

ANALYSIS OF FOOD SECURITY AND COPING STRATEGIES OF SMALLHOLDER VEGETABLE FARMERS IN KANO METROPOLIS, NIGERIA

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ABSTRACT

Households' livelihood security remains an important issue in the economic development of low household income communities. The study analyzed the food security and coping strategies of smallholder vegetable farmers in Kano metropolis, Nigeria. Primary data were collected using structured questionnaire. A multi-stage sampling technique was used to select 248 vegetable farmers from three metropolitan Local Government Areas for the study. Descriptive statistics were used to describe the socio-economic profiles of the vegetable farmers and identify the coping strategies adopted to mitigate the effects of COVID-19, while Foster-Greer and Thorbecke (FGT) model was used to estimate the food security status of the vegetable farmers in the study area. Average age of the vegetable farmers was 39 years; majority (96.4%) were married, with an average household size of 7 persons and a low level of formal education. Vegetable production only was the major livelihood practice by 70.6% of the farmers. Using an estimated mean per capita expenditure of ₦137,430 to establish the food security line, 72% of the farmers were food insecure during COVID-19. Major coping strategies practiced along the production, marketing and consumption chain included: accepting lower price, finding new markets and sales of key productive assets. The study concluded that COVID-19 negatively affected vegetable farmer's livelihoods and marketing activities, mainly through economic losses caused by difficulties in selling produce, reduced access to inputs and labour charges. Therefore, the study recommended programs that encourage off-farm income opportunities, and value addition in vegetable production should be promoted by government, non-governmental organizations, and stakeholders to reduce farmer's vulnerability to shocks affecting a single source of income.

Keywords: COVID-19; Foster-Greer and Thorbecke Model; Food security; Small-holder Farmers.

INTRODUCTION

Developing countries majorly rely on agriculture for both livelihoods and food security. Traditionally, farming households focus solely on agriculture, with minimal diversification into other economic activities

(Reardon *et al.* 2006). Ojeleye (2015) posited that farmers in Nigeria heavily depend on both on-farm and off-farm activities to sustain their livelihood securities. The term "livelihood" often overlaps with "economic strengthening" and encompasses aspects like

production, employment and household income. Households' livelihood security remains an important issue in the economic development of low household income communities (Mishra & Debata, 2021). It has been defined as adequate and sustainable access to the income and resources required to meet basic needs. The basic needs include adequate access to food, health facilities, educational opportunities (Mishra & Debata, 2021).

As the Coronavirus disease 2019 (COVID-19) pandemic progressed, trade-offs emerged between the need to curtail the virus and to avoid disastrous economic, livelihood and food security crises that hurt the world's poor and hungry most (Laborde, *et al.* 2020). The pandemic reached Nigeria in February 2020, but originated months earlier in China. Its rapid spread forced governments, including Nigeria's, to enact strict lockdowns and restrictions, disrupting economies across all sectors, including agriculture. Nigeria's agricultural sector, particularly vegetable production, holds immense significance. Unlike many other countries, the agricultural sector in Nigeria accounts for 70% employment of the populace and is thus the single largest source of livelihoods that produces almost 80% of the food needs (Abdul *et al.*, 2020). However, vegetable supply chains are highly susceptible due to the perishability of the crop. Delays and disruptions caused by lockdown have led to significant spoilage and post-harvest losses. Therefore, quantifying the impact of COVID-19 on Nigeria's vegetable production systems is crucial.

History is peppered with emergencies that have hammered food and nutrition security, ripping apart the livelihoods of entire communities. The 2008 global economic crisis

sent food prices skyrocketing, triggering economic and social unrest even in wealthy nations (FAO, 2019). Similarly, the 2014 Ebola epidemic devastated food security in affected countries (Thomas & Perez, 2014). In Ethiopia, COVID-19 lockdowns restricted movement, leading to a drop-in livestock demand and fear of infection (Tamru, 2020). Also, studies in India showed that COVID-19 lockdowns caused a critical shortage of farm labour (Lu, 2020). The COVID-19 pandemic slammed farming households, particularly vegetable producers. They grappled with disrupted supply chains, vulnerability to food insecurity threats, incomes decline, labour shortages at farms and the interrupted markets functions, as well as food price volatility and changes in consumer purchasing behaviour. Consequently, understanding the pandemic's effects on their well-being is crucial for identifying and addressing potential humanitarian concerns. Despite growing concerns about COVID-19's impact on agriculture and food security, information specific to vegetable farmers in developing countries remains scarce. Research gaps exist in several areas: Few studies have examined the concrete effects of COVID-19 on developing country vegetable farmers, with most focusing on developed nations. Much existing research are qualitative, exploring and describing challenges rather than quantifying their extent (Saakuma, 2020). Little is known about the specific coping mechanisms adopted by vegetable farmers to navigate the pandemic's impacts. Most research studies are either broader or focus on other crops besides vegetables. Existing research in the study area prioritize profitability and potential of vegetable farming (Dawaki & Shuaibu, 2014; Shuaibu, *et al.*, 2017) over food security concerns. There is a dearth of research on policy implications and interventions tailored to the specific needs of Kano

State's vegetable farmers during and after COVID-19. It is vital to identify best practices and policy recommendations to sustain the livelihoods of vegetable farmers. To achieve this, there is the need to address research gaps, enhancing the understanding and support for farmers in developing countries. This will enable them to navigate future challenges effectively and bolster their resilience. In view of the foregoing background, the study aimed to achieve the following objectives:

- i. describe the socio-economic profiles of the vegetable farmers in the study area;
- ii. estimate the food security status of the vegetable farmers;
- iii. identify the coping strategies adopted to mitigate the effects of COVID-19 shock in the study area.

MATERIALS AND METHODS

The Study Area

The study was conducted in three Metropolitan Local Government Areas of Kano, Nigeria, among smallholder vegetable farmers farming along the Jakara River, comprising Fagge, Nassarawa, and Ungoggo. The population of these Local Government Areas, estimated using the annual growth rate of 3.3% provided by the National Population Commission (NPC, 2006), was put at 3,338,474 people in the year 2024. Kano metropolis covers an area of 499 km², lying within latitude 11°56'0"N and 12° 07'0"N, and longitude 8°25'0"E and 8°33'30"E (NIPOST, 2009). Kano State lies in the tropical wet and dry climate zone. Average rainfall is about 1000 mm in the southern part, 800 mm around metropolitan Kano and about 600 mm in the north-east. The rainy season usually covers the months of May-October, followed by harmattan, which usually begins in November and ends

in February. Average daily maximum temperature is about 33.1°C and daily minimum temperature about 15.85°C (Dambatta & Sogbesan, 2015). Kano State is bordered to the north and northwest by Katsina State; to the east and northeast by Jigawa State; to the south by Bauchi State and to southwest by Kaduna State. Majority of the inhabitants are traders, with civil servants, transporters and those engaged in vegetable crops production, poultry, seedling production and land developers (KNARDA, 2011). A large number of people within the metropolitan areas are engaged in the marketing of agricultural food-stuffs, including vegetables (Baba, 2008). Based on livestock production, sheep, goats and cattle production are commonly available, especially among the peri-urban and rural dwellers.

Sampling Techniques

The target populations for this study were all vegetable farmers in the three (3) metropolitan Local Government Areas of Kano State (Table 1). Multi-stage sampling technique was employed in the selection of location and respondents. The first stage involved the purposive selection of Kano State from the Northwest zone of Nigeria, based on the intensity of COVID-19 cases and the importance of the state in the Nigerian economy. The second stage involved selection of the metropolitan LGAs where the national lockdown, curfew, social distancing and movement restriction implementation were highly felt. The third stage involved the purposive selection of three LGAs where urban and peri-urban irrigation farming activities along the Jakara River take place. Consequently, Fagge, Nassarawa, and Ungoggo LGAs were selected for the study. In stage four, three production sites each were randomly selected from Fagge and Ungoggo and two production sites from Nassarawa

LGA which gave rise to a total sample of eight production sites included in the study. The last stage involved the simple random sampling of 248 of vegetable farmers representing 10% of 2484 members in the list collected from their association (Table 1). Kajang, (2014) as adopted by Sani and Oladimeji (2017) posited that $\geq 10\%$ of the population is a fair representation especially where there is a large population.

Data Collection and Analysis

Data for this research were collected from primary sources with the aid of a structured

questionnaire administered to the vegetable farmers with the assistance of trained enumerators carefully selected by the researcher who can interview and communicate effectively in a manner that can influence farmers to give sufficient information. The questionnaire provided information on the socio-economic characteristics of the vegetable farmers which includes the age of farmer, farming experience, household size, education level and annual income, food expenditures etc. and coping strategies adopted during and post-lockdown of COVID-19.

Table 1: Summary of the Sampling

Local Government Area	Production site	Estimated Sampling frame	Sample size
Fagge	Kwakwaci	47	5
	Nomansland	123	12
	Jaba	505	51
Nassarawa	Gama-Kwari	246	25
	PRP	335	34
Ungoggo	Gayawa	447	45
	Rimaye	506	51
	Dankunkuru	275	28
Total		2,484	248

Source: Field Survey, 2022

Tools of Analysis

Descriptive Statistics

Descriptive statistics such as frequency and percentage, minimum, maximum, mean, standard deviation, mode, bar chart, and pie chart were used.

The descriptive approach is as explained below:

Arithmetic Mean: this is the set of scores divided by the total number of observations.

The mean is written mathematically as:

$$\bar{X} = \frac{\sum X_i}{n} = \frac{X_1 + X_2 + X_3 + \dots + X_n}{n} \quad (1)$$

Where;

$\bar{X}$ = Arithmetic mean

$\sum$ = Summation

X_i = Individual observation

$i = 1, 2, 3, \dots, n$

Percentage: This was employed to determine the population of farmers in a particular response. The percentage is written mathematically as:

$$\text{Percentage (\%)} = \frac{X}{N} \times 100 \quad (2)$$

Where;

% = Percentage

X = Individual observation, N = Total observation

Foster-Greer and Thorbecke (FGT) Food Security Analysis food insecurity incidence, gap, and severity were estimated similarly to previous studies

The Foster–Greer and Thorbecke (FGT) class of decomposable poverty measure was adopted to show the various food security statuses of the households. Measures of the Foster-Greer and Thorbecke (FGT) measures are mathematically derived as:

$$P\alpha = \frac{1}{n} \sum_{i=1}^q \left(\frac{z-y_i}{z} \right)^\alpha 1(y_i \leq z) \quad (3)$$

Where,

α = the FGT food insecurity index which takes values 0, 1, 2, (Foster *et al.*, 2010).

n = Total number of vegetable farmers,

z = Food security line (₦137,430 Per Person Per Year) (NBS,2020)

q = Number of households below the food security line,

y_i = Per-capita annual expenditure of the i th farmers.

That is,

$$\text{Food Insecurity Headcount } P_0 = \frac{1}{n} \sum_{i=1}^q \left(\frac{z-y_i}{z} \right)^\alpha = \frac{q}{n} \quad (4)$$

$$\text{Food Insecurity Depth or Gap } P_1 = \frac{1}{n} \sum_{i=1}^q \left(\frac{z-y_i}{z} \right)^1 \quad (5)$$

$$\text{Food Insecurity Severity } P_2 = \frac{1}{n} \sum_{i=1}^q \left(\frac{z-y_i}{z} \right)^2 \quad (6)$$

RESULTS AND DISCUSSION

Majority of the respondents in the study area were still economically active and expected to be productive with the available resources, irrespective of their food security status (Table 2). The finding conforms to

Sani *et al.*, (2014) who posited that farmers in Kano were within the youthful age of 20 to 49 years, who are considered to be agile. Average household size of the vegetable farmers was 7 persons, implying that the household size in the study area was fairly

large, compared to the national average of 5, reported by the National Bureau of Statistics (2010). This could negatively influence the expenditure pattern of household food consumption, especially amidst the pandemic. Adebayo (2012), Bashir, (2012) and Adepoju & Adejere (2013) studies showed that an increase in one family member increases the chances of a household

becoming food insecure by indirectly reducing income per head, expenditure per head and per capita food consumption. This may be attributed to the fact that household size exerts more pressure on consumption than it contributes to production (Paddy, 2003). It is assumed that larger households will be more likely to adopt coping strategies in response to the COVID-19 pandemic.

Table 2: Quantitative Socio-economic Characteristics of Vegetable Farmers

Variables	Minimum	Maximum	Mean	Std. dev
Age (years)	18	70	38.88	11.953
Household size(number)	1	24	7	5.057
Farm Size(hectares)	0.4	3.5	1.4	0.6214
Income Level (₦)	105,000	2,200,000	575,766	315,112
Farming Experience(years)	3	50	17.40	10.633
Distance to market(minutes)	20	60	35.27	12.675

Source: Field Survey, 2022

Average farm size of the vegetable farmers in the study area was 1.4 hectares, with a minimum farm size of 0.4 ha and maximum of 3.5 ha (Table 2). This implies that the areas were dominated by smallholder farmers. This supports the findings of Okunlola (2019) which highlighted the dominance of smallholder farmers in Nigeria's agricultural production system, responsible for a substantial part of agricultural output. Also, the observation aligns with the research conducted by Ogunlela & Mukhtar (2009) and Nchuchuwe & Adejuwon (2012) who noted that smallholder farmers own between 1 and 3 hectares. Thus, households that cultivate more farmland and grow a variety of crops would likely have dietary diversity options and may accumulate more assets to

be resilient from shock and stress, which would likely translate into vegetable farmer's food security.

Average income of the farmer's earnings was ₦575,766 from the sale of vegetables and other sources, with a minimum of ₦105,000 and maximum of ₦2,200,000 (Table 2). This indicates that the vegetable farmers obtained reasonable amount of cash from their sale of vegetables and other activities which empowered them economically. The number of years a farmer has spent in farming indicates the practical knowledge he has gained on how to cope with production, since well-experienced farmers are better risk managers than inexperienced ones (Onyekuru, 2008). The years of experience of the farmers

ranged between 3 and 50 years, with an average of 17 years. This implies that some of the vegetable farmers in the study area had relatively high years of experience. Ideally, they are expected to adjust to changing economic conditions and adopt coping strategies to warrant efficient activity. Average distance traveled in minutes from farm household residence to the main market was 35.27 minutes for the entire sample (Table 2). The implication is that the further away the market is from the vegetable farmers' homes residents, the less likely they access the market due to restriction measures. e.g. lockdown or curfew.

96.4% of the farmers were married and only 3.6% were single (Table 3). The high proportion of married respondents (96.4%) implies that the study finding largely reflects household-based decision-making, where family responsibilities may influence re-

spondents' livelihood strategies resource allocation and adoption of innovations. This agrees with Mbah, *et al.*, (2017), who observed that 80.2% of the vegetable farming households were married. It is anticipated that married farmers will be more likely to adopt coping strategies in response to the COVID-19 pandemic. Education plays an important role in improving the well-being of people. Majority (68.5%) of the farmers had formal education (Table 3), while a few (31.5%) had no formal education. The finding implies that, in analyzing the effects of COVID-19, farmers with formal education were likely better positioned to understand pandemic-related restrictions and adopt appropriate coping strategies, thereby influencing the extent to which COVID-19 affected their livelihoods compared to those without formal education. It is suggested that the more educated farmers will be more likely to adopt coping strategies.

Table 3: Qualitative Socio-economic Characteristics of the Vegetable Farmers

Categories/Discrete Variables	Category	Frequency	Percentage	Mode
Marital Status	Single	9	3.6	Married
	Married	239	96.4	
Educational Status	Informal	78	31.5	Primary education
	Primary	90	36.3	
	Secondary	68	27.4	
	Tertiary	12	4.8	
Membership of cooperative	Member	238	95.9	Members
	Non-member	10	4.1	
	Personal Savings	167	67.3	Personal saving
Source of capital	Loan/borrow	53	21.4	
	Friend & Relative	28	11.3	
Farm Ownership	Purchased	41	16.5	Inherited
	Rented	17	6.9	
	Inherited	190	76.6	
Household status	Owned	243	97.9	Owned
	Rent/Least	5	2.1	
Labour Type used	Hired labour	9	3.6	Family labour
	Family labour	128	51.6	
	Hired/Family labour	111	44.8	

Source: Field Survey, 2022

Memberships in cooperative associations indicate the social networks available to the farmer. These networks of social relationships determine farmers' access to credit and other resources needed for agricultural production. Membership in a cooperative association is notably higher among vegetable farmers in the study area, with the majority (95.9%) being members, while 4.1% were non-members of any association (Table 3). This higher membership rate among vegetable farmers suggests a stronger engagement in agricultural activities. Farmers believe that being part of a cooperative association affords them greater access to agricultural information (exposure to vital information about COVID-19), more affordable inputs (e.g., economic stimulus package amidst the COVID-19 pandemic), and improved extension services. This observation aligns with the research conducted by Balogun *et al.* (2018) and Ojiagu and Uchenna (2015). For example, governmental and non-governmental aid to farmers is channeled through associations rather than to individuals.

Capital refers to the cash being put to work for productive or investment purposes. From the research findings (Table 3), capital for the business was mostly from informal sources, and the majority of the farmers depend on their personal savings (67.3%), followed by loans (21.4%) and family and relatives (11.3%). The finding implies that the heavy reliance on personal savings (67.3%) and informal financing sources limited farmers' financial resilience, making them more vulnerable to income shocks and business disruptions during the pandemic. This finding agrees with Ayoola (2001), who stated that farmers' inability to get formal capital could be attributed to the stringent policy measures used by local moneylenders in recovering their money.

16.5% of the farmers acquired their farmland through purchase and rented (6.9%), while the majority (76.6%) acquired their land through inheritance (Table 3). The finding implies that the predominance of inherited farmland (76.6%) suggests farmers had relatively secure land access, which may have reduced displacement risks during COVID-19, but limited financial flexibility since inherited land is less likely to be used for collateral to cushion pandemic-related shocks. As noted by Matthew & Enitan (2022), the land used by most of the urban farming households belongs to them and their family/relatives. Ownership of houses and other housing infrastructure can be seen as a proxy for wealth. Almost all the vegetable farmers (97.9%) own their houses, while a few (2.1%) rent and pay annually. This implies that there is less burden or expense of paying rent. This is in line with the work of Abdullahi, Abbas & Abdullahi (2018), who stated that more than half of the respondents in their study area inherited their houses. 51.6% of the vegetable farmers used family labour both pre-COVID-19 and during the COVID-19 while 44.8% utilized both family and hired labour, with few (3.6%) used hired labour most often (Table 3). This shows that vegetable farming is labour-intensive in the study area. This is contrary to the work of Edohen & Ikelegbe (2018) which stated that the majority of the farmers relied much on hired labourers for farming purposes.

Food security status reveals that incidence among vegetable farmers was 0.72 (Table 5). This implies that about 72% of the vegetable farmers were food insecure as against 28% that were food secure. This is because they lack adequate income to meet the minimum standard of living, i.e., their income level falls short of the food security line. It also shows that the food insecurity gap was 0.342, representing the percentage of income required to

bring a food-insecure vegetable farmer up to the food security line. This implies that 34.2% of ₦137,430 is required to bring a food-insecure vegetable farmer to the food security line. The food insecurity severity of the households was 0.204. This implies that food insecurity is more severe among food-

insecure vegetable farmers, with about 20.4% (Table 5). The study aligns with Padmaja *et al.* (2022), who stated that more than 40% of the households surveyed experienced deterioration in food security status during the pandemic.

Table 5: Food Security Status of Smallholder Vegetable Farmers

Variables	Food Security Status		Total
	Food secure	Food insecure	
Food security line (Z)	₦137,430		
Number of Vegetable Farmers	70	178	248
Percentages (%)	28.22	71.77	100
Head Count/Incidence (P ₀)	0.28	0.72	1
Food Insecurity Depth/Gap (P ₁)		0.342	34.2
Food Insecurity Severity(P ₂)		0.204	20.4

Source: Field Survey, 2022; NB: FS line = ₦137,430 (National Food Security line).

The major effects include: “Market closure or disruptions (for sales)” (M=4.62), “loss of income” (M=4.57), “Market closure or disruptions (for purchases)” (M=4.47), and “increase in food prices” (M=4.33). The result is consistent with findings of PricewaterhouseCoopers [PWC] (2020), who posited that the COVID-19 crisis and its associated effects (e.g., inter-state movement restriction) led to a tendency for more speculative buying and increases in food prices while farmers experienced a decline in their disposable income. As reported by Cariappa *et al.* (2021), Consumers in India also stated an increase in food prices during the pandemic. For example, Ruan *et al.* (2021), the daily price of Chinese cabbage sharply increased by 46% initially in China. Rising food prices reflect a shortage of supplies resulting from reduced production, lower food imports, and increasing demand

(Abdul, 2020). Coping strategies can be defined as a response to adverse events or shocks, e.g., COVID-19. These strategies range in intensity from activities like food rationing, drawing down savings, accepting a lower selling price, to more permanent strategies like the sale of assets.

Vegetable farmers developed up to five different coping strategies to cope with the COVID-19 lockdown situation (Fig.1), namely accepting a lower selling price (34.16%), finding new markets (26.92%), producing less vegetables for selling (21.95%), eating more own production rather than selling (14.49%), with the few producing more vegetables than before the pandemic for selling (2.48%) – Fig.1. This aligns with Balana *et al.* (2020), who stated that accepting lower farm gate prices was a major strategy practiced by farmers during the

lockdown and the intensity of the COVID-19 pandemic. This implies that adopting these coping strategies by the vegetable farmers in the study area was targeted at producing transformation and managing supplies, as finding alternative markets.

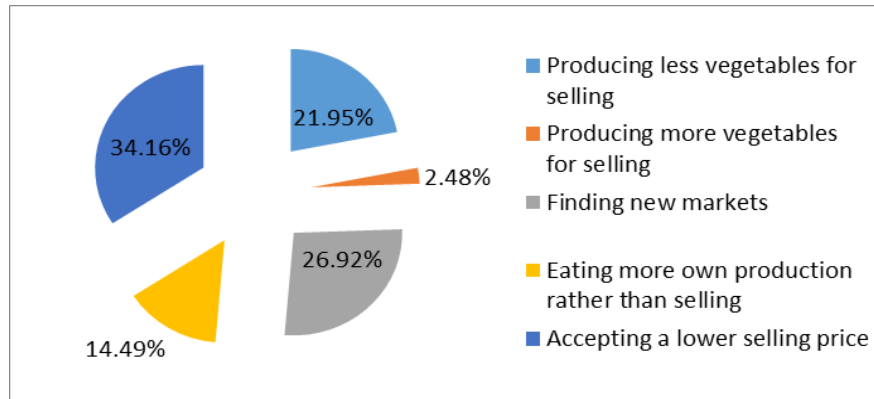


Figure 1: Production and Marketing Coping Strategies Adopted During Lockdown
Source: Field Survey, 2022

Households' adjusted consumption pattern aimed at averting food insecurity. "Sales of key productive assets", including production land, as practiced by more than one-quarter (28.63%) of the farmers (Fig. 2), followed by withdrawal of savings for consumption (21.83%). 18.27% of the vegetable farmers borrowed cash or purchased food on credit from others, some 12.85% of the farmers resulted in "eating monotonous foods", while 9.29% expressed "reduction in food consumption daily".

The vegetable farmers adopted the "eating of less preferred food" (5.42%), while a few (3.72%) skipped meals (Fig. 2). Studies from Nigeria reported that households compensate for income losses by selling farm and household assets, borrowing from friends, family, and local lenders, and dipping into their savings (Balana *et al.*, 2020; Obayelu *et al.*, 2021; Yegbemey *et al.*, 2021). In general, an emergency coping strategy is the worst since it compromises the quality of life in the long term. However, starvation or begging was not reported by any households.

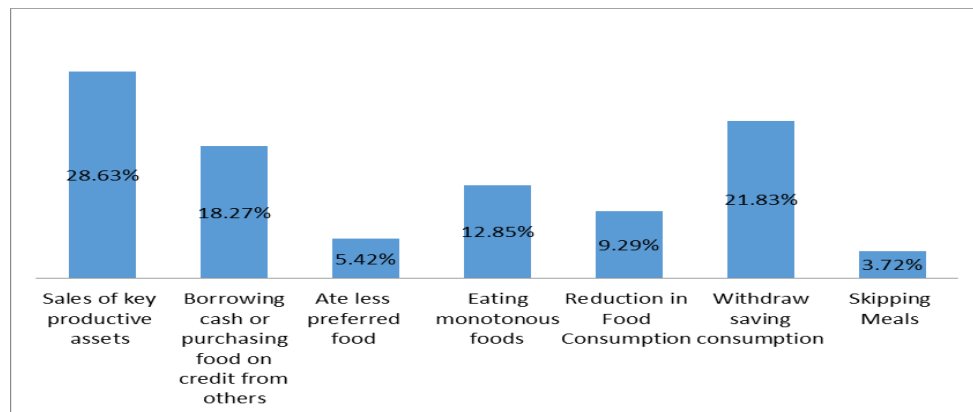


Figure 2: Households' Adaptive Consumption Pattern during Lockdown
Source: Field Survey, 2022

The vegetable farmers strictly engaged in three different marketing strategies to cope with the indirect effects of the COVID-19 pandemic after the lockdown period (Fig. 3) and mostly include: “finding new markets for selling of produce” as practiced by 59.46% of the vegetable farmers, this is

highly utilized even more than the period of the pandemic. More than one-quarter of the farmers involved in “accepting lower selling price (27.30%)”, to avoid postharvest losses, while “eating more of their own production rather than selling” was also adopted by 13.51% of the farmers (Fig. 3).

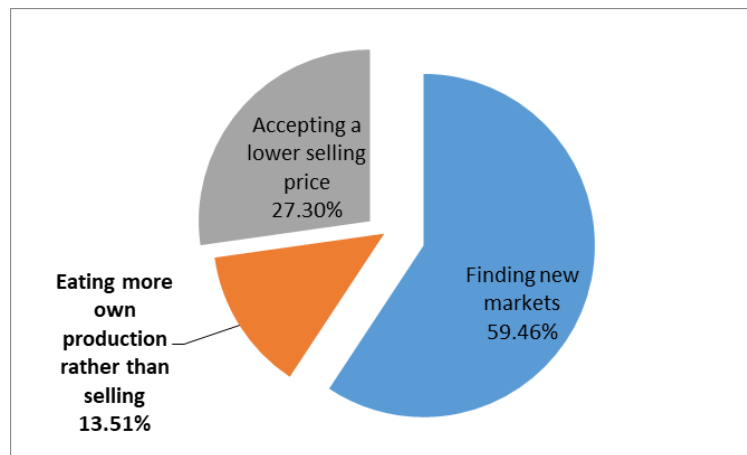


Figure 3: Production and Marketing Strategies Post-Lockdown
Source: Field Survey, 2022

Vegetable farming households with different food insecurity status employed different coping strategies depending on their access to such options (Fig. 4). Households in both locations employed similar coping strategies to deal with the stress to their food security. Households that were in a more intense state of food insecurity tended to sell their “key productive assets” as a coping mechanism (28.62%). “Eating monotonous food” was also practiced by less than one-quarter of the farmers (21.05%), and “borrowing cash or purchasing food on credit” was practiced by 21.01% to cope with the stress. 12.68% of the vegetable farmers practiced “withdrawal of savings for consumption” while 8.33% are into “travel to search for a job”. There was a “reduction in food consumption” as stated by 5.43%, and 5.07% of farmers “Ate

less preferred food” to cope with stress (Fig. 4).

The findings are not consistent with Adesoji (2020) and Oyeniyi (2021), who stated that more dryland farmers went into reducing food consumption and drawing down of savings as their coping mechanism. According to Pandey (2021), small and marginal farmers were more likely to have sold productive assets compared to large farmers.

SUMMARY AND CONCLUSION

The study examined the food security status and coping strategies of small vegetable farmers in Kano metropolis during the covid-19 pandemic. This study concluded that COVID-19 had negative impacts on the vegetable farmers’ livelihood and marketing-related activities, with major effects resulting

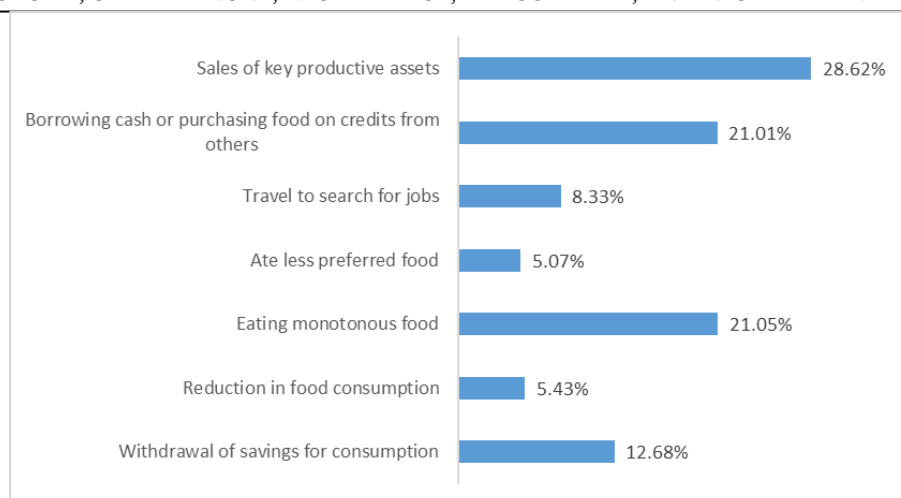


Figure 4: Household Consumption Coping Strategies Post-Lockdown
Source: Field Survey, 2022

in economic losses due to difficulties in marketing produce in conventional channels, but also difficulties in managing production systems through reduced access to inputs and labour.

To cope with these challenges, the vegetable farmers adopted coping strategies along the production, marketing, and consumption in the direction of a search for greater autonomy of their systems, including finding new markets and sales of key productive assets during and after lockdown.

It was concluded that the food insecurity incidence, gap and severity among vegetable farming households were high during the COVID-19 lockdown in the study area.

RECOMMENDATION

1. Authorities' such as government and stakeholders should develop more resilient and decentralized marketing systems, including improved transportation networks and digital marketing platforms, to ensure that farmers can access

markets even during crises such as pandemics or movement restrictions.

2. Government, non-governmental organizations, and stakeholders, in times of emergencies such as pandemic, targeted social protection programs, food assistance, and inputs subsidies should be implemented to support smallholder farmers and prevent severe food insecurity.
3. Programs that encourage off-farm income opportunities, and value addition in vegetable production should be promoted by government, non-governmental organizations, and stakeholders to reduce farmer's vulnerability to shocks affecting a single source of income.

AUTHORS CONTRIBUTION

Muhammad Halliru: Managed data collection, interpretation of data, writing of manuscript, material support, and review of manuscripts and wrote the first draft of the manuscript.

Umar Ibrahim Sabo: Managed the literature

searches, development of methodology, data analysis, and the development of the model. All authors read and approved the final manuscript.

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ETHICAL STATEMENT

Not applicable

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this research.

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