inequalities that continue to marginalize women and create barriers to their access to resources (Anderson, Reynolds, Biscaye, Patwardhan, & Schmidt, 2020). In the agricultural sector, despite women contributing significantly to food production (FAO, 2020), reports indicate that they continue to face difficulties in accessing productive resources such as land, water, credit, and extension services (Adomaa, 2022).

The concept of empowerment has gained popularity globally, especially in relation to food security. Internationally, the positive linkage between women empowerment and food security has been documented in previous studies among rural dwellers (Huang, Nie, & Jia, 2023; Sarker, Roy, Yeasmin, & Asaduzzaman, 2024; Tesafa, Mulugeta, & Tsehay, 2025). In South Africa, Limpopo Province, Murugani and Thamaga-Chitja (2019) found empowerment indicators such as input in productive decisions and public speaking to be positively associated with food security, while access to and decisions on credit had an adverse effect. Meanwhile, in KwaZulu-Natal, Sharaunga (2015) found a correlation between food security and women's empowerment in agriculture across dimensions such as socio-cultural empowerment, economic agency, financial capital empowerment, and physical capital empowerment.

However, the focus of the above-mentioned studies was on rural women, highlighting a research gap concerning urban women. Although women in urban areas are often considered advantaged in many aspects, including economic opportunities and resources, there are women in lower strata within urban settings. Women in urban areas face economic inequalities and are underrepresented in decision-making processes (Menon, Ranjitha, & Sharma, 2020). This indicates that gender inequality remains a persistent issue across all societies. Global statistics show an increase in female-headed households (Trias-Prats & Esteve, 2025), emphasizing the need for urgent action to address gender disparities. To fill this critical gap in existing literature, this study aims to examine the relationship between women empowerment and household food security among urban crop farmers. The goal is to provide empirical evidence that can inform policies on women empowerment and food security in the study area. The specific objectives of this study are as follows: (1) To assess the level of empowerment of urban crop farmers in the study area, using the Women's Empowerment in Agriculture Index (WEAI); (2) To determine the household food security status of urban crop farmers in the study area; (3) To analyze the relationship between women empowerment and household food security among urban crop farmers in the study area.

2. EMPIRICAL LITERATURE REVIEW

2.1. *Women Empowerment in Urban Areas*

Studies have shown a positive correlation between women empowerment and urbanization (Cinar & Ugur-Cinar, 2018; Kaur, 2023). This was attributed to higher education levels and more employment opportunities among women residing in urban areas (Kaur, 2023). However, literature shows that despite this positive association, the lack of empowerment in urban areas remains prevalent (Biswas & Banu, 2023; Huang et al., 2023). For example, a comparative study conducted in India revealed that more women were economically disempowered in urban areas than in rural areas (Biswas & Banu, 2023). Additionally, results from a metropolitan city in Pakistan indicated that women experienced disempowerment in control over resources, mobility, and participation in decision-making (Hussain & Jullandhry, 2020).

Similarly, in South Africa, it has been reported that women in urban areas face economic challenges and limited employment opportunities compared to men (Dunn & Maharaj, 2025). In line with these findings, the Enterprises University of Pretoria (Pty) Ltd (2023) added that South African women's participation in the economy and labor market remains limited. This low participation of women in the labor force has been reported at both the national and provincial levels. According to Statistics South Africa, about 55.8% and 64.2% of women participated in the labor force at the national and provincial levels, respectively, compared to 65.6% and 74.9% of their male counterparts (Statistics South Africa, 2024a). This indicates the persistent gender disparities in the country. Although significant progress has been made toward addressing these challenges, more gender-responsive interventions are still necessary (Dhamija, Roychowdhury, & Shankar, 2025).

2.2. *Women Empowerment in Agriculture and Food Security in Urban Areas*

Lack of ownership over agricultural land among urban women exacerbates food insecurity as they are not able to cultivate diversified crops (Nchanji et al., 2023), thus negatively affecting their ability to consume diverse diets. In the literature, lack of dietary diversity has been linked to poor dietary quality, micronutrient deficiencies, and non-communicable diseases (Madlala, Hill, Kunneke, & Faber, 2024). In a country like South Africa, where unemployment levels are high, urban agriculture has the potential to contribute to women empowerment, resulting in improved household food security (Hando & Legesse, 2022). However, lack of access to productive resources such as agricultural land and credit among women has been documented across several provincial contexts (Commission for Gender Equality, 2024). While this is indicative of the prevailing gender disparities in the country, it also limits women's participation in urban agriculture, thus negatively affecting their agricultural productivity (Manyike, Taruvinga, & Zhou, 2025; Thobejane, Swanepoel, Van Niekerk, & Van Der Merwe, 2023) and worsening food insecurity. Women's limited access to land may result in heavy reliance on market food, adding more burden among low-income earners. Kabahinda (2023) argues that women in urban areas require land rights to improve their food security and financial independence through their own consumption and selling of their produce.

3. MATERIALS AND METHODS

3.1. *Study Area*

The study was conducted in the City of Ekurhuleni Metropolitan Municipality in Gauteng Province, South Africa (Figure 1). Ekurhuleni Metropolitan Municipality is predominantly urbanized. It is characterized by warm summers, dry winters, and an average annual rainfall of approximately 148 mm. The municipality functions as an industrial and logistics hub. Agriculture contributes only 0.42% to the economy, which is the lowest among all economic sectors (City of Ekurhuleni, 2021). The study area was selected because it is among the regions where the homestead food garden programme has been implemented to address food insecurity. For this investigation, seven townships were purposively selected: Tembisa, Katlehong, Tsakane, Etwatwa, Duduza, Kwa-Thema, and Germiston, as they have high potential for agricultural activities.

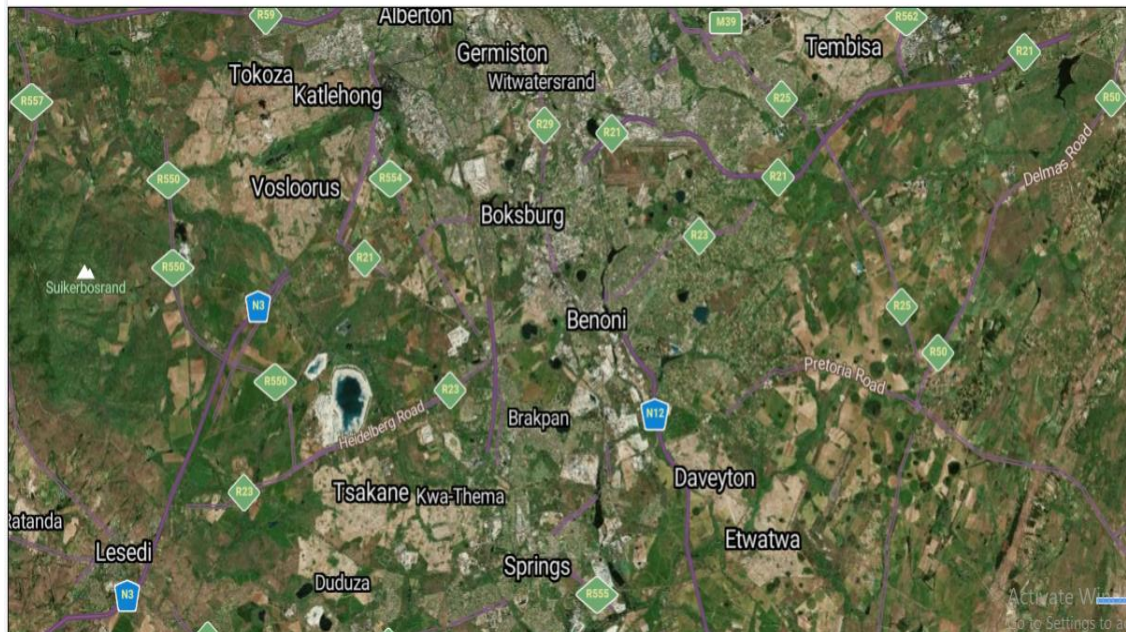


Figure 1. Map of the Ekurhuleni Metropolitan Municipality.

3.2. Study Design

This study employed a quantitative, cross-sectional design to achieve the objectives of the study.

3.3. Study Population and Sampling Technique

The study population included female crop farmers profiled by the Gauteng Department of Agriculture, Rural Development and Environment (GDARDE) for their homestead food garden programme in 2022/2023. The sample size of 216 was selected randomly from the total population of 495 using a formula by Krejcie and Morgan (1970).

3.4. Data Collection

Primary data were collected from female crop farmers using a structured questionnaire, which was administered by the researcher. The questionnaire comprised four sections: general information, socio-economic characteristics, WEAI modules, and Food Consumption Score (FCS). To collect data, participants were visited by the researcher at their homes, gardens, and community venues. Prior to data collection, respondents were provided with an information sheet and a consent form. Data were collected from 3 July to 26 August 2024.

3.5. Data Analysis

Numerical data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 28.0 and Stata version 15.0. To achieve the study objectives, descriptive statistics and the Ordered Logistic Regression Model (OLRM) were employed. For descriptive statistics, measures such as minimum, maximum, mean, standard deviation, frequency, and percentages were used. FCS was used as a proxy for food security and as an outcome variable for the econometric model. This indicator was chosen because of its longer recall period and broader overview of food consumed (FAO & WFP, 2012). WEAI was used to measure women empowerment. A detailed explanation of how each of these was used in the study is presented below.

3.5.1. Computing the WEAI

WEAI is a survey-based index developed to measure empowerment and inclusion of women in the agricultural sector (Alkire et al., 2013). An adapted WEAI was used in this study to capture only the Five Domains of

Empowerment (5DE) of women involved in urban crop production in the study area. These domains were measured and weighted as recommended by Alkire et al., (2013). The 5DE and their indicators include production (input in productive decisions, autonomy in production), resources (ownership of assets, purchase, sale or transfer of assets, and access to and decisions on credit), income (control over use of income), leadership (group membership and speaking in public), and time (workload and leisure). Table 1 shows the detailed WEAI description.

Table 1. The 5DE, their indicators, description and weights.

5DE	Indicators	Description	Weight
1. Production	1. Input in productive decisions	Ability to make decisions either solely or jointly about food and cash crop farming, livestock, and fisheries.	1/10
	2. Autonomy in production	Ability to act according to one's own values and judgment inputs regarding the types of crops to buy, when to take or sell crops to market, and livestock purchasing.	1/10
2. Resources	3. Ownership of assets	Sole or joint ownership of household assets such as land, livestock, consumer durables, and agricultural equipment.	1/15
	4. Purchases, sales, or transfers	Decision-making authority over the purchase, sale, and transfer of household assets.	1/15
	5. Access to and decisions on credit	Decision-making authority over obtaining credit and using credit proceeds	1/15
3. Income	6. Control over use of income	Sole or joint control over income and expenditures.	1/5
4. Leadership	7. Group membership	Active member in at least one economic or social group.	1/10
	8. Speaking in public	Ability to speak in public for reasons such as ensuring proper payment of wages for public work programs, protesting the misbehavior of authorities, or helping to decide on infrastructure.	1/10
5. Time	9. Workload	The productive and domestic workload in a 24-hour period.	1/10
	10. Leisure	Subjective satisfaction with available leisure time	1/10

Source: Alkire et al. (2013).

3.5.2. Computing the FCS

FCS is a food frequency proxy that was designed by the World Food Programme (2008). It has been used extensively in previous food security studies (Cheteni, Khamfula, & Mah, 2020; Abegunde, Sibanda, & Obi, 2022; Acheampong, Obeng, Opoku, Brobbey, & Sakyiamah, 2022). Using a seven-day recall as a reference period, FCS examines food consumed by households. Food consumed is then grouped into nine food groups and summed. As guided by WFP, values were capped at seven. The frequency of each food group consumed was then multiplied by its weight to obtain a weighted score. Since households had high consumption of oil and sugar, seven was added to the standard threshold as recommended by the World Food Programme (2008). The scores were used to categorize households into three consumption groups, as shown in Table 2.

Table 2. Three food consumption categories of FCS.

FCS	Profile
0 – 28	Poor consumption score
28.1 – 42	Borderline consumption score
> 42	Acceptable consumption score

3.5.3. Ordered Logistic Regression Model (OLRM)

OLRM was used in the study to determine the ordinal response variable (Grilli & Rampichini, 2021). OLRM was selected since the outcome variable had three responses. The model is used to determine whether the variables

used in the study will predict the probability of households falling into either a poor, borderline, or acceptable consumption group. The equation of the model is expressed as follows.

$$\text{Log} \left(\frac{P(Y \leq k)}{P(Y > k)} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \dots + \beta_n X_n + \varepsilon \quad (1)$$

Where

Y = The food security status (1 = poor, 2 = borderline, 3 = acceptable consumption score).

β_0 = The parameter to be estimated.

x = Set of independent variables.

ε = Random error term.

Table 3 shows the independent variables used in the OLRM to determine the relationship between women empowerment and household food security and their expected outcomes.

Table 3. The independent variables, their values, descriptions, and expected outcomes.

Variables	Measurement type	Description and value	Expected sign
Age	Continuous	Number of years	-
Household size	Continuous	Total number of household members	+
Farming experience	Continuous	Total number of years in farming	+
Monthly household income	Dummy	Total amount of money earned monthly	+
Household head gender	Dummy	Gender of the household head (0 = Male; 1 = Female)	-
Educational level	Dummy	Highest level of schooling completed	+
Employment status	Dummy	Work status (0 = Not employed; Employed = 1)	+
Business	Dummy	Owns a business (0 = if no; 1 = if yes)	+
Garden size	Dummy	Size of the garden in operation	+
Frequency of extension visits	Dummy	Number of times received extension visits	+
Overall empowerment score	Continuous	Empowerment score of women	+
Input in productive decisions	Dummy	0 = If a woman is inadequately empowered; 1 = If a woman is adequately empowered	+
Autonomy in production	Dummy	0 = If a woman is inadequately empowered; 1 = If adequately empowered	+
Ownership of assets	Dummy	0 = If a woman is inadequately empowered; 1 = If adequately empowered	+
Access to and decisions on credit	Dummy	0 = If a woman is inadequately empowered; 1 = If adequately empowered	+
Control over use of income	Dummy	0 = If a woman is inadequately empowered; 1 = If adequately empowered	+
Workload	Dummy	0 = If a woman is inadequately empowered; 1 = If adequately empowered	+

Before running the OLRM, univariable regression was performed to assess the relationship between the dependent outcome and each predictor (Padmanaban, Mishra, & Srinivasan, 2024). Predictors with a p-value less than 0.25 in the univariable analysis were included in the next step, which involved multivariable regression. This step evaluates the correlation between the dependent outcome and multiple predictors simultaneously, with other predictors held constant. A manual backward selection process was used, and predictors with a p-value less than 0.157 were selected for the final regression model (Zapiain, 2025). Prior to performing the OLRM, assumptions must be verified to ensure the model's validity and reliability. In this study, the proportional odds assumption and multicollinearity were tested to confirm no violations. The parallel regression assumption yielded a p-value of 0.71, indicating no violation. Multicollinearity was assessed using the Variance Inflation Factor (VIF), with predictors

having a VIF less than 5 to prevent high correlation. The tolerance values for predictors were below 0.20, indicating low multicollinearity (Mahmood, 2024).

The -2 log-likelihood (-121.94) was employed to measure how well a statistical model fits the set of observations. The goodness of fit had a chi-squared value of 42.36 with a p-value of 0.0006, suggesting that the fitted model has a substantial improvement in the independent variables used to predict the outcome compared to the null model. The deviance test showed a p-value of 1, while the deviance chi-square tests were statistically not significant ($p > 0.05$), which indicates that the model provides a satisfactory fit to the observed data.

3.6. Ethical Consideration

This study was ethically approved by the College of Agriculture and Environmental Sciences' Ethics Committee (Ref #: 2024/CAES_HREC/2583). Gatekeeper permission to conduct the study was obtained from the GDARDE.

4. RESULTS AND DISCUSSIONS

4.1 (a). Socio-Demographic Characteristics of the Participants

Table 4 shows the continuous socio-demographic data of the respondents. The age ranged from 19 to 102 years old, with a mean of 50.31. The majority of the farmers were above the age of 50 years. Conversely, a similar aging pattern is observed in a study conducted among the homestead food gardeners in Gauteng by Maponya and Oelofse (2023). An important issue emerging from these findings is the lack of youth participation in agriculture, raising concerns for the future of food gardening as a livelihood activity. This can be explained by the lack of interest in agricultural activities, suggesting that younger generations in urban areas prefer to participate in other economic activities. Nigus, Ketema, Haji, and Sileshi (2024) reported that younger farmers are more inclined to adopt improved farming innovations.

Moreover, ageing has been found to affect farmers physically, thus leading to decreased agricultural production (Tong et al., 2024). Older farmers may not be physically fit enough to execute demanding agricultural activities, thus exacerbating food insecurity. It can therefore be argued that, since being young captures the inclination to adapt to sustainable agricultural practices, it may be associated with improved productivity, thus translating to improved food security.

Household size varied between 1 and 18 members, with a mean of 5.17. These results align with those observed by the GHS, as reported by Statistics South Africa (2024c), where over 87% of households have fewer than five members. In KwaZulu-Natal, Lembete, Agyepong, and Mbombo-Dweba (2024) observed that households with more members are more likely to engage in food gardening to enhance their food security. It can be argued that larger households require more food, and gardening thus plays a role in supplementing food supplies. This is consistent with the findings of Olufemi-Phillips, Igwe, Ofodile, and Louis (2024), who found that an increase in household size poses a significant threat to household food security, indicating that as the dependency ratio increases, additional resources are needed to meet the food requirements of all members.

The farming experience ranged from 1 to 30 years, with a mean of 6.47. It was discovered that the majority (71.8%) of the respondents had a farming experience of less than 5 years. This could be attributed to the fact that agriculture is scarce in urban areas, considering limited access to farming land and increasing urbanization. This is concerning as farming experience has been found to influence agricultural productivity (Sennuga, Isola, Bamidele, Ameh, & Olaitan, 2024).

This may be attributed to the fact that increased agricultural productivity is assured by many years of experience. This particularly implies that increased agricultural production will minimize the chances of the household experiencing food insecurity through food and income supplements.

Table 4. Continuous socio-demographic characteristics of the participants (n = 216).

Variables	Mean	Standard deviation	Minimum	Maximum	Range
Age (Years)	50.31	13.51	19.00	102.00	83.00
Household size	5.17	2.56	1.00	18.00	17.00
Farming experience (years)	6.47	6.26	1.00	30.00	29.00

Source: Field data (2024).

4.1 (b). Demographic Characteristics of the Participants

Table 5 presents the demographic characteristics of the respondents. The results in Table 5 show that 56.9% of households were headed by females, while 43.1% were headed by males. These findings are consistent with the study conducted by Mahlangu, Maponya, and Letsoalo (2024) in Gauteng, South Africa, which concluded that female-headed households predominantly engaged in food garden activities. This aligns with national statistics indicating that 42.3% of households in South Africa are led by women (Statistics South Africa, 2024b). Furthermore, consistent with previous research, which suggests that households led by women are more vulnerable to food insecurity (Kajiita & Kang'ethe, 2024), this indicates that women may participate in food gardening as a strategy to mitigate food insecurity.

Regarding educational attainment, most women (72.2%) had attained secondary education. This suggests that most respondents could read and write. Similar findings were reported in a study on backyard food gardens conducted in Gauteng Province, South Africa, where all the women attained formal education (Thomas & Terblanche, 2021). Secondary education is associated with the adoption of innovation and increased agricultural productivity (Odoro-Ofori, Prince, & Elfreda, 2014). Rudolph, Muchesa, and Sibanda (2024) demonstrate the importance of education among women in transforming agriculture and food security. This may suggest that education serves as an integration of a gender lens within the contexts of agriculture and food security.

Table 5. Socio-demographic characteristics of the participants (n = 216).

Variables	Category	Frequency (n)	Percentage (%)
Household head	Female	123	56.9
	Male	93	43.1
Educational level	No formal education	11	5.1
	Primary	38	17.6
	Secondary	156	72.2
	Tertiary	11	5.1
Employment status	Unemployed	83	38.4
	Employed part-time	3	1.4
	Employment full-time	12	5.6
	Pensioner	47	21.8
Business	Stipends	71	32.9
	Does not own a business	49	22.7
Monthly household income	Owns a business	167	77.3
	<R1500	26	12.0
	R1501 - R2500	46	21.3
	R2501 - R3500	41	19
	R3501 - R5000	55	25.5
Frequency of extension visit (Per year)	> R5001	48	22.2
	<1	22	10.2
	2 - 4	148	68.5
	5 - 7	28	13
Garden size (Sqm)	> 8	18	8.3
	< 10	25	11.6
	11- 50	21	9.7
	51 - 250	67	31
	251 - 2500	57	26.4
	>2501	46	21.3

Source: Field data (2024).

Unemployment was reported by 38.4% of women in this study, with 32.9% receiving monthly stipends provided by the government and non-governmental organizations (NGOs), while another 21.8% were pensioners (Table 5). These results are expected, especially considering the 31.8% unemployment rate reported in the City of Ekurhuleni report (City of Ekurhuleni, 2021) and in line with the high unemployment rate of women nationally, which is currently 35.8% based on the statistical findings from the Quarterly Labour Force Survey as reported by Statistics South Africa (2024d). Furthermore, considering the educational level that the majority of respondents had attained, these results suggest that secondary education alone is not enough to secure formal employment.

With regard to business, the majority of women (77.3%) owned a business. This finding may suggest a sense of financial independence among women. Midamba, Jjengo, and Ouko (2025) found women's non-farm income to be a contributor to increased agricultural productivity and additional income, especially for farmers whose farms generate only a small amount of revenue. This reduces reliance on farm income, which can be subjected to threats. Moreover, Abu and Soom (2016) postulate that one of the main reasons farmers own businesses is to supplement their household incomes and improve their food security. Off-farm income offers farmers income diversification and ensures that households sustainably continue to obtain food, especially when unexpected events occur on the farms.

As illustrated in Table 5, about 25.5% of the respondents fell within the R3501 and R5000 income bracket. This means that the majority of respondents earned R5000 or less. This implies that the households in the study were a low socio-economic group. According to reports, a monthly household food basket costs an average of R5,433.70 (Pietermaritzburg Economic Justice & Dignity Group, 2025). Therefore, an average monthly income of R5000 does not sufficiently meet all the household's needs. A household food basket is a term used to refer to the affordability of 44 basic food items that most households need each month (Opperman, 2023).

All respondents in the current study had access to extension visits as they participated in the government programme (Table 5). However, the frequency of extension visits received by respondents was inconsistent. For example, 68.5% received extension visits at least two to four times per year, while only 10.2% received extension visits once annually. The frequency of extension support in this study exceeds findings from several other studies in South Africa. In the Free State Province, Myeni, Moeletsi, Thavhana, Randela, and Mokoena (2019) reported that 99% of farmers did not have access to extension support. Similarly, in Limpopo Province, Mkansi, Ledwaba, and Mokhaukhau (2025) found that only 36.9% of farmers received extension support. These results may be attributed to the fact that the respondents are part of the government programme, which includes access to extension services as one of its key deliverables (GDARDE, 2024). Extension support involves disseminating new information and training farmers in sustainable farming practices, which can lead to increased productivity and improved food security (Raidimi & Kabiti, 2019).

A significant proportion of women (52.3%) operated a garden size of 250 sqm or less. A garden size of less than 1000 sqm is considerably inadequate to meet household food security needs by most standards. For example, a review article by Carstens, Hay, and Van der Laan (2021) concluded that, in order to meet food security needs, an average household requires a garden size of at least 1000 m². Small garden sizes have been linked to low productivity and food insecurity and limit households' ability to generate income from excess garden produce (Khumalo & Sibanda, 2019). Additionally, farm size can influence the adoption of new technologies and farming practices (Hu, Li, Zhang, & Wang, 2022). This finding corroborates the key conclusion by Kanosvamaha, Follmann, and Tevera (2024), whose research on communal gardens in Cape Town, South Africa, revealed that the average garden size was 900 sqm with an average of four members. Generally, access to land is a challenge in urban areas due to high competition between agriculture and urban expansion.

4.2. The Empowerment Level of the Respondents in the Study Area

Table 6 shows the WEAI indices based on the 5DE score and their index value. The results indicate that 42.1% of women were not adequately empowered in one or more domains. There is a higher empowered headcount score in

this study compared to a study conducted in Brazil by [Vedana, Garcias, and Arends-Kuenning \(2023\)](#). This suggests that 57.9% of women in the current study had adequate achievements in most indicators. This may be attributable to the fact that 57.9% of households in this study were female-headed, which naturally makes women the decision-makers. This view is supported by [Beriso, Amare, and Eneyew \(2023\)](#), who found that women heading households are more likely to have greater decision-making power. This indicates that the absence of men in households may protect women from patriarchal systems where they are viewed as secondary decision-makers. The results further show that 16.8% of disempowered women had inadequate empowerment in the weighted domains, indicating that these women failed to achieve adequacy in many areas. Women's M0 value in this study is 0.244. There are similarities in the disempowered index between this study and previous literature. In Pakistan, the disempowered index for women was 0.251 ([Amber & Fakhar, 2019](#)). The 5DE score for women in this study is 0.756, with a mean disempowerment of 0.12. The 5DE score corroborates the findings of [Amber and Fakhar \(2019\)](#).

Table 6. WEAI 5DE score.

Indices	Index value
Disempowered headcount (H)	42.1%
Empowered headcount (1-H)	57.9%
Intensity of empowerment (A)	16.8%
Disempowered index ($M0 = H \times A$)	0.244
5DE score ($1 - M0$)	0.756
Mean disempowerment	0.12
Observations	216

Source: Field data (2024).

Table 7 presents the disaggregation of ten indicators related to women's empowerment. The results indicate that control over income use (96.8%), input into productive decisions (95.4%), and group membership (95.8%, $n=207$) contributed most significantly to women's empowerment. The high percentage of input into productive decisions may be attributed to the fact that most women are able to make decisions regarding agricultural activities. In Kenya, empowerment in this domain has been shown to significantly enhance agricultural productivity compared to other indicators ([Diirro, Seymour, Kassie, Muricho, & Muriithi, 2018](#)). [Connors et al. \(2023\)](#) found that women who were sufficiently empowered in this indicator produced diverse food crops, which improved the dietary diversity of food consumed within their households. This suggests that women's empowerment in input into productive decisions is vital for their livelihoods, as it diversifies both income sources and food supplies.

Meanwhile, the positive results on control over income use may be attributed to women having decisions on income-generating activities such as cash crop farming (84.3%), non-farm activities such as owning a business (77.3%), and 61.6% earning income from employment or an old-age social grant. This may suggest that women's ability to earn their own incomes gives them more autonomy in how they utilize it. The findings further depict income diversification among women. Moreover, [Wenda, Fon, Molua, and Longang \(2024\)](#) observed that women being empowered in this indicator leads to improved household nutrition, suggesting that women spend most of their income on nutritious foods.

Consistent with the results found by [Thobejane et al. \(2023\)](#) in Gauteng Province, South Africa, this study found that 95.8% of women were empowered in the group membership indicator. There are several benefits associated with belonging to groups. Literature states that group membership facilitates information and agricultural input sharing, thus enabling farmers to adopt improved farming practices and overcome several obstacles they face ([Sinyolo & Mudhara, 2018](#)). Generally, this implies that social cohesion encourages the sharing of resources among women. Belonging to groups is a form of social capital that affords women access to resources that might be difficult to obtain individually. Consistent with previous studies, the majority (81.0%) of women had ownership of assets (**Table 7**). For instance, in Limpopo Province, South Africa, [Murugani and Thamaga-Chitja \(2019\)](#) and in Bangladesh, [Sraboni,](#)

Malapit, Quisumbing, and Ahmed (2014) found that 98% and 92.5% of women were empowered in the ownership of assets, respectively. In the current study, these findings could be linked to the high number of women-led households, as shown in section 3.1, hence the ownership of assets. Women's ownership of assets increases their bargaining power and financial autonomy, thus improving food security (Jemaneh & Shibeshi, 2023). This means that women empowered in this indicator tend to exert influence on intra-household bargaining, suggesting that these women can have their voices heard. The first indicator that significantly contributed to the disempowerment of women in the study is the purchase, sale, or transfer of assets (Table 7). The study found that only 15.3% of women were empowered regarding this indicator. These findings contrast with those of Murugani and Thamaga-Chitja (2019), who reported that 99.1% of women in Limpopo Province, South Africa, were empowered. The discrepancies between these findings may be attributed to differences in study area characteristics. This indicator considers productive resources such as land (Alkire et al., 2013); therefore, given that the current study focused exclusively on women based in Gauteng Province, the results are not unexpected. In Gauteng, access to agricultural land is limited, as it is the smallest province in South Africa (GDARDE, 2024). Consequently, this suggests that women in urban areas face greater disadvantages, encountering both process-related and structural challenges.

The other indicator that contributed to the disempowerment of women was access to and decisions on credit. In line with this finding, in Eritrea, Bahta, Strydom, and Donkor (2015) found that only 33% of women were able to achieve this indicator. What is interesting is that this study found the reason to be limited access to social and collateral support. Meanwhile, the women in the study showed strong social networks. Therefore, this may suggest that these women feared risk-taking and lacked confidence to borrow money.

Similar to a previous study by Thobejane et al. (2023), the majority of women (78.7%) in this study were empowered in the public speaking indicator. Considering their group membership participation, these results suggest that these women have built strong networks that provide them with a safe space to voice their opinions in public. Moreover, Hashimy et al. (2023) believe that being able to speak in public can be associated with personal and professional advancement. Women who can speak in public, especially when standing up against unfair treatment, are less likely to be subjected to unfair practices such as patriarchal and societal norms.

Regarding workload, the results indicate that only 39.8% of women were empowered. Based on a detailed 24-hour time allocation, it is evident that women are the primary participants in household responsibilities. Consequently, spending eight hours a day on agricultural activities confirms what is indicated in the literature: women predominantly play a significant role in the agricultural sector (FAO, 2020). Workload has been identified by several studies as an indicator contributing to disempowerment (Cullen, 2019; Sraboni et al., 2014).

Table 7. Indicators of the five domains of empowerment adequacy score (n = 216).

5DE	Indicators	Adequacy percentage (%) (Mean)
Production	Input in productive decisions	95.4 (0.95)
	Autonomy in production	81.9 (0.82)
Resources	Ownership of assets	81.0 (0.81)
	Purchase, sale, or transfer of assets	15.3 (0.15)
	Access to and decisions on credit	35.2 (0.35)
Income	Control over use of income	96.8 (0.97)
Leadership	Group membership	95.8 (0.96)
	Speaking in public	78.7 (0.79)
Time	Workload	39.8 (0.40)
	Leisure	34.3 (0.34)

Source: Field data (2024).

As a result, the current study shows that only 34.3% of women are satisfied with their leisure time. Leisure is the second indicator that significantly contributes to women's disempowerment. This suggests that workload prevents women from engaging in leisure activities. Therefore, women often have to trade off their leisure time to manage

their high workload. Consistent with findings on workload and leisure, Wang, Gu, Nie, and Dogot (2024) found that, overall, time is the most significant domain contributing to women's disempowerment.

4.3. The Food Security Status of the Households in the Study Area

Table 8 shows the distribution of households by FCS. The results indicate that a large proportion of households (89.4%) had an acceptable consumption score. The number of respondents with an acceptable consumption score is higher compared to previous studies conducted in other parts of South Africa. For example, in KwaZulu-Natal, Zaca et al. (2025) found that 72.5% of households had an acceptable consumption score. Meanwhile, in Mpumalanga Province, Agholor and Yusuf (2024) reported that only 50.01% of households had an acceptable FCS. The findings in the current study may be explained by the fact that women were the beneficiaries of the food security programme, as previous studies have found urban households in South Africa to be food insecure (Mudau & Mahlatsi, 2022; Nenguda & Scholes, 2022). Conversely, in KwaZulu-Natal, Thamaga-Chitja, Tamako, and Ojo (2025) reported that over 84.4% of urban households are mildly food insecure. Additionally, a study conducted in KwaZulu-Natal by Ngema, Sibanda, and Musemwa (2018) concluded that government food security projects are effective in improving household food security.

Table 8. Household FCS for a period of 7 days (n = 216).

FCS level	Range	Frequency	Percentage	Mean	Standard deviation
Poor	0 – 28	3	1.4	24.00	1.00
Borderline	28.1 – 42	20	9.3	39.95	4.36
Acceptable	>42	193	89.4	70.88	14.32
	23 – 96	216	100	67.00	17.72

Source: Field data (2024).

Table 9. Ordered logistic regression model of FCS on women empowerment and socio-demographic variables (n = 216).

Variables	Coefficient	Standard error	P>z	Marginal effects		Acceptable
				Poor	Borderline	
Socio-demographic variables						
Age	-0.054*	0.028	0.052	0.001	0.003	-0.004
Household size	1.001	0.721	0.162	-0.012	-0.061	0.073
Farming experience	0.022	0.068	0.749	-0.000	-0.001	0.002
Monthly household income	0.010	0.244	0.688	-0.001	-0.006	0.007
Household head gender	-0.174	0.630	0.782	0.002	0.011	-0.013
Educational level	3.060***	1.104	0.006	-0.037	-0.184	0.221
Employment status	1.371*	0.703	0.051	-0.017	-0.083	0.099
Business	2.136**	0.887	0.016	-0.026	-0.129	0.154
Garden size (sqm)	-0.507*	0.295	0.086	0.006	0.031	-0.037
Frequency of extension visits	0.565	0.520	0.277	-0.037	-0.034	0.041
Empowerment variables						
Empowerment score	1.772	1.770	0.317	-0.021	-0.107	0.107
Input in productive decisions	0.9410	1.288	0.461	-0.011	-0.057	0.069
Autonomy in production	-2.854**	1.244	0.022	0.034	0.172	-0.206
Ownership of assets	0.228	0.846	0.788	-0.003	-0.014	0.016
Access to and decisions on credit	0.785*	0.467	0.094	-0.009	-0.047	0.057
Control over use of income	2.431*	1.411	0.085	-0.029	-0.147	0.176
Workload	1.697*	1.874	0.089	-0.141	-0.105	0.146
Number of observations	=216					
LR chi ² (17)	=42.36					
Prob > chi ²	=0.0006					
Pseudo R ²	=0.258					

Note: ***=p<0.01; **=p<0.05; *=p<0.1.

4.4. The Relationship Between Women Empowerment, Socio-Demographic Characteristics, and Food Security Status in the Study Area

Age is an important factor in food security. The model results indicated that age had a negative association and was statistically significant (Coeff=-0.05; $p=0.052$) with FCS (Table 9) at a 10% level. This suggests that each additional year of age increased the chances of households falling into the poor and borderline FCS categories by 0.07% and 0.33%, respectively, thus decreasing the likelihood of falling under the acceptable category by 0.40%. Similarly, Nontu et al. (2024) also found this variable to be negative and significant for food security, suggesting that younger farmers are more productive than older ones. Moreover, Pourebrahim et al. (2024) found that economic factors, including income and employment, are determinants of food insecurity among older households. The reason younger people tend to be food secure is likely because they are still physically fit enough to engage in agricultural and income-generating activities.

Educational level was positively associated (Coeff=3.06) and statistically significant ($p=0.006$) with FCS at the 1% level. Women's attainment of higher education decreased the likelihood of belonging to the poor and borderline FCS by 3.70% and 18.44%, respectively, while the likelihood of having an acceptable FCS increased by 0.13%. Similarly, in Zambia, Nkomoki, Bavorová, and Banout (2019) found that increased educational attainment translates to higher FCS. This is because educated women are more likely to secure employment opportunities with better income, thus giving them bargaining power.

Similarly, employment status positively and significantly affected FCS (Coefficient=1.37; $p=0.051$) at the 10% level. The likelihood of an employed respondent being in the poor and borderline categories decreased by 1.65% and 8.26%, respectively, while the likelihood of being in the acceptable FCS increased by 9.91%. Surprisingly, a study conducted in the rural areas of the Eastern Cape found contrasting results, with employment status being negatively correlated but not statistically significant to FCS. These inconsistencies may be explained by the fact that employment status plays a crucial role in determining food security status in urban areas (Chakona, 2022). Considering that Nenguda and Scholes (2022) found heavy reliance on food purchased in the markets among urban dwellers in Gauteng Province, employment is critical as it enables households to earn the income needed to procure food.

Owning a business was positively correlated (Coeff= 2.14, $p=0.016$) with an FCS at the 5% level. The likelihood of a respondent who has a business being in the poor and borderline categories decreased by 25.77% and 12.87%, respectively, while their likelihood of being in the acceptable FCS increased by 15.45%. According to Abu and Soom (2016), engaging in other income-generating activities can help supplement household income, making it easier for households to diversify their diets. Meanwhile, garden size negatively and significantly affected (Coeff= -0.51; $p=0.086$) FCS at a 10% level. An increase in the size of the garden increased the chances of households falling into the poor and borderline FCS groups by 0.61% and 3.05%, respectively, while the chances of falling into the acceptable FCS were lowered by 3.66%. Typically, garden size is found to be positively related to food security as it allows for the production of a wider range of crops (Naicker, Naidoo, & Ngidi, 2023; Onyenekwe, Amaechina, Onah, Ayogu, & Eze, 2025). However, the results of this study found an inverse relationship. This paradox may be explained by the fact that women in this study were resource-constrained; therefore, larger garden sizes may be difficult to operate. In Zambia, Petros, Feyissa, Sileshi, and Shepande (2025) found that an increase in farm sizes will lead to lower productivity as larger farm sizes may be labor-intensive and face difficulties in resource allocation. Therefore, a decrease in agricultural productivity may expose households to food insecurity.

The study also found that autonomy in production comprises a negative coefficient and is statistically significant (Coeff=-2.85; $p=0.022$) at the 5% level. This indicates that the likelihood of women being empowered in autonomy in production results in an increased probability of having poor and borderline FCS by 3.44% and 17.20%, respectively, while the probability of having an acceptable FCS decreases by 20.6%. These findings are inconsistent with the literature (Mataka, Kaitibie, & Ratna, 2023; Onah, Horton, & Hoddinott, 2021). Women in this study lacked access to the necessary resources that improve participation in agricultural activities. Therefore, it can be suggested that

being autonomous in food production is not sufficient to ensure food security, as other factors can hinder production. Moreover, women being autonomous in agriculture can increase the workload, thus resulting in food insecurity. This, therefore, suggests the need for context-specific food security strategies. Access to and decisions regarding credit, which serve as an indicator of the 5DE, exhibited a positive coefficient and were statistically significant (Coeff=0.78; $p=0.094$) with FCS at 10%. A unit increase in access to credit decreased the probability of households falling under poor and borderline FCS by 0.95% and 4.73%, respectively, while it increased the likelihood of falling under an acceptable FCS by 5.68%. These findings align with previous studies by Boltana, Tafesse, Belay, Recha, and Osano (2023) and Cheteni et al. (2020), which identified access to credit as a major determinant of food security. Although access to credit has been shown to positively influence food security, prior research indicates that this effect depends on the type of credit. For instance, a study conducted in Malawi by Boltana et al. (2023) found that informal credit adversely affects food security, whereas formal credit enhances it. Consequently, when advising households on credit options, it is important to emphasize the significance of selecting the appropriate type of credit. The results showed that control over the use of income had a positive correlation and was statistically significant (Coeff=2.43; $p=0.085$) with an FCS at 10%. Women being empowered in controlling the use of income resulted in a decreased probability of having poor and borderline FCS by 2.93% and 14.65%, respectively, while the probability of having an acceptable FCS increased by 17.58%. This is supported by Gitungwa et al. (2021), who found that when women have control of income, they use their share to improve household food supplies. In addition, income is not only allocated to food but also to food with high nutritional value (Wenda et al., 2024). This can be explained by the fact that women are the primary food providers; therefore, they always ensure that the household's food supplies are met.

The study found that empowerment in workload had a positive coefficient and was statistically significant (Coeff=1.70; $p=0.089$) at a 10% significance level. Women being empowered in workload decreased the probability of having poor and borderline food consumption scores (FCS) by 14.11% and 10.49%, respectively, while increasing the probability of falling into an acceptable FCS by 14.60%. A study conducted by Haque, Salman, Hasan, Prithi, and Hossain (2024) observed similar findings, indicating that a balanced workload positively influences food security. Women's intense workload can affect both their physical and mental well-being, which can consequently impact their productivity (Rathnachandra & Malkanthi, 2021). Conversely, Khed and Krishna (2023) found that women's poverty restricts their participation in income-generating activities. It can therefore be contended that women's unbalanced time affects their leisure activities, overall energy expenditure, mobility, and consequently their capacity to provide food for their households. The variables such as household size, household head gender, farming experience, monthly household income, frequency of extension visits, empowerment score, input in productive decisions, and ownership of assets did not show a significant relationship with FCS.

5. CONCLUSION AND RECOMMENDATIONS

This study assessed whether there is a relationship between socio-demographic characteristics and women empowerment with food security among urban crop farmers in the Ekurhuleni Metropolitan Municipality. The study revealed that more than half of the women in the study achieved an empowerment score of 80% or higher. The indicators that contributed most to the disempowerment of women are leisure time, purchase, sale, and transfer of assets, access to and decisions on credit, and workload. These findings suggest that gender inequalities remain prevalent in households and within agricultural contexts. Women's disempowerment in workload reflects time poverty, as women are constrained from engaging in leisure activities. Disempowerment in access to and decisions on credit may not only imply financial exclusion but also hamper their economic development. Additionally, inadequate achievement in the purchase, sale, or transfer of productive agricultural assets may imply limitations in intra-household bargaining power, limited participation in agriculture, and financial insecurity.

The study revealed that households had an acceptable FCS. This further affirms the importance of supported, coordinated intervention in reducing food insecurity. A regression model showed that empowering women in control

over the use of income, access to, and decisions on credit and workload were positively associated with food security. Moreover, empowerment in autonomy in production was negatively associated with food security.

Based on the findings, the study recommends that governments at various levels prioritize the allocation of agricultural productive resources, such as agricultural land, to improve the empowerment of women. Empowerment in these resources will improve their financial flexibility, thus their bargaining power. While women's access to and decisions on credit were relatively low, this indicator was found to positively influence food security. These outcomes highlight the need for the implementation of policies and programmes that are targeted to improve credit facilities. The study recommends interventions aimed at improving and supporting women's income-generating activities to enhance their financial autonomy, risk management, and households' dietary diversity. Creation of employment, funding business opportunities, and promoting education will mitigate the adverse repercussions of food insecurity among women. It is important to raise awareness of gender and patriarchal norms, which will unburden women from a high workload and afford them fair opportunities in line with their male counterparts. Governments and NGOs should educate women about these patriarchal norms to ensure that women are aware of the gender and power dynamics that subordinate them, so that they can take control over their lives.

Socio-demographic variables such as business, employment status, and educational level had a positive influence on food security, while age and garden size had an adverse influence.

5.1. Limitations and Recommendations for Future Research

The study was limited to the GDARDE (Ekurhuleni region) beneficiaries, particularly female crop farmers; therefore, estimates of women empowerment and food security levels are not fully representative of the findings for other women in urban and rural contexts with different socio-demographic characteristics. Secondly, the sampling size did not cover the entire population of the area; therefore, other women may be underrepresented. Thirdly, the cross-sectional design limits causality between the variables and the outcomes. Future studies could explore the relationship between women empowerment and food security among non-beneficiaries, farmers in general, and a broader targeted study area in South Africa. Further research is required to reveal the negative correlation between garden size and women empowerment in autonomy in production and food insecurity more clearly. Longitudinal research studies are recommended to track the relationship between women empowerment and food security.

Funding: This work was supported by the University of South Africa's Masters and Doctoral Support Program. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Institutional Review Board Statement: The Ethical Committee of the College of Agriculture and Environmental Science's Ethics Committee, Unisa, South Africa has granted approval for this study on 04 February 2024 (Ref. No. 2024/CAES_HREC/2583).

Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

Data Availability Statement: Upon a reasonable request, the supporting data of this study can be provided by the corresponding author.

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

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

REFERENCES

- Abegunde, V. O., Sibanda, M., & Obi, A. (2022). Effect of climate-smart agriculture on household food security in small-scale production systems: A micro-level analysis from South Africa. *Cogent Social Sciences*, 8(1), 2086343. <https://doi.org/10.1080/23311886.2022.2086343>
- Abu, G. A., & Soom, A. (2016). Analysis of factors affecting food security in rural and urban farming households of Benue State, Nigeria. *International Journal of Food and Agricultural Economics*, 4(1), 55-68. <https://doi.org/10.22004/ag.econ.231375>

- Acheampong, P. P., Obeng, E. A., Opoku, M., Brobbey, L., & Sakyiamah, B. (2022). Does food security exist among farm households? Evidence from Ghana. *Agriculture & Food Security*, 11(1), 24. <https://doi.org/10.1186/s40066-022-00362-9>
- Adomaa, F. O. (2022). Improving rural women's access to productive resources: Are the low hanging fruits too low to make a difference? *Feminist Africa*, 3(2), 98–108.
- Agholor, I. A., & Yusuf, S. F. G. (2024). Dynamics of society, food availability and consumption: Underlying evidence from selected smallholders in South Africa. *African Journal of Food, Agriculture, Nutrition and Development*, 24(12), 25205–25231. <https://doi.org/10.18697/ajfand.137.24980>
- Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A., Seymour, G., & Vaz, A. (2013). The women's empowerment in agriculture index. *World Development*, 52, 71–91. <https://doi.org/10.1016/j.worlddev.2013.06.007>
- Amber, Z., & Fakhar, S. (2019). Women's empowerment in agriculture. *International Journal of Advance Study and Research Work*, 2(5), 13–24. <https://doi.org/10.5281/zenodo.3219294>
- Anderson, C. L., Reynolds, T. W., Biscaye, P., Patwardhan, V., & Schmidt, C. (2020). Economic benefits of empowering women in agriculture: Assumptions and evidence. *The Journal of Development Studies*, 57(2), 193–208. <https://doi.org/10.1080/00220388.2020.1769071>
- Bahta, T. A., Strydom, D. B., & Donkor, E. (2015). *Women access to credit: An empirical evidence from Eritrea*. Paper presented at the Research in Agriculture and Applied Economics 29th Triennial Conference of the International Association of Agricultural Economists (IAAE), Milan, Italy. <https://doi.org/10.22004/ag.econ.211195>
- Beriso, G., Amare, A., & Eneyew, A. (2023). Women empowerment in agricultural activities and its impact on farming household food security: The case of Anna Sorra District, Guji Zone, Oromia regional state, Ethiopia. *Cogent Food & Agriculture*, 9(2), 2263952. <https://doi.org/10.1080/23311932.2023.2263952>
- Biswas, B., & Banu, N. (2023). Economic empowerment of rural and urban women in India: A comparative analysis. *Spatial Information Research*, 31(1), 73–89. <https://doi.org/10.1007/s41324-022-00472-3>
- Boltana, A., Tafesse, A., Belay, A., Recha, J. W., & Osano, P. M. (2023). Impact of credit on household food security: The case of Omo microfinance institution in Southern Ethiopia. *Journal of Agriculture and Food Research*, 14, 100903. <https://doi.org/10.1016/j.jafr.2023.100903>
- Carstens, G., Hay, R., & Van der Laan, M. (2021). Can home gardening significantly reduce food insecurity in South Africa during times of economic distress? *South African Journal of Science*, 117(9/10), 1–7. <https://doi.org/10.17159/sajs.2021/8730>
- Chakona, G. (2022). Household dietary patterns and food security challenges in Peri-Urban South Africa: A reflection of high unemployment in the wake of rising food prices. In *Transforming Urban Food Systems in Secondary Cities in Africa*. In (pp. 231–249). Cham: Springer International Publishing.
- Cheteni, P., Khamfula, Y., & Mah, G. (2020). Exploring food security and household dietary diversity in the Eastern Cape Province, South Africa. *Sustainability*, 12(5), 1851. <https://doi.org/10.3390/su12051851>
- Cinar, K., & Ugur-Cinar, M. (2018). What the city has to offer: Urbanization and women's empowerment in Turkey. *Politics & Gender*, 14(2), 235–263. <https://doi.org/10.1017/S1743923X18000028>
- City of Ekurhuleni. (2021). *Profile and analysis: District development model*. Retrieved from https://www.cogta.gov.za/ddm/wp-content/uploads/2020/08/Take2_DistrictProfile_EKURHULENI-2.pdf
- Commission for Gender Equality. (2024). *Exploring barriers to women's access to communal land in selected provinces of South Africa*. Johannesburg, South Africa: Commission for Gender Equality.
- Connors, K., Jaacks, L. M., Awasthi, A., Becker, K., Kerr, R. B., Fivian, E., . . . Bliznashka, L. (2023). Women's empowerment, production choices, and crop diversity in Burkina Faso, India, Malawi, and Tanzania: A secondary analysis of cross-sectional data. *The Lancet Planetary Health*, 7(7), e558–e569. [https://doi.org/10.1016/S2542-5196\(23\)00125-0](https://doi.org/10.1016/S2542-5196(23)00125-0)
- Cullen, S. (2019). *Women's economic empowerment in agricultural production: A case study of Gergera Watershed project*. MRes Thesis. University College Cork, Cork, Ireland.

- Dhamija, G., Roychowdhury, P., & Shankar, B. (2025). Does urbanization empower women? Evidence from India. *Journal of Population Economics*, 38(1), 27. <https://doi.org/10.1007/s00148-025-01085-4>
- Diirro, G. M., Seymour, G., Kassie, M., Muricho, G., & Muriithi, B. W. (2018). Women's empowerment in agriculture and agricultural productivity: Evidence from rural maize farmer households in western Kenya. *PloS One*, 13(5), e0197995. <https://doi.org/10.1371/journal.pone.0197995>
- Dunn, S., & Maharaj, P. (2025). Female labour force participation in South Africa. *Journal of Asian and African Studies*, 60(4), 2672-2690. <https://doi.org/10.1177/00219096231224696>
- Enterprises University of Pretoria (Pty) Ltd. (2023). Women in the South African economy 2024. In Commission for Gender Equality.
- FAO. (2020). *Annual statistical publication. Food and Agriculture Organization of the United Nations*. Retrieved from <https://www.fao.org/3/cb1329en/CB1329EN.pdf>
- FAO, IFAD, UNICEF, WFP, & WHO. (2024). *The state of food security and nutrition in the world 2024: Financing to end hunger, food insecurity and malnutrition in all its forms*. Rome: FAO. <https://doi.org/10.4060/cd1254en>
- FAO, & WFP. (2012). *Household dietary diversity score and food consumption score: A joint statement of FAO and WFP (Issue May)*. Food and Agriculture Organization of the United Nations. Retrieved from <https://www.fao.org/nutrition/assessment/tools/household-dietary-diversity/en/>
- GDARDE. (2024). *Annual report for 2023/24 financial year*. Retrieved from https://provincialgovernment.co.za/departments_annual/1466/2024-gauteng-agriculture-and-rural-development-annual-report.pdf
- Gitungwa, H., Gustafson, C. R., Jimenez, E. Y., Peterson, E. W., Mwanzalila, M., Makweta, A., . . . VanWormer, E. (2021). Female and male-controlled livestock holdings impact pastoralist food security and women's dietary diversity. *One Health Outlook*, 3(1), 3. <https://doi.org/10.1186/s42522-020-00032-5>
- Grilli, L., & Rampichini, C. (2021). Ordered logit model. In Encyclopedia of quality of life and well-being research. In (pp. 1-4). Cham: Springer International Publishing.
- Hando, F. H., & Legesse, M. A. (2022). Impact of program-based sustainable urban agricultural intervention on women empowerment in Addis Ababa: Evidence from women empowerment in agriculture index analysis. *African Journal of Agricultural Research*, 18(5), 308-321. <https://doi.org/10.5897/AJAR2022.16001>
- Haque, S., Salman, M., Hasan, M. M., Prithi, A. A., & Hossain, M. E. (2024). Women's empowerment and its role in household food security to achieve SDGs: Empirical evidence from rural Bangladesh. *Sustainable Development*, 32(4), 4297-4314. <https://doi.org/10.1002/sd.2893>
- Hashimy, S. Q., Jahromi, A., Hamza, M., Naaz, I., Nyamwero, N. B., & Basavarajappa, H. T. (2023). Nurturing leadership and capacity building for success: Empowering growth. *International Journal of Rehabilitation and Special Education*, 3(2), 33-46.
- Hu, Y., Li, B., Zhang, Z., & Wang, J. (2022). Farm size and agricultural technology progress: Evidence from China. *Journal of Rural Studies*, 93, 417-429. <https://doi.org/10.1016/j.jrurstud.2019.01.009>
- Huang, Y., Nie, F., & Jia, X. (2023). Forty years after poverty reduction in China: The role of women's empowerment in enhancing food security and diet diversity. *Nutrients*, 15(12), 2761. <https://doi.org/10.3390/nu15122761>
- Hussain, S., & Jullandhry, S. (2020). Are urban women empowered in Pakistan? A study from a metropolitan city. *Women's Studies International Forum*, 82, 102390. <https://doi.org/10.1016/j.wsif.2020.102390>
- Jemaneh, S. A., & Shibeshi, E. M. (2023). Women empowerment in agriculture and its effect on household food security: Evidence from Gamo Zone of Southern Ethiopia. *Agriculture & Food Security*, 12(1), 37. <https://doi.org/10.1186/s40066-023-00437-1>
- Kabahinda, J. (2023). Understanding women's land ownership in rural and peri-urban Uganda. *International Journal of Gender and Women's Studies*, 11(2), 24-36.

- Kajiita, R. M., & Kang'ethe, S. M. (2024). Socio-economic dynamics inhibiting inclusive urban economic development: Implications for sustainable urban development in South African cities. *Sustainability*, 16(7), 2803. <https://doi.org/10.3390/su16072803>
- Kanosvamhira, T. P., Follmann, A., & Tevera, D. (2024). Experimental urban commons?: Re-examining urban community food gardens in Cape Town, South Africa. *The Geographical Journal*, 190(2), e12553. <https://doi.org/10.1111/geoj.12553>
- Kaur, M. (2023). A study of women empowerment in urban and rural area. *Research in Multidisciplinary Subjects*, 1, 55–59.
- Khed, V. D., & Krishna, V. V. (2023). Agency and time poverty: Linking decision-making powers and leisure time of male and female farmers of Central India. *World Development Perspectives*, 29, 100484. <https://doi.org/10.1016/j.wdp.2022.100484>
- Khumalo, N. Z., & Sibanda, M. (2019). Does urban and peri-urban agriculture contribute to household food security? An assessment of the food security status of households in Tongaat, eThekweni Municipality. *Sustainability*, 11(4), 1082. <https://doi.org/10.3390/su11041082>
- Lembete, S., Agyepong, A. O., & Mbombo-Dweba, T. P. (2024). Assessment of the adoption and determinants of food garden initiative by peri-urban dwellers in Ray Nkonyeni Municipality, South Africa. *Journal of Agribusiness and Rural Development*, 1(71), 71–80. <https://doi.org/10.17306/J.JARD.2024.01688>
- Madlala, S. S., Hill, J., Kunneke, E., & Faber, M. (2024). Perceived barriers and enablers for consuming a diverse diet in women residing in resource-poor communities in Cape Town, South Africa: A qualitative study. *South African Journal of Clinical Nutrition*, 37(4), 184–192. <https://doi.org/10.1080/16070658.2024.2427979>
- Mahlangu, M., Maponya, P., & Letsoalo, S. (2024). Socio-economic factors influencing sustainability of the homestead food gardens: A case of households in Gauteng Province, South Africa. *AGROFOR International Journal*, 9(2), 124–132.
- Mahmood, S. H. (2024). Estimating models and evaluating their efficiency under multicollinearity in multiple linear regression: A comparative study. *Zanco Journal of Human Sciences*, 28(5), 264–277. <https://doi.org/10.21271/zjhs.28.5.17>
- Manyike, J. Z., Taruvinga, A., & Zhou, L. (2025). Factors influencing livestock ownership and herd intensity among smallholder farmers in the Eastern Cape, South Africa. *Heliyon*, 11(2), e41787. <https://doi.org/10.1016/j.heliyon.2025.e41787>
- Maponya, P., & Oelofse, D. (2023). Urban agriculture and agro-environment: A case study of homestead food gardeners in the City of Tshwane, Gauteng Province, South Africa. In *Agricultural Bioeconomy* (pp. 315–336). <https://doi.org/10.1016/B978-0-323-90569-5.00001-9>
- Mataka, T., Kaitibie, S., & Ratna, N. N. (2023). Can women's empowerment in livestock farming improve household food security? Empirical evidence from rural households in Malawi. *Agriculture & Food Security*, 12(1), 35. <https://doi.org/10.1186/s40066-023-00436-2>
- Mazenda, A., Manzi, P., Mushayanyama, T., & Ngarava, S. (2022). Household level determinants of food security in the City of Tshwane, South Africa. *Food Research*, 6(6), 184–192. [https://doi.org/10.26656/fr.2017.6\(6\).915](https://doi.org/10.26656/fr.2017.6(6).915)
- Menon, S., Ranjitha, M., & Sharma, S. (2020). A study on the status of women's empowerment in urban Bangalore, India. *Journal of International Women's Studies*, 21(5), 54–64.
- Midamba, D. C., Jjengo, A., & Ouko, K. O. (2025). Understanding gender differences in maize productivity among smallholders in central Uganda: A total factor productivity approach. *Discover Agriculture*, 3(1), 50. <https://doi.org/10.1007/s44279-025-00203-w>
- Mkansi, N. D., Ledwaba, L. J., & Mokhaukhau, J. (2025). Smallholder farmers' perceptions of climate change adaptation strategies: The case of the greater Giyani local municipality, Limpopo province. *Research on World Agricultural Economy*, 6(1), 276–289. <https://doi.org/10.36956/rwae.v6i1.1287>
- Mudau, J., & Mahlatsi, M. L. S. (2022). Present realities of urban food insecurity in South African townships. *African Renaissance*, 19(2), 159–177.
- Murugani, V. G., & Thamaga-Chitja, J. M. (2019). How does women's empowerment in agriculture affect household food security and dietary diversity? The case of rural irrigation schemes in Limpopo Province, South Africa. *Agrekon*, 58(3), 308–323.
- Muzhinji, N., & Ntuli, V. (2020). Genetically modified organisms and food security in Southern Africa: Conundrum and discourse. *GM Crops & Food*, 12(1), 25–35. <https://doi.org/10.1080/21645698.2020.1794489>

- Myeni, L., Moeletsi, M., Thavhana, M., Randela, M., & Mokoena, L. (2019). Barriers affecting sustainable agricultural productivity of smallholder farmers in the Eastern Free State of South Africa. *Sustainability*, 11(11), 3003. <https://doi.org/10.3390/su11113003>
- Naicker, M., Naidoo, D., & Ngidi, M. (2023). Assessing the impact of community gardens in mitigating household food insecurity and addressing climate change challenges: A case study of ward 18, Umdoni Municipality, South Africa. *African Journal of Inter/Multidisciplinary Studies*, 5(1), 1-12. <https://doi.org/10.51415/ajims.v5i1.1129>
- Nchanji, E. B., Chagomoka, T., Bellwood-Howard, I., Drescher, A., Schareika, N., & Schlesinger, J. (2023). Land tenure, food security, gender and urbanization in Northern Ghana. *Land Use Policy*, 132, 106834. <https://doi.org/10.1016/j.landusepol.2023.106834>
- Nenguda, R., & Scholes, M. C. (2022). Appreciating the resilience and stability found in heterogeneity: A South African perspective on urban household food security. *Frontiers in Sustainable Food Systems*, 6, 721849. <https://doi.org/10.3389/fsufs.2022.721849>
- Ngema, P. Z., Sibanda, M., & Musemwa, L. (2018). Household food security status and its determinants in Maphumulo local municipality, South Africa. *Sustainability*, 10(9), 3307. <https://doi.org/10.3390/su10093307>
- Nigus, G., Ketema, M., Haji, J., & Sileshi, M. (2024). Determinants of adoption of urban agricultural practices in eastern Haraghe zone of Oromia region and Dire Dawa City administration, Eastern Ethiopia. *Heliyon*, 10(4), e26758. <https://doi.org/10.1016/j.heliyon.2024.e26758>
- Nkomoki, W., Bavorová, M., & Banout, J. (2019). Factors associated with household food security in Zambia. *Sustainability*, 11(9), 2715. <https://doi.org/10.3390/su11092715>
- Nontu, Y., Mdoda, L., Dumisa, B. M., Mujuru, N. M., Ndwandwe, N., Gidi, L. S., & Xaba, M. (2024). Empowering rural food security in the Eastern Cape Province: Exploring the role and determinants of family food gardens. *Sustainability*, 16(16), 6780. <https://doi.org/10.3390/su16166780>
- Oduro-Ofori, E. Prince, A. A., Aboagye Anokye, & Elfreda, A. N. A. (2014). Effects of education on the agricultural productivity of farmers in the Offinso Municipality. *International Journal of Development Research*, 4(9), 1951-1960.
- Olufemi-Phillips, A. Q., Igwe, A. N., Ofodile, O. C., & Louis, N. E. (2024). Analyzing economic inflation's impact on food security and accessibility through econometric modeling. *International Journal of Green Economics*, 18(3), 142-156.
- Onah, M. N., Horton, S., & Hoddinott, J. (2021). What empowerment indicators are important for food consumption for women? Evidence from 5 Sub-Saharan African countries. *PLoS One*, 16(4), e0250014. <https://doi.org/10.1371/journal.pone.0250014>
- Onyenekwe, C. S., Amaechina, E. C., Onah, O. G., Ayogu, C. J., & Eze, C. S. (2025). Effects of urban agriculture on food security and poverty reduction in Enugu State, Nigeria. *Journal of Economics and Allied Research*, 10(1), 58-76.
- Opperman, I. (2023). *South Africans struggle as household food basket costs surge by R141.82 in one month*. South Africa: The Citizen.
- Padmanaban, G., Mishra, A., & Srinivasan, A. (2024). Logistic regression analysis for categorical outcome. In A. Srinivasan, A. Mishra, & P. Kumar-M (Eds.), *R for Basic Biostatistics in Medical Research*. In (pp. 235-251). Singapore: Springer.
- Petros, C., Feyissa, S., Sileshi, M., & Shepande, C. (2025). Factors influencing climate-smart agriculture practices adoption and crop productivity among smallholder farmers in Nyimba District, Zambia. *F1000Research*, 13, 815. <https://doi.org/10.12688/f1000research.144332.3>
- Pietermaritzburg Economic Justice & Dignity Group. (2025). *Household affordability index*. Pietermaritzburg, South Africa: Author. Retrieved from https://za.boell.org/sites/default/files/2025-02/january-2025-household-affordability-index-pmbejd_29012025.pdf
- Pourebrahim, F., Omidvar, N., Rezazadeh, A., Eini-Zinab, H., Shirani, P., & Ghodsi, D. (2024). Food security and its association with socioeconomic status and dietary diversity in free living older people in Tehran, Iran. *BMC Geriatrics*, 24(1), 128. <https://doi.org/10.1186/s12877-024-04705-y>

- Raidimi, E. N., & Kabiti, H. M. (2019). A review of the role of agricultural extension and training in achieving sustainable food security: A case of South Africa. *South African Journal of Agricultural Extension*, 47(3), 120-130. <https://doi.org/10.17159/2413-3221/2019/v47n3a520>
- Rathnachandra, S. D. D., & Malkanthi, S. H. P. (2021). Time poverty and food production of women farmers: Case of Imbulpe DS division in Sri Lanka. *Journal of Dry Zone Agriculture*, 7(2), 21-36. <https://doi.org/10.4038/jdza.v7i2.26>
- Rudolph, M., Muchesa, E., & Sibanda, C. (2024). The Influence of education on women and food security. *South African Journal of Agricultural Extension*, 52(2), 91-106. <https://doi.org/10.17159/2413-3221/2024/v52n2a15734>
- Sambo, T. A., Oguttu, J. W., & Mbombo-Dweba, T. P. (2025). Food insecurity and coping strategies of Phezukomkhono Mlimi farming households in Nkomazi Local Municipality, South Africa. *African Journal of Food, Agriculture, Nutrition & Development*, 25(2), 1-19. <https://doi.org/10.18697/ajfand.139.25035>
- Sarker, T., Roy, R., Yeasmin, S., & Asaduzzaman, M. (2024). Enhancing women's empowerment as an effective strategy to improve food security in rural Bangladesh: A pathway to achieving SDG-2. *Frontiers in Sustainable Food Systems*, 8, 1436949. <https://doi.org/10.3389/fsufs.2024.1436949>
- Sennuga, S. O., Isola, E. O., Bamidele, J., Ameh, D., & Olaitan, M. (2024). Impact of fuel subsidy removal on agricultural production among Smallholder Farmers in Niger State, Nigeria. *Journal of Economics, Business Management and Administration*, 5(2), 7-17.
- Sharaunga, S. (2015). *The significance of women empowerment on rural livelihood outcomes among irrigation and dry-land farming households in Msinga*. South Africa: University of KwaZulu-Natal.
- Shelembe, N., Hlatshwayo, S. I., Modi, A., Mabhaudhi, T., & Ngidi, M. S. C. (2024). The association of socio-economic factors and indigenous crops on the food security status of farming households in KwaZulu-Natal Province. *Agriculture*, 14(3), 415. <https://doi.org/10.3390/agriculture14030415>
- Sinyolo, S., & Mudhara, M. (2018). Farmer groups and inorganic fertiliser use among smallholders in rural South Africa. *South African Journal of Science*, 114(5-6), 1-9. <https://doi.org/10.17159/sajs.2018/20170083>
- Sraboni, E., Malapit, H. J., Quisumbing, A. R., & Ahmed, A. U. (2014). Women's empowerment in agriculture: What role for food security in Bangladesh? *World Development*, 61, 11-52. <https://doi.org/10.1016/j.worlddev.2014.03.025>
- Statistics South Africa. (2024a). *Gender series: Women Empowerment 2014-2024* (Vol. 9). Pretoria: Statistics South Africa.
- Statistics South Africa. (2024b). *General household survey 2023: Measuring the progress of development in the country*. Pretoria: Statistics South Africa.
- Statistics South Africa. (2024c). *General household survey 2023*. Report No. P0318. Pretoria: Statistics South Africa.
- Statistics South Africa. (2024d). *Quarterly labour force survey, Quarter 4: 2024*. Report No. P0211. Pretoria: Statistics South Africa.
- Statistics South Africa. (2025). *Food security in South Africa in 2019, 2022 and 2023: Evidence from the general household survey*. Report No. 03-10-28. Pretoria: Statistics South Africa.
- Tesafa, F., Mulugeta, M., & Tsehay, S. (2025). Women empowerment, efficiency and food security nexus in rural Ethiopia: A generalized structural equation modeling. *Helixyon*, 11(1), e41273. <https://doi.org/10.1016/j.helixyon.2024.e41273>
- Thamaga-Chitja, J. M., Tamako, N., & Ojo, T. O. (2025). Implications of land ownership heterogeneity on household food security: A case study of urban farming in Pietermaritzburg, KwaZulu-Natal Province. *Land*, 14(2), 236. <https://doi.org/10.3390/land14020236>
- Thobejane, K., Swanepoel, J. W., Van Niekerk, J. A., & Van Der Merwe, H. (2023). Measuring women's empowerment in agriculture in the Gauteng Province of South Africa. *South African Journal of Agricultural Extension*, 51(3), 161-185. <https://doi.org/10.17159/2413-3221/2023/v51n3a15857>
- Thomas, M., & Terblanche, S. E. (2021). The impact of backyard gardening on livelihoods of households in Sedibeng District Municipality in Gauteng Province, South Africa. *South African Journal of Agricultural Extension*, 49(1), 30-41. <https://doi.org/10.17159/2413-3221/2021/v49n1a10776>

- Tong, T., Ye, F., Zhang, Q., Liao, W., Ding, Y., Liu, Y., & Li, G. (2024). The impact of labor force aging on agricultural total factor productivity of farmers in China: Implications for food sustainability. *Frontiers in Sustainable Food Systems*, 8, 1434604. <https://doi.org/10.3389/fsufs.2024.1434604>
- Trias-Prats, R., & Esteve, A. (2025). Rising female-headed households: Shifts in living arrangements or heightened gender symmetry? *Population and Development Review*, 51(2), 889-917. <https://doi.org/10.1111/padr.12692>
- Vedana, R., Garcias, M., & Arends-Kuenning, M. P. (2023). *Women's empowerment: Evidence from rural Western Paraná (Brazil)*. Retrieved from https://www.researchgate.net/profile/Roberta-Vedana-2/publication/368685462_Women's_empowerment_evidence_from_rural_Western_Parana_Brazil/links/63f524c7574950594531e6be/Womens-empowerment-evidence-from-rural-Western-Parana-Brazil.pdf
- Wang, J., Gu, R., Nie, F., & Dogot, T. (2024). Women's empowerment in western China: measurement, determinant factors and its correlation with poverty. *AGROFOR International Journal*, 9(2), 51-58.
- Wenda, S. B. D., Fon, D. E., Molua, E. L., & Longang, S. G. (2024). Women, income use and nutrition quality: Effects of women's decision-making in rural households in Cameroon. *Agriculture & Food Security*, 13(1), 29. <https://doi.org/10.1186/s40066-024-00480-6>
- World Food Programme. (2008). *Food consumption analysis: Calculation and use of the food consumption score in food security analysis*. Rome, Italy: United Nations World Food Programme.
- Zaca, F. N., Chipfupa, U., Ojo, T. O., Managa, L. R., Mabhaudhi, T., Slotow, R., & Ngidi, M. S. C. (2025). The role of fruit trees in reducing food insecurity and improving nutrition security of rural households: A case study of the KwaZulu-Natal Province, South Africa. *Journal of Agriculture and Food Research*, 21, 101883. <https://doi.org/10.1016/j.jafr.2025.101883>
- Zapiain, S. R. A. (2025). Multivariable selection methods. In *Conceptual Variable Design for Scorecards* (pp. 459-493). Berkeley, CA: Apress