





# UNDERSTANDING THE ROLE OF HOME GARDENS IN HOUSEHOLD FOOD SUPPLY IN TIMES OF SHOCKS AND UNCERTAINTY: EVIDENCE FROM COVID-19 LOCKDOWN IN NIGERIA

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## ABSTRACT

Home gardening has continued to gain increased interest among researchers because of its role in promoting household food security and strengthening local agrifood systems, particularly in developing countries like Nigeria. In times of shocks like the COVID-19 pandemic, which severely disrupted food supply chains, it offers significant potential to drive sustainable household food supply. However, its potential to fully support household food supply in Nigeria remains underutilized. This study analyzes the role of home gardens in food supply among households during the COVID-19 lockdown, using cross-sectional data from 140 university staff members randomly selected. The data were collected via an online survey during the COVID-19 lockdown and analyzed using a probit model. The result shows that most respondents owned a home garden. However, only 52 percent of the home gardeners obtained food from the garden during the COVID-19 lockdown. Socio-demographic characteristics such as gender and age were inversely related to ownership of a home garden, while household size, house location and education showed a positive and significant relationship. The food crops grown in the home gardens were mainly vegetables, cassava (*Manihot esculenta*) and maize (*Zea mays*). The primary reason for owning a home garden was the access to organic food and vegetables. The findings of this study suggest that home gardens offer the potential to sustain household food supply in times of food shocks and uncertainty.

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## INTRODUCTION

Home gardening has continued to gain increased interest among researchers because of its role in promoting household food security and strengthening local agrifood systems (Lal, 2020). The effects of food price volatility and global food shocks can also be potentially reduced by intensifying food production in home gardens (Kumareswaran & Jayasinghe, 2022). Furthermore, home gardening is a crucial component of local food systems and agricultural landscapes. Building a resilient and sustainable food system in developing countries already facing high food insecurity and poverty levels is pertinent. It is a promising approach for reducing household food insecurity and increasing food production. This is because the home garden provides direct access to food for households, typically daily, and ensures household food security by producing a variety of healthy foods all year round. Additionally, its relevance increases during periods of food shocks, with some households establishing home food gardens mainly to address food crises (Katz, 2020; Music et al., 2022). For instance, the COVID-19 pandemic disrupted household food supply, increasing the uptake of home garden food among households (Montefrio, 2020). During the COVID-19 lockdown, the food systems in most developing countries were greatly threatened due to the restrictions on transportation that interfered with the logistics of food supply from rural to urban areas (Wetaya, 2020). Countries with unstable food systems, such as Nigeria, experienced increased effects due to pre-existing vulnerabilities, including poor infrastructure, high levels of poverty, and dependence on imported food. The COVID-19

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lockdown restrictions began in April 2020 as a precautionary measure to slow the spread of the virus in Nigeria (Haider, et al., 2020). This led to a ban on social gatherings and the closure of schools, businesses, markets, shops and religious centres. The lockdown raised concerns about the disruption of food supply, given that the COVID-19 outbreak came unexpectedly and most households were not adequately prepared to store sufficient food to serve during the lockdown. Hence, the COVID-19 lockdown further exacerbated the risk of food insecurity, hunger and malnutrition among households (Lal, 2020). This led to a considerable focus on home gardens for food supply to cushion food shocks and improve household food and nutrition security (Chandran & Podikunju, 2021). The ability of home gardens to supply households with a wide range of nutritious and healthy foods such as fruits, legumes, root crops and vegetables, coffee, flowers (both for sales and ornamentals), medicines, spices and tea leaves supports enhanced household food security. Besides, it is also a source of income, strengthens social relations, promotes physical exercise and provides environmental support (Darly et al., 2021). Despite the growing evidence of the benefits of home gardening, it has yet to gain widespread, especially in urban areas. Although the COVID-19 pandemic lockdown has increased the proliferation of home gardens due to a shortage of food supply, many households are yet to understand the importance of home gardening in promoting household food security (Montefrio, 2020; Music et al., 2022). There is also a paucity of studies on the adequacy of food supply from home gardens during the COVID-19 lockdown in the Nigerian context. Therefore, this study analyses the food supplies from home gardening under the COVID-19 lockdown in Nigeria, giving empirical evidence from households in a university community. The study answers the following questions: Do farmers' socio-demographic factors influence owning a home garden? Was the home garden able to supply food during the COVID-19 lockdown to those with home gardens? Was the food supply from the home garden to the household during the COVID-19 lockdown sufficient? Specifically, we describe the socio-demographic characteristics of home gardeners, food grown and food supply from home gardens during the COVID-19 pandemic. We analyze factors influencing owning a home garden using a probit model. Our result suggests that socio-demographic characteristics such as age, gender, household size, house location and education have a relationship with ownership of home gardens. The results further show that 52 percent of farmers who owned home gardens obtained food from the garden during the COVID-19 lockdown, though at a minimal level.

The rest of the paper has three sections. The next section focuses on the material and methods, the third on the results and discussions, and the last on concluding and drawing policy implications from the research.

## LITERATURE REVIEW

Home gardening has long been recognized as a key component of household food security and the local food system. They provide immediate access to fresh produce, diversify diets, and contribute to local food systems. Landon-Lane (2004) defined home gardening as a system of farming that integrates several physical, social, and economic functions on the land surrounding the family's home to supplement the supply of nutritious food at the household level in the study area. Several studies have shown the importance of home gardening in promoting household food security. For instance, Musotsi et al. (2008), Machida (2019), Rammohan et al. (2019), Castañeda-Navarrete (2021), Issahaku et al. (2023), and Gwacela et al. (2024) noted that higher nutritional outcomes and more food diversity in households are associated with home gardens. It helps improve the eating habits and consciousness of nutritious food among younger children (Libman, 2007). Contrarily, Du Toit et al. (2022) suggest that home gardens do not necessarily improve household food security. Furthermore, home gardens also serve as safety nets during food crises and shocks (Galhena et al., 2013; Montefrio, 2020; Mead et al., 2023). The COVID-19 lockdown disrupted household food supply in Nigeria, as in most developed countries (Lal, 2020). In response to the disruptions in food supply, households turned to home gardening to supplement their food supply (Paganini et al., 2020; Music et al., 2022; Wu et al., 2023). However, there is limited empirical research on the efficiency of food supply from home gardens during the COVID-19 lockdown in Nigeria.

## MATERIALS AND METHODS

The study was conducted in the University of Nigeria, Nsukka (UNN) community in South Eastern Nigeria. The University is at 6°51'24"N and 7°23'45"E, with a land mass of approximately 871 hectares on the hilly savannah in Nsukka and about 80 kilometres North of Enugu (National Population Commission, NPC, 2006). The university has 530 senior and 62 junior staff housing units. The University staff living in staff quarters can access land around their homes. The data for the study was collected from the university staff between April 2020 and June 2020 during the COVID-19 lockdown via an online survey. It is important to note that the COVID-19 lockdown in Nigeria lasted from 30<sup>th</sup> March to 4<sup>th</sup> of May. Google forms were randomly distributed to the university community members through social media platforms (WhatsApp) and emails. A total of 140 responses were received at the end of the survey. Data collected include food crops grown in the home garden, food supply from the home garden during the COVID-19 lockdown, reasons for having a home garden, and respondents' socioeconomic characteristics.

The probit model analysed factors influencing the decision to own a home garden. The probit model constrains the estimated probabilities to be between 0 and 1. In specifying the probit model, the dependent variable, Y, takes the value of 1 if the home garden supplied food during the COVID-19 lockdown and zero if otherwise. The latent model is presented as follows:

$$Y_i = X_i\beta + \varepsilon_i \quad (1)$$

$$Y_i = 1 \text{ if } Y_i > 0$$

Otherwise = 0

Where,  $Y$  is binary outcome (1 if the home garden was able to supply food during the COVID-19 lockdown and 0 otherwise),  $\beta$  and  $X_i$  are the parameter estimates and explanatory variables, respectively. The error term  $\varepsilon_i$  is assumed to be normally distributed.

Probit analysis is based on the cumulative normal probability distribution (Ghozali & Ratmono, 2013). The probability of having a home garden is specified in (2), where  $\Phi$  represents the cumulative distribution. The conditional probability is specified as,

$$P(Y = 1|X_1, X_2, \dots, X_n) = \Phi(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k) = \Phi(X_i' \beta) \quad (2)$$

The relationship between the explanatory variables and the outcome variables is interpreted using the marginal effect, which accounts for the partial change in the probability. The marginal effect associated with continuous explanatory variables  $X_k$  on the probability  $P(Y_i = 1|X)$ , holding the other variables constant, can be derived as follows:

$$\frac{\delta P_i}{\delta X_{ik}} = \Phi(X_i' \beta) \beta_k \quad (3)$$

Where;  $\Phi$  represents the probability density function of a standard normal variable.

The marginal effects on dummy variables are estimated differently from continuous variables. Discrete changes in the predicted probabilities constitute an alternative to the marginal effects when evaluating the influence of a dummy variable. Such an effect can be derived from the following:

$$\Delta = \Phi(x\beta, D = 1) - \Phi(\tilde{y}\beta, D = 0) \quad (4)$$

Where  $x$  and  $\tilde{y}$  are explanatory variables,  $\beta$  is the parameter to be estimated and  $\Phi$  is the cumulative standard normal distribution function. It is assumed that the conditional probability has a normal distribution.

## RESULTS AND DISCUSSIONS

### Socioeconomic characteristics of respondents

Table 1 represents the respondents' socioeconomic characteristics. The results show that most respondents are male (61 percent), while 39 percent are female. The average age, household size, and household expenditure are 46 years, 6, and 76600 Naira, respectively.

Table 1. Socioeconomic characteristics of the respondent

Socioeconomic characteristics	Description	Measurement	Mean	S.D	Percentage (%)
<b>Sex</b>	Sex of respondent	Dummy	0.607	0.490	61 39
		Male = 1 Female = 0			
<b>Age</b>	Age of the respondent	Years	46	8.4	
<b>Household size</b>	Number of persons living in a household	Continuous	6	2.14	
<b>Household expenditure</b>	Household monthly expenditure (Naira)	Continuous	76600 75557.1	54527.4	
<b>Staff category</b>	Category of staff in the university	Dummy	0.707	0.457	70 30
		Teaching staff = 1 Non-teaching staff = 0			
<b>Education</b>	Academic qualification of the respondent	Dummy	0.564	0.497	56 44
		PhD degree = 1 No PhD degree = 0			
<b>Marital status</b>	Marital status of the respondent	Dummy	0.910	0.291	90.71 9.29
		Married = 1 Not married = 0			
<b>Labour</b>	Labour used in the home garden	Dummy	0.578	0.496	58 42
		Family labour = 1 Hired labour = 0			
<b>Home garden</b>	If the respondent owns a home garden	Dummy			
		Yes = 1 No = 0			

Approximately 70 per cent of the respondents were teaching staff of the university, while 30 percent were the non-teaching staff. The majority (56 percent) of the staff interviewed had a PhD (Doctor of Philosophy), while 44 percent had lower degrees (Masters's degree, bachelor's degree, and Diploma). This is expected, given that respondents are working in

an academic institution. Most respondents were married (91 percent), while 9 percent were unmarried. Family labour is mostly (60 percent) used in the garden, while 40 percent used hired labour. Furthermore, about 58 percent of the respondents owned a home garden, while 42 percent did not have one.

### Distribution of Food Crops Grown By Respondents in the Home Garden

The food crops grown in the home garden include fruits (41%), vegetables (93.3%), maize (30%), cocoyam (13.3%), cassava (46.7%), cowpea (3.8%), yam (17.3%), potatoes (10.7%), and pigeon peas (2.5%), as represented in Table 2. This is in line with Adebisi et al. (2019) study that showed that the common food crops grown in the home gardens were aloe vera, black beans, cassava, cocoyam, cucumber, garden egg, ginger, maize, melon, potato, tomato, three-leaf yam, okra pepper and yam. The results also showed that vegetables were mainly grown in the home gardens, which is crucial for household food and nutritious security. The findings of Lal (2020) also showed that vegetables are mainly grown in home gardens. Kegler et al. (2020) also noted that home gardening was consistently linked to increased consumption of fruits and vegetables.

Table 2. The food grown by respondents in the home garden

Food crops grown by respondents	Percentage
Vegetables	93.3
Maize ( <i>Zea Mays</i> )	30
Cassava ( <i>Manihot esculenta</i> )	46.7
Yam ( <i>Dioscorea alata</i> )	17.3
Potatoes ( <i>Ipomoea batatas</i> )	10.7
Cocoyam ( <i>Xanthosoma sagittifolium</i> )	13.3
Fruits	41
Cowpea ( <i>vigna unguiculata</i> )	3.8
Pigeon pea ( <i>cajanu cajan</i> )	2.5

Source: Online survey 2020

Some of the fruits grown include pawpaw (*Carica papaya*), mango (*Mangifera indica*), cashew (*Anacardium occidentale*), plantain (*Musa paradisiaca*), orange (*Citrus sinensis*), oil palm (*Elaeis guineensis*), Soursap (*Annona muricata*), moringa (*Moringa oleifera*), banana (*Musa sapientum*), African star apple (*Chrysophyllum albidum*), African pear/plum (*Dacryodes edulis*), guava (*Psidium guajava*), coconut (*Cocos nucifera*), avocado (*Persea Americana*), cucumber (*Cucumis sativus*), breadfruit (*Artocarpus altilis*), lemon (*citrus limon*) and cashew (*Anacardium occidentale*). Vegetables grown include fluted pumpkin leaf (*Telfairia occidentalis*), scent leaf (*Ocimum gratissimum*), green (*Amaranthus hybridus*), bitter leaf (*Vernonia amygdalina*), water leaf (*Talinum triangulare*), jute leaves (*Corchorus olitorius*), wild spinach (*Gnetum africanum*), lemon grass (*Cymbopogon citratus*), tomatoes (*Solanum lycopersicum*), pepper (*Capsicum annum*), okra (*Abelmoschus esculentus*), and garden egg (*Solanum melongena*). The diverse food grown in the home gardens shows that it not only has the potential to promote household food security but can contribute significantly to household diet diversity (Rammohan et al., 2019; Ogutu et al., 2023).

### Ownership of Home Garden and Its Influencing Factors

While a greater percentage of the respondents (58%) owned a home garden, 42 percent did not have a home garden. The respondent gave several motives for having a home garden. These include engaging in leisure and recreational activities (5%), maintaining a clean compound for preventing the spread of grasses and weeds that can attract snakes (7.5%), obtaining organic and healthy food (70%) (With healthy food defined as produce grown without any inorganic inputs such as pesticides, fertilizers, herbicides, etc.), cultivating vegetables (5%), ensuring an adequate food supply (13.75%), and passing down indigenous knowledge of agricultural practices to their children (1.25%). Access to organic and healthy food was the major reason for owning a home garden. Basha et al. (2015) and Lamonaca et al. (2022) also noted that organic food is predominantly preferred due to health-related concerns.

Conversely, among the households without home gardens, 8 percent stated it was not worthwhile. This could be attributed to a lack of knowledge of the many benefits of growing a home garden (Al-Mayahi et al., 2019). According to Rammohan et al. (2019), home gardens are critical in promoting food security and diet diversity. An additional 8 percent indicated that their schedules are highly demanding, leaving them with insufficient time for tending to a home garden. Meanwhile, 24 percent stated that maintaining a garden is burdensome. The majority, 60 percent, noted the lack of available land as the primary impediment to owning a home garden. Notably, there is an uneven land distribution among respondents, especially those living on university campuses. Additionally, some respondents use the available land for constructing infrastructure such as car garages, which reduces or eliminates the possibility of having a home garden.

The probit model's result gave a Log likelihood of -53.397 and a Pseudo R-square of 0.44. The LR chi<sup>2</sup>(8) is 83.82, and a Prob > chi<sup>2</sup> of 0.0000. Furthermore, the receiver operating characteristic (ROC) curve was computed and presented in Figure 1 to assess the model's predictive power. The ROC represents the relationship between sensitivity and specificity, comparing the actual response values to the fitted values.

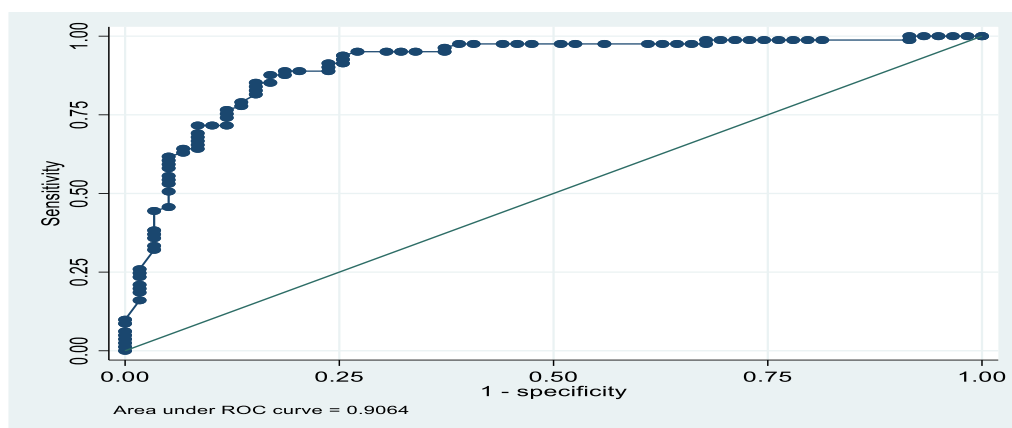


Figure 1. Receiver Operating Characteristic (ROC) curve

The region containing values ranging from 0 to 1 is called the concordance index (c index). A c-index value of 0.5 indicates a model's absence of predictive power, whereas a value approaching 1 signifies exceptional predictive power. The area under the curve is 0.9064, indicating that the model has predictive power. The results of the probit model are presented in Table 3.

Table 3. Factors influencing ownership of a home garden

Variable	Definition	Measurement	Coefficient	Marginal effects (dy/dx)
Marital status	Marital status of the respondent	Dummy (Married =1, Not married =0)	0.303 (0.519)	0.065 (0.111)
Age (Years)	Age of the respondent	36 – 45	-0.497 (0.480)	- 0.089 (0.083)
		46 – 55	-1.225** (0.533)	- 0.229 ** (0.087)
		56 – 65	-1.631** 0.592	- 0.313*** (0.098)
Sex	Sex of the respondent	Dummy (Male =1, Female = 0)	-0.606** (0.313)	-0.131** (0.066)
Household size	Number of persons living in a household	Continuous	0.229*** (0.088)	0.049*** (0.017)
Home location	Location of residence of the respondent	Dummy (On-campus residence – 1 Off-campus residence - 0)	2.088*** (0.362)	0.449 *** (0.050)
Education	Academic qualification of the respondent	PhD holder -1	0.573** (0.306)	0.123** (0.064)
		Non-PhD holder - 0		

\*\*\* p<.01, \*\* p<.05, \* p<.1 (In parentheses are the SE -Standard Error)

The marginal effects show that age, gender, household size, house location, and education significantly affect owning a home garden. The respondents in the age range of 46 to 65 years have a significant and negative relationship with ownership of home gardens. The marginal effect results show that the chances of owning a home garden decrease by about 9 percent for individuals between the ages of 46 and 65. This implies that older respondents are less inclined to own a home garden. This may be due to respondents' reliance on family labour as the primary source of labour for the garden. Basarir et al. (2022) also showed that a lack of ability to maintain the home garden has an inverse relationship with ownership of the home garden. However, this is contrary to the findings of Mao et al. (2020) and Zheng et al. (2022), which showed in their studies that older individuals are more inclined to have a home garden, especially as older individuals are more health-conscious with their eating habits. Furthermore, the results show that males have a lower probability of owning a home garden than females. Mdiya and Mdoda (2021) also showed that women are predominantly involved in home gardens. The household size shows a positive and significant relationship with the home garden. An increase in household size increases the probability of owning a home garden by 5 percent. This is consistent with the findings of Onomu et al. (2022), which state that larger households are likely to own a home garden. This may also result from larger households' increased food demand and labour availability.

Regarding respondents' residence, residing on the university campus increases the chances of having a home garden by 45 percent. This is in line with the findings of Schupp et al. (2016), which state that the residence of a household significantly affects the ownership of a home garden. The respondents' education also showed a positive relationship with home gardens. This implies that earning a PhD increases the chances of owning a home garden by approximately 12 percent. Basarir et al. (2022) also showed that holding an MSc/PhD degree increases the likelihood of having a home garden.

### The proportion of household food from the home garden during the COVID-19 lockdown

A respondent is considered to have a food supply during COVID-19 if any form of food was obtained within the perimeter of their home during the COVID-19 lockdown. The results show that only about 52 percent of those who owned a home garden agreed that their garden could provide food during the COVID-19 lockdown. However, 48 percent could not obtain

food from the home garden, as shown in Figure 3. The inability to access food from their home garden during the COVID-19 lockdown may be attributed to the lack of preparedness for the lockdown, which came unexpectedly. In addition, a challenge that emerged during the pandemic was the coinciding of the implementation of lockdown measures and the beginning of the planting season rather than the harvest season. As such, residents were unable to obtain food from their home gardens in a period when crops were supposed to be cultivated. In Nigeria, the rainy season typically occurs from April to October, while the dry season extends from November to March (Odekunle, 2004).

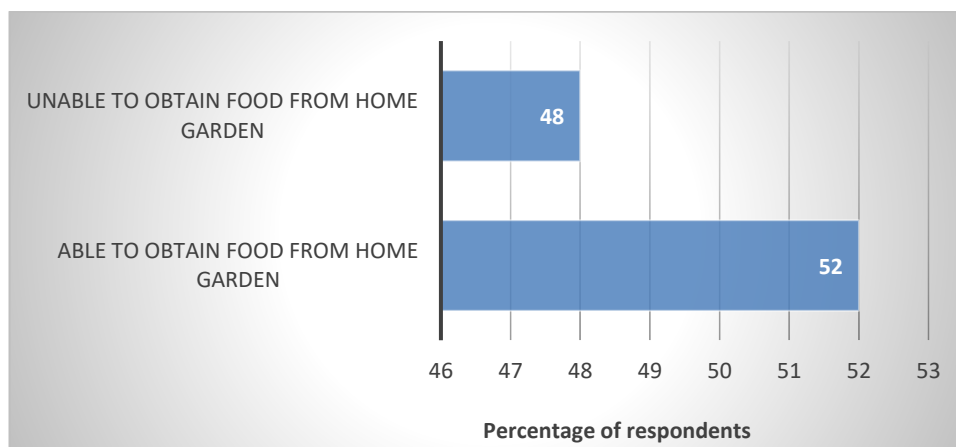


Figure 2. Food supply from the home garden during the COVID-19 lockdown

The distribution of the proportion of food supply from the home garden during the COVID-19 lockdown on a scale of one to ten (1 – 10) is presented in Figure 3. The respondents were asked about the proportion of food supplied from the home garden during the COVID-19 lockdown on a scale of 1 – 10 (ascending order). Approximately 11 percent chose zero, which implies that the home garden did not supply any food during the COVID-19 lockdown. Another, 28 percent chose one, 25 percent chose two, 11 percent chose three, 11 percent chose four, 7 percent chose five and 7 percent chose six.

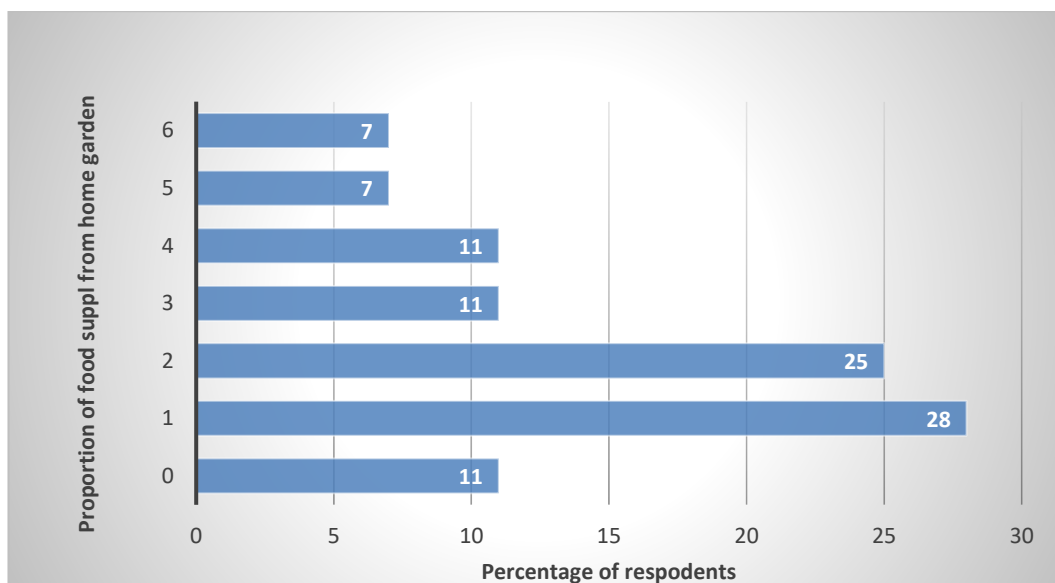


Figure 3. The proportion of food supply from a home garden in a range of 0-10 (ascending order)

None of the respondents chose seven, eight, nine or ten, indicating that the home garden supplies food to households during the COVID-19 lockdown, but the supply was minimal. That notwithstanding, despite the unexpected implementation of the lockdown just before the beginning of the planting season, the home garden was able to supply some food to households. Therefore, by strategically timing and adequately preparing, the home garden has the potential to provide households with an ample supply of food. Mead et al. (2023) and Lal (2020) also noted that home gardens have the potential to supply food to households and reduce food insecurity. Additionally, 51.2 percent of respondents practicing home gardening wished they had expanded their home garden before the pandemic and hoped to expand it in the next planting season.

## CONCLUSIONS

The study analyzed the role of home gardens in household food supply during the COVID-19 lockdown. Home garden supplied food to more home gardeners during the COVID-19 lockdown. However, the food supply from home gardens was limited due to the lockdown at the start of the planting season. Home gardening was primarily motivated by the desire to

access organic food and vegetables. Socio-demographic factors also influence home garden ownership. The study highlights the importance of home gardens in enhancing household food security and building resilient food systems. Therefore, given the multifaceted benefits of home gardens, this study suggests the need for increased awareness and sensitization on the importance of home gardens in building sustainable local food systems and resilience to food shocks. This is particularly critical in developing countries, where food insecurity and vulnerability to climate change impacts are prevalent.

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