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Asian Journal of Agriculture and Rural Development
Volume 14, Issue 4 (2024): 184-193.

http://www.aessweb.com/journals/5005

Evaluating the challenges of food access and the factors influencing it among residents of peri-urban areas in Ray Nkonyeni Municipality, Kwazulu-Natal Province, South Africa

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Article History
Received: 5 July 2024
Revised: 12 November 2024
Accepted: 25 November 2024
Published: 17 December 2024

Keywords
Food access
Food gardening
Food security
Household income
Poverty
Urban agriculture
Urban households.

ABSTRACT
This research examines the assessment of food insecurity and its determinants among different provinces in South Africa. A quantitative study design was conducted to assess food insecurity status and its determinants in a peri-urban area, namely Ray Nkonyeni Local Municipality in KwaZulu-Natal province, South Africa. Data was collected from 360 systematic, randomly selected households. The results showed that 71.00% of these were food insecure. Food insecurity was more pronounced among older, unemployed, less educated, and low-income respondents. Households with an income of between R4001 and R5000 (adjusted odds ratio (AOR)=0.05; 95% confidence interval (95% CI):0.01–0.41) and those with an income ≥R5000 (AOR=0.01; 95% CI:0.00–0.11) had lower odds of experiencing food insecurity compared with those with an income of <R1000. Households with more than one source of income (AOR=2.36; 95% CI:1.07–5.17) were more likely to experience food insecurity than those with a single source of income. Households that participated in food gardening had higher odds (AOR=3.40; 95% CI: 1.45–7.95) of being food insecure than those that did not participate in food gardening. Food insecurity was very high in this peri-urban area. Food insecurity was associated with household income, number of income sources, and participation in food gardening. Policymakers and other stakeholders should focus on these groups with a view to improving household food security.

Contribution/Originality: This is one of the few studies that have assessed food insecurity and its determinants in peri-urban areas. The study contributes to the scant literature by quantifying the degree of food insecurity in peri-urban areas.Significant determinants include household income, number of income sources, and participation in food gardening.

DOI: 10.55493/5005.v14i4.5259
ISSN(P): 2304-1455/ ISSN(E): 2224-4433

How to cite: Mbombo-Dweba, T. P., Lembete, S., & Sambo, T. A. (2024). Evaluating the challenges of food access and the factors influencing it among residents of peri-urban areas in Ray Nkonyeni Municipality, Kwazulu-Natal Province, South Africa . *Asian Journal of Agriculture and Rural Development, 14*(4), 184–193. 10.55493/5005.v14i4.5259

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1. INTRODUCTION
Global statistics show that the urban population has been expanding rapidly. Estimates indicate that between 1990 and 2018, the urban population grew from 2.29 billion to 4.2 billion (United Nations, 2018). This upward urbanization trend is anticipated to continue, with projections suggesting that over 70% of the world's population will be living in urban areas by 2050 (Ritchie, Samborska, & Roser, 2018). Available literature suggests that Africa is the fastest urbanizing region, with its population expected to triple in the next 40 years (Güneralp, Lwasa, Masundire, Parnell, & Seto, 2017). In 2021, approximately 56% of the population of Africa were urban residents.

However, the available literature shows that rapid urbanization has resulted in a number of problems, such as unemployment, poverty, and a lack of housing, and has placed a huge demand on basic education and healthcare services (African Policy Circle, 2020). In view of the increase in the number of urban poor, and since poverty and food security are interdependent, there is an urgent need to assess the food security status of this growing population (Jonah & May, 2020). Similarly, Van den Berg and Walsh (2023) call for the prioritization of research on the impact of urbanization on food security. It is known that people living in rural areas are likely to experience food insecurity (Battersby & Haysom, 2019). This has led to research and food security policies that concentrate on rural areas (Berlie, 2023; Jonah & May, 2020; Mazenda, Molepo, Mushayanyama, & Ngarava, 2022).

While a number of national food security studies have been conducted in South Africa (Shisana et al., 2014; Stats, 2019, 2021) they fail to examine the geospatial dimensions of food security. For instance, these national and provincial studies do not segregate data on food security between rural and urban areas. Therefore, although these studies provide evidence of food insecurity among urban dwellers (Battersby & Haysom, 2019) they lack precision and thus fail to quantify the degree of food insecurity in urban areas (Rudolph, Kroll, Muchesa, Paiker, & Fatti, 2021). This lack of urban-specific data on food security makes it difficult to guide policy and formulate strategies to support the urban poor (Ruel, 2020). There is therefore a need for urban-focused case studies to provide empirical evidence on the food security status of populations such as the urban poor (Battersby & Haysom, 2019). The small number of local studies on food security among urban dwellers that could be sourced support the growing evidence that food insecurity is rife in urban areas. Mudau and Mahlatsi (2022) conducted a study that revealed a high level of food insecurity in townships. Rudolph et al. (2021) reached a similar conclusion, finding that 34% of households in their study, which was conducted amongst urban dwellers, were food insecure. Mazenda et al. (2022) likewise found food insecurity among urban dwellers to be critically high, Nenguda and Scholes (2022) reported that 71% of urban households in their study were food insecure. However, Gauteng was the focus of all studies (Mazenda et al., 2022; Mudau & Mahlatsi, 2022; Nenguda & Scholes, 2022; Rudolph et al., 2021). Evidence from other urban areas is lacking, and the extent of food security in urban areas is therefore not fully known (Ruel, 2020). Furthermore, there are limited studies on the determinants of food insecurity in urban areas. Because societal characteristics and contexts differ, context-specific studies (Mazenda et al., 2022) and area-tailored interventions (Simelane, 2024) are necessary. Simelane (2024) further argues that municipality-specific scientific data is crucial for the design of targeted interventions.Studies assessing the food security status in Ray Nkonyeni Local Municipality (RNLM) are not available. The RNLM is relatively small, with unique characteristics that distinguish it from large metropolitan municipalities, and was therefore considered likely to provide new insights regarding food security status among urban dwellers of smaller towns. This municipality is located in KwaZulu-Natal (KZN), which, like Limpopo province, constitutes a food insecurity hotspot in South Africa (Stats, 2021). This study hypothesized food insecurity to be high in urban areas, particularly in peri-urban areas, which are characterized by a younger population and high unemployment (Nenguda & Scholes, 2022). The intention of our study was therefore to assess food security status and determinants of food security among peri-urban dwellers in RNLM.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The study was carried out in the RNLM under the Ugu District Municipality of KZN province. The RNLM is also known as the South Coast due to its positioning in the southern coastal part of KZN (Figure 1).

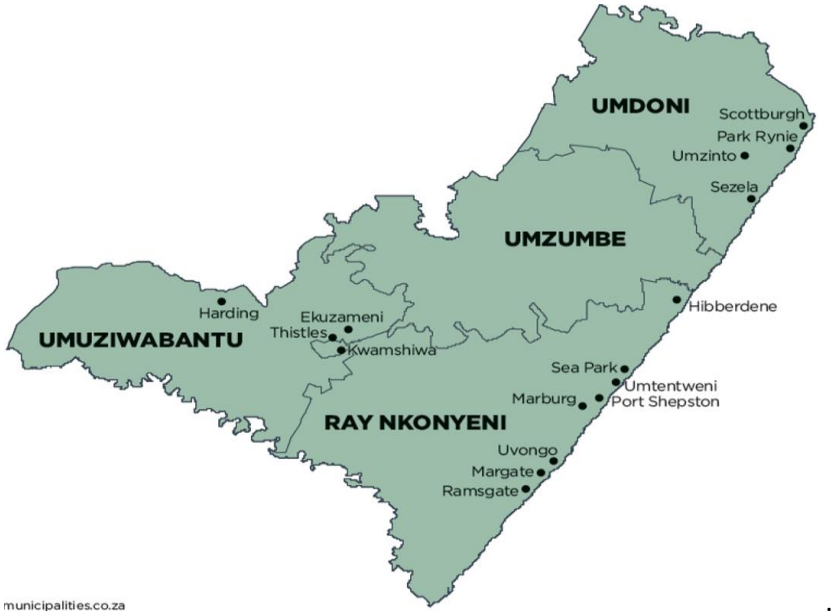

Figure 1. Map of RNLM.

Source: Municipalities of South Africa (2017).

The RNLM has a surface area of about 1594 km² and it is the largest of the four municipalities within the Ugu District Municipality (Municipalities of South Africa, 2023). The eastern part of RNLM is bounded by the Indian

Ocean, while the southern part is bounded by Umtamvuna River, which also serves as the boundary between KZN and the Eastern Cape province. The RNLM was selected as a study area due to its rapid urbanization as compared to the neighbouring municipalities (RNLM, 2023).

2.2. Research Design

A cross-sectional, quantitative design was adopted to achieve the objectives of the study.

2.3. Sample Size and Sample Selection

Out of a target population of 348 533 households (RNLM, 2023) a sample size of 384 was deemed adequate based on the formula described by Krejcie and Morgan (1970). Adults over the age of 18 who were household heads and residents in the area and who agreed voluntarily to participate in the study were recruited. Ultimately, 360 respondents met the inclusion criteria and were available to participate. Systematic random sampling was used to select participating households.

2.4. Data Collection

A questionnaire was used to collect respondents' socio-demographic information, while the Household Food Insecurity Access Scale (HFIAS) was used to measure the food security status of respondents using a four-week reference period. The researcher collected data between October and December 2019 with the assistance of two trained research assistants.

The questionnaire was designed in English, but prior to data collection, it was translated into isiZulu, the local language spoken in the study area. A pilot study was carried out to identify any ambiguities, and the results were used to improve the questionnaire.

2.5. Data Management and Analysis

2.5.1. Data Management

The data was recorded and coded in Microsoft Excel 2016 and thereafter imported into the Statistical Package for Social Sciences (SPSS) version 28 (IBM) for analysis. Based on the nine HFIAS homogenized questions, the HFIAS score for the individual households was computed by adding up the codes for frequency-of-events questions. This HFIAS score revealed the degree of food insecurity in the households over the previous four weeks. By following Coates, Swindale, and Bilinsky (2007) the codes 0,1,2, and 3 were used to denote that each of the nine food-insecurity-related events did not happen, rarely, sometimes, and often happen, respectively. Households were categorized as follows: households with a score of ≤1 as food secure; households with scores between 2 and 8 as mildly food insecure; those with scores between 9 and 17 as moderately food insecure; and households with a score of ≥18 as severely food insecure households (Simelane, 2024).

The households were further divided into three territories created on their encountering a single or multiple forms in each of these territories: (i) uncertainty or anxiety about food stocks in the household (question 1); (ii) insufficient quality and food type preference (questions 2–4); and (iii) insufficient food intake and its physical consequences (questions 5–9).

The household food insecurity access levels, that is, mild, moderate, or severe food insecurity, were further fused into food insecure to allow the outcome variable (household food insecurity access) to have only two possible outcomes (0=food secure; 1=food insecure). This fusion was rational, as supported by a number of studies conducted in South Africa and across the globe that suggest that all households within the three levels (i.e., mildly, moderately, and severely food insecure) are regarded as food insecure (Mncube, Ojo, & Nyam, 2023; Mota, Lachore, & Handiso, 2019; Nkoko, Cronje, & Swanepoel, 2024). Therefore, since the outcome variable was a binary variable, a binary logistic regression model was fitted to the data (Faizi & Alvi, 2023; Patel, 2021).

2.5.2. Data Analysis

Descriptive statistics were used to analyse categorical variables, and the results were reflected in tables and figures. Binary logistic regression was applied to identify the determinants of household food insecurity in the study area. According to Harris (2021) the binary logistic regression model is estimated by the following equation:

$$P(y) = \frac{1}{1+e^{-1(\beta_0+\beta_1 X_1+\beta_2 X_2)}} \qquad (1)$$

Where P(y) is the odds of one category of the outcome variable Y (the Y above can be either (0=food secure or 1=food insecure) depending on the score of i^{th} households on the outcome variable). β represents the coefficients of the predictor variable, and X represents the predictor variables.

In the model-building process, the univariate analysis was performed to isolate outcome variables significantly associated with the dependent variable at a cut-off point of p≤0.20. Later, a manual backward selection method was used to fit a multivariable binary logistic regression model, using all the variables that were significantly associated with the outcome variable in the univariate analysis.

Confounders in the model were validated by measuring the association before and after adjusting for a potential confounding variable. When the difference in the estimated measure of association is greater than 10%, we certify and individual variable as a confounder. The model maintained all confounders.

The multicollinearity test was performed by computing the variance inflation factor (VIF) and tolerance values. There was no problem with multicollinearity, since the VIFs and tolerance values of all the independent variables were

less than 3 and greater than 0.20, respectively. The model's goodness of fit was measured by running the Omnibus and Hosmer-Lemeshow (HL) tests. The likelihood ratio chi-square tests showed the model with the predictors to suit the data more accurately than the null model [x2(29)=142.36; p=0.00]. The results of the HL test also confirmed that the model suited the data perfectly [x2(8)=0.83; p=1.00]. Statistical significance was assessed at p=0.05.

2.6. Ethical Consideration

The College of Agriculture Ethics Committee (Reference number: 2019/CAES/047) of the University of South Africa approved the study prior to data collection. A written consent form was used to obtain consent from each participant.

3. RESULTS

3.1. The Distribution of Households based on their Food Security Status

The results (Table 1) showed only a slight difference between the percentage of male (72.07%) and female respondents (70.28%) who were food insecure. Of the respondents in the age categories 61–70 and >70 years, a large majority, at 84.21% and 77.42%, respectively, were food insecure.

In terms of marital status, respondents in all categories except for those who identified themselves as cohabiting reported high levels of food insecurity. In the latter category, there were more food secure households (66.67%) than food-insecure households (33.33%) (see Table 1). Households of which the head had been widowed were found to be more food-insecure (82.61%; n=9), with this percentage being higher than in other categories such as single (77.05%), divorced (74.19%), and married (58.16%). The majority of respondents owned formal houses, and the majority of households in this category (72.36%) were food insecure.

The results reported in Table 1 further indicate that 84.21% of households with more than 6 household members were food insecure, while 72.38% of households with 4 to 6 members reported as food insecure. By contrast, only 57.43% of households with 1 to 3 household members were food insecure. Of the respondents who lacked agricultural experience, a slightly higher percentage were food secure (52.78%) than were food insecure (47.22%). Among the respondents who indicated that they participated in food gardening, a higher percentage (78.93%) were food insecure, while of those who did not participate, the majority (50.51%) were food secure.

Table 1. Results showing socio-demographics of respondents based on their food security status.

Food security status					
Variable	**Level**	**Food secure**		**Food insecure**	
Overall		**n=105**	**%=29.0**	**n=255**	**%=71.0**
Gender of the household head	Male	31	27.93	80	72.07
	Female	74	29.72	175	70.28
Age	18–40	27	35.53	54	67.50
	41–50	26	32.50	54	67.50
	51–60	33	34.02	64	65.98
	61–70	12	15.79	64	84.21
	Above 70	7	22.58	24	77.42
Marital status of the household head	Single	44	22.45	152	77.55
	Married	41	41.84	57	58.16
	Divorced	8	25.81	23	74.19
	Widowed	4	17.39	19	82.61
	Cohabiting	8	66.67	4	33.33
Dwelling type	Formal (Own)	89	27.64	233	72.36
	Informal (Own)	4	33.33	8	66.67
	Renting	12	46.15	14	53.85
Number of household members	1–3 members	43	42.57	58	57.43
	4–6 members	50	27.62	131	72.38
	Over 6	12	15.79	64	84.21
Experience of the household head in agriculture	Yes	67	23.26	221	76.74
	No	38	52.78	34	47.22
Household participating in food gardening	Yes	55	21.07	206	78.93
	No	50	50.51	49	49.49

3.2. Socio-Economic Characteristics of Households Based on their Food Security Status

Table 2 presents socio-economic characteristics of households based on their food security status. It was found that of the respondents who had access to land, the greater percentage (74.84%) were classified as food insecure. With regard to the educational level achieved by the head of the household, in the case of respondents with no formal education, 76.67% of households were food insecure, in the case of respondents with primary education, 87.21% of households were food insecure; and where respondents had a high school education, 69.65% of households were food insecure. By contrast, where the household head had a tertiary education, 60.47% of households were food secure, and only 39.43% were food insecure.

As reflected in Table 2, among the respondents who identified themselves as unemployed, the larger percentage (84.30%) of households were food insecure, while among those that were employed, 58.51% of households were food insecure.

In cases where respondents had one income source, 71.77% of households experienced food insecurity, whereas among households with more than one source of income, this figure was 68.75%. 92.77% of the households without any employed members experienced food insecurity. Table 2 further reveals that as the number of employed members per households decreased.

Table 2. Results showing socio-economic characteristics of respondents based on their food security status.

Variable	Level	Food secure		Food insecure	
Overall		**N=105**	**%=29.0**	**n=255**	**%=71.0**
Access to land	Yes	77	25.16	229	74.84
	No	28	51.85	26	48.15
Level of education of the household head	No formal education	7	23.33	23	76.67
	Primary school	11	12.79	75	87.21
	High school	61	30.35	140	69.65
	Tertiary	26	60.47	17	39.43
Employment status	Unemployed	27	15.70	145	84.30
	Employed	78	41.49	110	58.51
Number of income sources	1 income	70	28.23	178	71.77
	More than 1 income	35	31.25	77	68.75
Number of household members employed	Number of member employed	6	7.23	77	92.77
	1–2 members employed	83	34.30	159	65.70
	>3 members employed	16	45.71	19	54.29
Income of the household head	Less than 1000	2	8.70	21	91.30
	R1000–R2000	12	13.04	80	86.96
	R20001–R3000	21	19.81	85	80.19
	R30001–R4000	24	35.29	44	64.71
	R40001–R5000	19	54.29	16	45.71
	Over R5000	27	75.00	9	25.00

Table 2 further shows that with regard to household monthly income, of the households with an income of over R5000, 75% were food secure and 25% were food insecure, while among households with an income of more than R4000, 54.29% were food secure and 45.71% were food insecure. Households with incomes of <R1000, R1000–R2000 and R2001–R3000 all experienced a degree of food insecurity, with 91.30%, 86.96% and 80.19%, of households in these respective categories classifying as food insecure.

3.3. Household Food Security Status of Peri-Urban Households

From the HFIAS data, four indicators of food security were computed and are presented in this section.

The results in Table 3 show that over two-thirds (70.06%, 70.03%, 65.06%, and 65.00%) of the households responded in the affirmative to questions 1–4 of the nine occurrence questions. The results further indicated that that 25.08% respondents experienced lack of food, 20.03% went to bed hungry and 18.09% spent the whole day without food over the recall period.

Table 3. Distribution of respondents by food insecurity indicators (Access scale).

Variable	Level	Frequency *(n)*	Percent *(%)*
1. Worry about food	Yes	254	70.06
	No	106	29.04
2. Unable to eat preferred food	Yes	253	70.03
	No	107	29.07
3. Eating limited variety of food	Yes	236	65.06
	No	123	34.04
4. Eating undesired food	Yes	234	65.00
	No	126	35.00
5. Eat a smaller meal	Yes	210	58.03
	No	150	41.07
6. Eat fewer meals in a day	Yes	168	46.07
	No	46.7	53.03
7. No food of any kind in the household	Yes	93	25.08
	No	267	74.02
8. Go to sleep hungry	Yes	73	20.03
	No	287	79.07
9. Go a whole day and night without eating	Yes	68	18.09
	No	292	81.01

Based on the HFIAS domains, the results in Figure 2 illustrate that the majority of participants experienced inadequate food quality (70.08%) and anxiety or uncertainty concerning food stock (70.06%). Insufficient food intake and its physical consequences were experienced by the smallest percentage (59.01%) of participants in this study.

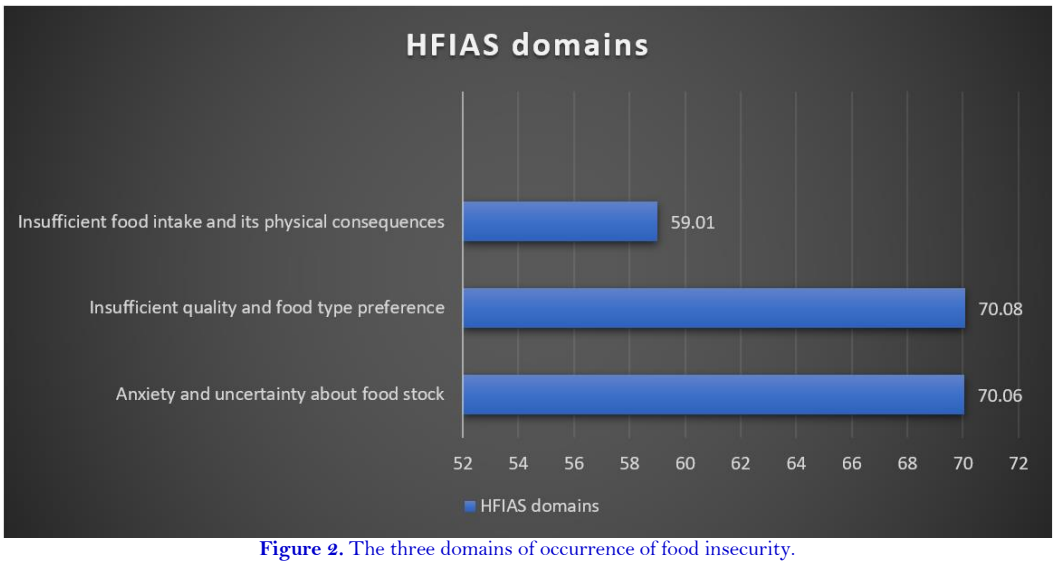

Figure 2. The three domains of occurrence of food insecurity.

The score was calculated on the basis of responses to the nine questions, with the maximum score being 27 and the minimum being 0. The lower the score, the less food insecurity a household experienced; alternatively, the the higher the score (maximum 27), the more food insecurity and less access the household experienced. The results of the study showed the mean food security score for these surveyed households to be 8.5. Based on the formula for calculating the HFIAS category and household food insecurity access prevalence presented above, the degree of food insecurity experienced by each urban household in RNLM was calculated and is presented in Table 4. The results revealed only 29.00% of households to be food secure, and the majority (71.00%) to be food insecure. Coates et al. (2007) suggested further subdividing respondents who were food insecure into three categories. It was found that the largest percentage of these respondents (40.00%) were moderately food insecure, while the remainder were either mildly food insecure (12.05%) or severely food insecure (18.06%) (Table 4).

Table 4. Prevalence of household food insecurity.

Food security status	Frequency (n)	Percent (%)
Food secure	105	29.00
Mildly food insecure	45	12.05
Moderate food insecure	145	40.00
Severely food insecure	67	18.06
Total	360	100

3.4. Factors Associated with Food Insecurity Among the Households

Table 5 presents the results of multivariate analysis. Households with higher incomes per month, that is, incomes between R4001 and R5000 (AOR=0.05; 95% CI:0.01–0.44; p=0.01) and those with incomes greater than R5000 (AOR=0.02; 95% CI:0.00–0.14; p=0.00) were less likely to experience food insecurity than those with a total income of less than R1000 per month. Households with more than one source of income were twice (AOR=2.36; 95% CI:1.07–5.17; p=0.03) as likely to be food insecure than those with a single income source as a referent. Similarly, households that engaged in food gardening (AOR=3.40; 95% CI:1.45–7.95; p=0.00) had significantly higher odds of experiencing food insecurity than households that did not engage in this practice.

Table 5. Multivariate analysis of the factors associated with food insecurity among the households (N=360).

Variable	Category	Food security status		AOR	p-value	95%CI
		Food secure	Food insecure			
		F (%)	F (%)			
Age	18–40	27 (35.53)	49 (64.47)	Ref		
	41–50	26 (32.50)	54 (67.50)	0.34	0.19	0.07–1.67
	51–60	33 (34.20)	64 (65.98)	0.36	0.23	0.07–1.88
	61–70	12 (15.79)	64 (84.21)	0.33	0.20	0.06–1.77
	Above 70	7 (22.58)	24 (77.42)	0.20	0.11	0.03–1.45
Gender	Male	31 (27.93)	80 (72.07)	Ref		
	Female	74 (29.72)	175 (70.28)	0.76	0.42	0.39–1.47
Marital status	Single	44 (22.45)	152 (77.55)	Ref		

Variable	Category	Food security status		AOR	p-value	95%CI
		Food secure	Food insecure			
		F (%)	F (%)			
	Married	41 (41.84)	57 (58.16)	0.59	0.15	0.29–1.20
	Divorced	8 (28.81)	23 (74.19)	1.06	0.91	0.35–3.22
	Widowed	4 (17.39)	19 (82.61)	1.99	0.34	0.48–8.23
	Cohabiting	8 (66.67)	4 (33.33)	0.31	0.16	0.06–1.62
Employment status	Unemployed	27 (15.70)	145 (84.30)	Ref		
	Employed	78 (41.49)	110 (58.51)	0.61	0.25	0.26–1.41
Level of education	No education	7 (23.33)	23 (76.67)	Ref		
	Primary level	11 (12.79)	75 (87.21)	1.04	0.96	0.28–3.79
	High school level	61 (30.35)	140 (69.65)	0.65	0.54	0.16–2.58
	Tertiary level	26 (60.47)	17 (39.43)	0.56	0.48	0.12–2.76
Members employed	None	6 (7.23)	77 (92.77)	Ref		
	1–2	83 (34.30)	159 (65.70)	0.48	0.24	0.14–1.66
	More than 2	16 (45.71)	19 (54.29)	0.78	0.76	0.15–3.92
Household income	less than R1000	2 (8.70)	21 (91.30)	Ref		
	R1000–R2000	12 (13.04)	80 (86.96)	0.42	0.36	0.06–2.76
	R2001–R3000	21 (19.81)	85 (80.19)	0.44	0.40	0.06–2.98
	R3001–R4000	24 (35.29)	44 (64.71)	0.16	0.07	0.02–1.17
	R4001–R5000	19 (54.29)	16 (45.71)	0.05	0.01	0.01–0.44
	Over R5000	27 (75.00)	9 (25.00)	0.02	0.00	0.00–0.14
Number of income sources	1 income	70 (28.23)	178 (71.77)	Ref		
	More than 1 income	33 (31.25)	77 (68.75)	2.36	0.03	1.07–5.17
Dwelling type	Formal	89 (27.64)	233 (72.36)	Ref		
	Informal	4 (33.33)	8 (66.67)	0.39	0.29	0.07–2.19
	Renting	12 (46.15)	14 (53.85)	0.40	0.14	0.12–1.34
Land access	No	28 (51.85)	26 (48.15)	Ref		
	Yes	77 (25.16)	229 (74.83)	0.96	0.95	0.32–2.86
Agricultural experience	No	38 (52.78)	34 (47.22)	Ref		
	Yes	67 (23.26)	221 (76.74)	2.20	0.08	0.91–5.31
Practising food gardening	No	50 (50.51)	49 (49.49)	Ref		
	Yes	55 (21.07)	206 (78.93)	3.40	0.00	1.45–7.95

4. DISCUSSION

The majority (>65.00%) of the food insecure households in the study indicated that they often worried about food, were unable to eat the food they preferred, and ate a limited variety of food. These are regarded as mild forms of food insecurity (Rudolph et al., 2021). Other studies conducted in South Africa (Rudolph et al., 2021) and Eastern Ethiopia (Derese, Belay, Fentie, & Derese, 2023) have found similar results to ours. However, the numbers reported in our study are slightly higher than those reported in the study by Rudolph et al. (2021). For example, in the latter study, approximately 50% of respondents reported experiencing the occurrences described by the first HFIAS questions. Just as was observed in previous studies conducted in urban areas in South Africa (Rudolph et al., 2021), a declining trend from the first to the ninth question was observed in our study. While this is reassuring in light of the fact that these questions reveal the severity of food insecurity, these proportions are high in comparison with findings of other studies conducted in other urban areas in Gauteng province (Rudolph et al., 2021) and Eastern Ethiopia (Derese et al., 2023). In the study by Derese et al. (2023) less than 15% of respondents experienced severe forms of food insecurity, such as sleeping hungry or not eating the whole day and night, compared with 20% and 18% of the respondents in our study who responded in the affirmative to these questions. With regard to domains of food insecurity, the proportion of households in our study reported as having insufficient food intake (59.01%) was slightly higher than the percentage in other urban areas in Gauteng (Rudolph et al., 2021). While insufficient food intake is considered a milder form of food insecurity, its existence is problematic due to its association with poor educational and psychological performance and health outcomes in both adults and children (Arora, 2018; Gregory, Mancino, & Coleman-Jensen, 2019; Reuter, Forster, & Brister, 2021). Differences between the study areas could explain the observed inconsistencies between the two studies. Generally, recent reports have indicated that at 51% food insecurity is much lower in Gauteng than in KZN (Simelane, 2024). Furthermore, over 70% of the households in our study experienced anxiety and uncertainty about food supply and insufficient food intake; this percentage was much higher than that reported in the previous studies (Derese et al., 2023; Rudolph et al., 2021). The age of the respondents may explain the observed difference between these studies. The majority of the respondents in our study (55.38%) were in the age category of 51 years and older; this age category is dominated by retirees and beneficiaries of old age grants. Available evidence suggests that retirees and beneficiaries of old age grants are more vulnerable to food insecurity (Sandile Mthethwa & Wale, 2020). People of working age, with an average age of 30 years, dominated the latter studies (Derese et al., 2023; Rudolph et al., 2021). This suggests that households headed by members of the younger generation are less likely to experience

food insecurity than households headed by older people. This view is supported by authors such as Oduniyi and Tekana (2020) who observed that food insecurity increases with the increase in age of the household head.

The mean HFIAS score in this study was 8.50. This is high by most standards and denotes high levels of food insecurity (Simelane, 2024). Moreover, this mean score is high in comparison with similar studies conducted in South Africa. For example, in a study involving 1000 households in the City of Johannesburg, a mean score of 5.7 was recorded (Rudolph et al., 2021), and a study conducted in selected smaller cities in KwaZulu-Natal revealed an average HFIAS score of 5.5 and 8.3 in Richard's Bay and Harrismith, respectively (Chakona, 2022). This suggests that the households in our study experienced difficulty in accessing food (Simelane, 2024). Furthermore, the results revealed 71.00% of households in our study to be food insecure. These results correspond with the results from studies conducted among urban dwellers in South Africa and Ghana (Nenguda & Scholes, 2022; Tuholske, Andam, Blekking, Evans, & Caylor, 2020). However, this percentage was considerably higher than that reported in urban areas in Eastern Ethiopia (41.7%) (Derese et al., 2023); East Africa (60.91%) (Gebremichael et al., 2022); and in Tembisa Township, South Africa (62%) (Mojela, Hlongwane, & Ledwaba, 2018). Time could explain the discrepancies between our study and these earlier studies, as evidence suggests an increasing trend in food insecurity (FAO, IFAD, UNICEF, WFP, & WHO, 2022).

Of the respondents in our study, 40% were moderately food insecure, while 18% were severely food insecure. While the percentage of severely food insecure households was slightly lower than that reported in the literature from other peri-urban areas (Chakona, 2022; Nenguda & Scholes, 2022) these numbers are worrying, especially considering that this percentage represents people who have run out of food and have gone for days without eating.

In our study, total monthly income, number of income sources, and participation in food gardening were significantly correlated with household food insecurity. The study showed that households with higher monthly incomes were less likely to be food insecure than those with lower incomes. This result is consonant with previous studies Kundu et al. (2021) and Nkomoki, Bavorová, and Banout (2019) where income was found to be inversely associated with household food insecurity, and confirms the finding of previous studies that income is the main determinant of food security in urban and peri-urban areas (Mazenda et al., 2022; Nenguda & Scholes, 2022; Ruel, Garrett, & Yosef, 2017). The association between income and food security in urban areas is attributable to the high dependency of urban households on the markets for food supply (Battersby & Haysom, 2019). Consequently, when food prices rise (FAO et al., 2022; Writer, 2022) households with low incomes struggle to meet their basic needs.

The odds of being food insecure were higher in households with multiple sources of income than in those with a single source of income. Although these results are consistent with the results of a study by Atuoye, Antabe, Sano, Luginaah, and Bayne (2019) conducted in the Upper West Region of Ghana, they were not expected. For example, in a study conducted using data extracted from the 2019 General Household Survey in South Africa, Sandile Mthethwa and Wale (2020) observed that income diversification reduced household food insecurity. Therefore, findings reported here may appear counterintuitive, given the broad body of literature substantiating the impact of income diversification on food insecurity (Akrasi, Eddico, & Adarkwah, 2020; Etea, Zhou, Abebe, & Sedebo, 2019). However, in an earlier study we published from the same study group, we observed that households with multiple income sources were recipients of pensions and government social grants, namely old age, disability, and children's grants (Lembete, Agyepong, & Mbombo-Dweba, 2024). These income sources are insufficient to maintain consumption and alleviate household food insecurity and poverty (Mthethwa & Wale, 2023). As a result, pensioners and beneficiaries of social grants are more vulnerable to food insecurity (Sandile Mthethwa & Wale, 2020). Berlie (2023) argues that it is the total income earned from these different sources, not the number of income sources, that determines food security.

In our study, households that participated in food gardening were more likely to experience food insecurity than those that did not engage in this activity. Similar findings were reported by Oguttu, Mbombo-Dweba, and Ncayiyana (2021) in a study conducted among urban residents in Gauteng, which revealed that households that had experienced some form of food insecurity in the previous year or lived in the poorest areas were more likely to engage in food gardening. Tawodzera and Chigumira (2019) found 92% of respondents in a study conducted in Epworth, an urban area in Zimbabwe, to be food insecure despite the majority of them participating in urban agriculture. Low-income urban households often use food gardening as a strategy to mitigate food insecurity, according to literature. However, the literature has also revealed that urban agriculture is often limited due to zoning laws and access to productive resources (Ruel et al., 2017; Tawodzera & Chigumira, 2019). Furthermore, the literature has demonstrated that agricultural activities in urban areas are limited to personal consumption and are highly seasonal (Lembete et al., 2024). This leaves low-income households vulnerable to food insecurity during the off-season.

5. CONCLUSION AND RECOMMENDATIONS

Although the majority of households in the study participated in food gardening, the level of food insecurity among the study population remained high. This demonstrates the complexity of food security in urban areas and provides an indication that finding a solution to the problem of food insecurity requires a multidimensional approach. Income, sources of income, and participation in food gardening were identified as factors that correlated with household food insecurity in the area. This suggests the necessity of targeted policy interventions intended to alleviate the unique difficulties that urban households are facing. This could include a review of the minimum wage in the informal sector to ensure that wages are on par with the rising costs in urban areas. Nevertheless, the study's findings of widespread adoption of food gardening are encouraging, and we recommend that we not ignore urban agriculture, but rather consider it as one of a range of strategies to enhance food security. However, innovative methods and support from extension and advisory services to maximize the outcome of this endeavour are necessary. Moreover, there is a need for training and resources to assist those participating in urban agriculture in producing not only for their own consumption but for income generation as well. This will not only benefit the participating households but could also

boost local food systems. Financial support and/or incentives to establish off-farm or non-farm income-generating ventures and the creation of employment safety nets such as the Community Work Programme and Expanded Public Works Programme are possible strategies to assist in improving household income. Further research is required to investigate the obstacles limiting the effectiveness of urban agriculture.

Funding: This research is supported by University of South Africa.
Institutional Review Board Statement: The Ethical Committee of the College of Agriculture and Environmental Sciences of the University of South Africa, South Africa has granted approval for this study on 26 April 2019 (Ref. No. 2019/CAES/047).
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.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: Involved in the study design, the data analysis and interpretation and the writing and reviewing of the manuscript, T.M.D.; involved in in the study design and data collection, S.L.; involved in the study design, the data analysis and interpretation and the writing and reviewing of the manuscript, T.A.S. All authors have read and agreed to the published version of the manuscript.

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