UNIZIK Journal of Agricultural Economics and Extension (UJAEE) Vol. 1 No.2 (2024): 422-431
A Journal of the Department of Agricultural Economics and Extension, Nnamdi Azikiwe University, Nigeria
Available at: https://journals.unizik.edu.ng/ujaee

Information and Post-Harvest Food Safety Handling Practices among Pumpkin Farmers in Ikwo Local Government Area of Ebonyi State, Nigeria

Agou, G.D.[1]*, Inyang, P.[2], Umeh, N.E.[3] and Agwu, O. O.[4]

[1]*Department of Agricultural Extension, Alex Ekwueme Federal University, Ndufu-Alike, Ikwo, Ebonyi*
[2]*Department of Crop Science, Alex Ekwueme Federal University, Ndufu-Alike, Ikwo, Ebonyi*
[3]*Department of Agricultural Extension, Alex Ekwueme Federal University, Ndufu Alike, Ikwo,*
[4]*Department of Agricultural Economics, Alex Ekwueme, Federal University Ndufu-Alike, Ikwo*

KEYWORDS:
Contamination Consumption, Handling, Health, Production

***CORRESPONDING AUTHOR:**
aguogabriel@gmail.com

ABSTRACT

The study assessed information and post-harvest food safety handling practices among pumpkin farmers in Ikwo Local Government Area, Ebonyi State. The specific objectives of the study were to: assess post-harvest food safety handling practices, identify the sources of information on post-harvest food safety handling practice and identify the constraints faced by small-holder pumpkin farmers in post-harvest food safety handling practices. Multi-stage sampling procedure was employed for the selection of the respondents while a well-structured questionnaire was used to collect data. Frequency, percentage, mean and factor analysis were used for data analysis with the help of SPSS. The study found that 59.7% of pumpkin farmers were females, the mean age was approximately 47 years, 41.7% obtained primary education, 59.9% were members of social organizations. Furthermore, the study found that 68.75% of the post-harvest food safety handling practices of the respondents were incorrect. Fellow farmers, television and friends/neighbours were among credible sources of information used by the respondents. Volume/income/sensitization, weak institution/prices/ health officers/knowledge were among constraints hindering post-harvest food safety handling. Relevant authorities should ensure that pumpkin farmers have access to training and adequate supports on post-harvest food safety handling practices to prevent contamination of pumpkin products that will promote public health.

INTRODUCTION

Pumpkins (*Cucurbita spp*.) are extensively cultivated around the tropical and sub-tropical and temperate countries including Asia, Africa, Europe, and the Oceanic continents, producing more than 20 million tons annually (Ceclu, *et al.*, 2021). China is the global highest producer in the world, accounting for 58% global pumpkin production per year. India is having 45,000 hectares of land apportioned for pumpkin cultivations, producing around 5 million metric tons per year, with an average weight of 8-01kg in fruits. In 2023, around 15.97 million cwt of pumpkins were produced in the United States as against 8.46 million cwt produced in 2001 (Shahbandeh, 2024). Pumpkin production in Germany had been increased over 500 hectares at the year 2018.

The Nigeria's favourable climate, with abundant rainfall and diverse agro-ecological zones, allows for year-round cultivation of various leafy green vegetables like pumpkin (Akinola, *et al.*, 2020). Pumpkin production in Nigeria in year 2018, was predicted to be 7.5 million tons (Food and Agriculture Organization, 2019). Pumpkins are used as food and vegetables for household consumption and as commercial and home garden crop (Osuji, *et al.*, 2022). The great diversity

and adaptation to a wide range of environments indicates the potential of this crop as it contributes to addressing the challenges of nutrition through offering healthy and affordable nutrient to the consumers (Maseko *et al.*, 2017). This is because pumpkins are rich in compounds such as vitamins, minerals, antioxidants and even anti-cancer factors needed to maintain health and fight off infections (Zilpah, 2024). However, pumpkins can be contaminated during post-harvest handling by small-holder farmers who often face constraints limited access to resources such as clean water, electricity, capital, insufficient infrastructure and lack of equipment for proper washing, cleaning, and storage constituting safety issues to the public (Food and Agriculture Organization, 2020). The lack of proper storage and transportation infrastructure is a significant challenge for small-holder farmers. Furthermore, factors such as dirty environment, use of dirty water for washing of pumpkin leaves, inadequate handwashing, dirty and contaminated utensil and poor hygiene of smallholder farmers and sellers among others can compromise the safety of pumpkins (Ndambi *et al.*, 2020). The contaminates pumpkins can have economic implications for small-holder farmers such as increased financial losses as farmers may struggle to sell their products or obtain fair prices in the market. Addressing the problem of contamination and promote public health is crucial to for pumpkin farmers to have access to information on post-harvest food safety handling practices. Based on the foregoing therefore, the study sought to assess information and post-harvest food safety handling practices among smallholder pumpkin farmers in Ikwo Local Government Area, Ebonyi State, Nigeria,

METHODOLOGY

The study was conducted in Ikwo Local Government Area, Ebonyi State, Nigeria. Ikwo being one of the Local Government Area in Ebonyi State is located within latitude: $6^0 3^I 11^I$N and longitude: $8^0 9^I$ 46 ^{I}E. Ikwo Local Government Area is made up of twelve autonomous communities which are: Ekpelu, Ekpaomaka, Ekawoke, Alike, Ndufu-alike, Ndufu-echara, Ndufu-omega, Ndegu-amagu, Ndegu-achara, Inyimagu, Igbudu and Okpituma autonomous communities. It has a land mass of approximately 5,000 kilometers squared and shares boundaries with Izzi in the North, Ezza in the West, Cross River State in the South and Abakaliki in the East. The population of Ikwo was estimated to be 284,400 people, according to National population commission, (2006). Ikwo is blessed with natural resources and has a semi tropical climate with varied temperature and rainfall patterns. The rainfall pattern is bimodal with peaks in July and September and ranges to 2500mm while temperature is at 30^{oc}. The indigenes are majorly farmers and cultivate the following crops in large quantities; Rice (Ereshi), Yam (Nji), Cocoyam (Nkashi) Cassava (Njakpu), Potatoes (Ogogo), Groundnut (Ashimoko), Soya bean (Azaku), Guinea corn (Igeri), Bambara nut (Akpanyinko) alongside with livestock production.

All the pumpkin farmers in Ikwo Local government Area made up the population for the study. Multistage sampling procedure was used for the selection of respondents. At the first stage, Ikwo Local Government Area was purposively selected based on its massive involvement in pumpkin production. The second state involved the use of random sampling technique to select 4 autonomous communities out of the 12 in the local government area. The third stage involved the use of purposive sampling technique to select 2 villages from each of the selected autonomous communities, giving a total of 8 villages. The last stage involved purpose selection of nine pumpkin farmers, giving a total of 72 pumpkin farmers for the study. A well-structured questionnaire was used to collect data. The data collected were analyzed using frequency, percentage, mean score, while variables, factor analysis (Principal Component). The hypothesis was tested using multiple regression model.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Pumpkin Farmers

Table 1 shows that 59.7% of pumpkin farmers were female. This implies that majority of pumpkin farmers were female farmers and this agrees with Igbinidu and Egbodion (2023). This might be because males usually have access to agricultural productive resources than females. About 27.8 % of the farmers were in between 31 and 40 years of age with an approximately mean age of 47 years. This implies that most of the farmers were young, able and ready to cope with drudgery that comes with farming, and this agrees with Nimiye *et al.* (2024) who found that 38.9% of pumpkin farmers were between the age of 31-40 years. More so, the result shows that 41.7% of pumpkin farmers obtained primary education. This is in consonant with that of Olabanji *et al*. (2018) who found that 44.8% of pumpkin farmers obtained secondary education. The average household size was 7 persons and this means that majority of the respondents had large household size that could supply family labour for pumpkin production and this agrees with the finding of Enete and Okon (2010). Furthermore, the result indicates that 59.7% of the farmers were in social organization. This implies that majority of the respondents belonged social organization and this could be due to the benefit associated with belonging to social organizations. Social organization membership provides access to loans, inputs, information and others. The finding corroborates the finding of Amolegbe *et al.* (2022).

Table 1: Socio-economic demographics of smallholder pumpkin farmers

Characteristics	Frequency	Percentage	Mean
Sex			
Male	43	40.3	
Female	29	59.7	
Age			
Less than 30	10	13.9	
31-40	20	27.8	
41-50	18	25.0	47
51-60	14	19.4	
61 and above	10	13.9	
Educational Level			
No formal education	4	5.6	
Primary education	30	41.7	
Secondary education	22	30.6	
Tertiary education	16	22.2	
4. Household size			
1-5	26	36.1	
6-10	38	52.8	7
11 and above	8	11.1	
Membership of social organization			
Yes	43	59.7	
No	29	40.3	
Different Social organizations			
Processors' association	8	11.1	
Village cultural association	34	47.2	
Political group	30	41.7	

Farming experience in years				
1-5	18	25.0		
6-10	26	36.1		11
11-15	10	13.9		
16 and above	18	25.0		
Farm size (hectares)				
1-4	59	81.9	4	
5-8	11	15.3		
9 and above	2	2.8		
Annual income (naira)				
Less than 200,000	16	22.2		
200001 – 400,000	30	41.7		
400,001-600,000	16	22.2		402,500.00
600,001 and above	10	13.9		
Access to credit facilities				
Yes	58	80.6		
No	14	19.4		
Source of credit facilities				
Commercial banks	4	5.6		
Microfinance bank	6	8.3		
Isusu	26	36.1		
Friends	20	27.8		
Relatives	16	22.2		
Extension visits				
Yes	28	39.9		
No	44	61.1		

Source: Field survey, 2024

The result further reveals that majority (81.9%) of pumpkin farmers had farm size of between 1 and 4 hectares and the average farm size was approximately 4 hectares. This implies that majority of the respondents were small-holder farmers who only had access to small and fragmented farmlands for cultivation of their crops. Also, 41.7% of the farmers earned between ₦200001 and ₦400,000 with the mean annual income was ₦402,500.00. Majority (80.6%) of the pumpkin farmers had access to credits of which majority (36.1%) sourced their credits from Isusu and this implies that majority of the respondents had access to credits from Isusu.

Post-harvest Food Safety Handling Practices of Pumpkin Farmers

Post-harvest food safety practices are presented in Table 2. The mean value indicates that properly wash the pumpkin before selling ($\bar{x}$=2.2639). This implies that the farmers understood the importance of washing pumpkins before selling as it helps to reduce physical contaminants. Furthermore, the respondents also agreed that they did not leave pumpkin leaves by the road side on bare ground ($\bar{x}$=2.2361), implying that they understood the danger associated with leaving pumpkin leaves by the road side. This is because leaving pumpkin leaves by the road exposes it to insects, reptiles and other animals, thereby compromising its safety for consumption and this is congruent with the assertion of Agou *et al.* (2024). The mean value shows that the respondents agreed that the washing of

garment frequently worm for marketing of pumpkin ($\bar{x}$=2.1250) was another post-harvest food safety handling practice. The finding suggests that the respondents knew that importance of personal hygiene as it helps reduce cross contamination from clothes to pumpkin leaves. They also agreed that using modern facilities for storage ($\bar{x}$=2.0278) was another post-harvest food safety handling practice and this indicate that the respondents understood the significant of using modern storage facility, which increases the shelf-life and preserving the quality of leafy vegetables (Balagun & Ariahu, 2020).

Table 2: Pumpkin farmers' post-harvest food safety handling practices

Post-harvest food safety handing practices	Mean	Std. Dev
Properly wash the pumpkin before selling	2.2639	1.18670
Not leaving pumpkin leaves by the road side on bare ground	2.2361	1.28362
Washing of garment frequently worm for marketing	2.1250	1.37316
Using modern facilities for storage	2.0278	1.11295
Not harvesting pumpkin at the right time	1.9722	1.38373
Not allow ventilation during storage of pumpkin seeds	1.9722	1.26683
Spreading pumpkin on dirty tarpaulins	1.9583	1.22690
Applying pesticides on stored pumpkin seeds	1.9444	1.23207
Processing and marketingof pumpkin in a dirty environment	1.9444	1.35198
Not Washing of hands after toilet during processing and marketing	1.9306	1.37714
Not Keeping personal hygiene during processing and marketing	1.9028	1.27996
Not Allowing correctly drying of pumpkin seeds before storage	1.7917	1.23263
Allowing animals marching on pumpkin	1.7500	1.13522
Not regularly inspecting pumpkin	1.5278	1.35285
Allowing Children play with pumpkin	1.4306	1.03225

Source: Field work, 2024

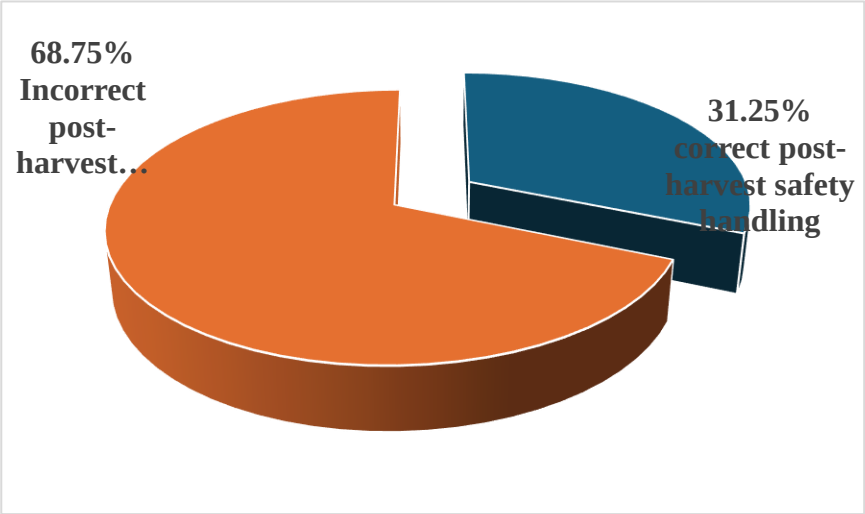


Fig 1: Level of Post-harvest Safety Handling Practices of Pumpkin Farmers

Fig 1 reveals that 68.75% of the post-harvest safety handling practices were incorrect while 31.25% were correct post-harvest safety handling practices. This implies that the majority of post-harvest handling practices of the respondents were incorrect. This might be due to the lack of enforcement

of food safety regulations by the relevant authorities. The finding contradicts that of Chukwukasi et al. (2023) who found that 70.5% of post-harvest food safety handling practice of food handlers in Enugu state, Nigeria was good.

Sources of Information on Post-Harvest Safety Handling Practices

Table 2 reveals that fellow farmers (100.0%,) ranked 1st as a source of information on post-harvest handling safety practices utilized by pumpin farmers. The use of television (97.2%) which ranked 2nd source of information appears to have gained more acceptance considering the long period that it has existed. Therefore, its use among farmers in rural areas proves convenient and acceptable (Funom, 2021). The finding also indicates that friends/neighbours (86.1%) ranked 3rd and family members (83.3%) ranking 4th sources of information on post-harvest food safety handling practices. In spite of advent of modern electronic channels of accessing information, farmers still access information from friends/neighbours and family members, respectively (Funom, 2021). The finding implies the respondents knew the importance of using neighbours/friends and family members to access credible information on post-harvest food safety handling practices. This supports the findings of Adio et al. (2016) that found that one of the information sources accessible to farmers in Kwara state was family members. Furthermore, newspaper (76.7%) 5th, mobile phone (63.9%) 6th, public sanitary officers/health officers (63.9%) 7th, extension agents (55.6%) 8th, input dealers (53.8%) 9th and fellow traders (50.0 %) ranking 10th. The findings are consistent with that of Rehman *et al*. (2013) reported that one of the print media such Newspaper was another useful source of information used by farmers. Furthermore, Olabanji *et al*. (2018) corroborated in their findings that newspaper and extension agents were among the sources of information used by fluted pumpkin farmers in Yola North local government area.

Table 3: Sources of information on post-harvest safety handling practices

Information sources	Percentage	Ranking
Fellow farmers	100.0	1
Television	97.2	2
Friends/neighbours	86.1	3
Family members	83.3	4
Newspaper	76.7	5
Mobile phone	63.9	6
Public sanitary officers/health officers	63.9	7
Extension agents	55.6	8
Input dealers	53.8	9
Fellow traders	50.0	10
Food organization	47.2	

Source: Field survey, 2024.

Credibility of the Sources of Information

Credibility of sources of information are presented in Table 4. The table shows that family members ($\bar{x}$=2.9167) ranked 1st most credible source of information available to the farmers, suggesting family members served as credible source of information on post-harvest food safety handling practices to the respondents. Also, traders ($\bar{x}$=2.9167) ranked 2nd credible information source, implying that fellow traders provided reliable information to the farmers. Another credible source according to the mean value was food organization ($\bar{x}$=2.8889), which ranked 3rd. Food

organizations such as restaurants, hotels and others provided credible information since they are the end users of pumpkin leaves. More so, public sanitary officers/health officers ($\bar{x}$=2.8333) was ranked 4th credible source of information and this might be because of their knowledge about food safety handling practices and the appropriate measures that could prevent contaminations.

Table 4 further reveals the mean values, of which fellow farmers ($\bar{x}$=2.6667) was the 5th credible source of credible information used by the respondents and this suggests that farmers who are into the same production could play an advisory role to fellow farmers. Considering the importance of religious organization ($\bar{x}$=2.6528), the mean indicates that it was 7^{6h} credible source of information used by pumpkin farmers and this might be because religious organizations such as church and mosque stationed in rural areas are held with high esteem and as such any information coming from these sources is regarded with much respect. Also, input dealers ($\bar{x}$=2.5000) ranked 7th source of providing credible information used by the respondents. This could be because input dealers who had direct interaction with input dealers might serve as a channel through which credible information percolate into the farming communities. The study also found that friends/neighbours ($\bar{x}$=2.3056) ranked 8th most credible sources of information used by the respondents to access information on post-harvest food safety handling practices. This confirms the finding of Sajina, *et al*. (2018) that friends and neighbours were among the credible sources of food safety practices information in Manipur India.

Table 4: Credibility of the sources of information

Sources	Mean	Std. Deviation	Ranking
Family members	2.9167	0.93070	1
Traders	2.9167	0.86806	2
Food organization	2.8889	0.97223	3
Public sanitary officers/health officers	2.8333	0.99293	4
Fellow farmers	2.6667	0.88811	5
Religious organization	2.6528	1.02311	6
Input `sdealers	2.5000	1.02091	7
Friends/neighbours	2.3056	0.61983	8
Radio	1.6250	0.51560	
Newspaper	1.5278	0.69144	
Extension agents	1.5556	0.74850	
Television	1.3611	0.58876	
Mobile phone	1.5694	0.70863	

Source: Field survey, 2024 Cut-off point: 2.0

Perceived Constraints faced by Pumpkin Farmers in Post-Harvest Handling Practices

Perceived constraints faced by pumpkin farmers in post-harvest handling practices are presented in Table 5. The constraints are grouped into factors such as factor 1(Volume/Income/sensitization), factor 2 (weak institution/prices), factor 3 (health officers) and factor 4 (marketing activities**).** Factor 1 (volume/income/sensitization) had loading variables such as the volume of our farm produce (0.535), lack of finance to construct modern storage facility (0.687), poor access to credit facilities (.718). The lack of finance and access to credits faced by the respondents could because most farmers in developing countries are small-holder farmers who make little from agriculture and might not have enough collateral/security to obtain credits from financial institutions (Ikenga et al. 2024). Lack of sensitization and campaign (.687). The volume of farm produce prevented the respondents from observing post-harvest food safety handling practices. This might be because

most of the rural farmers do not have the capacity to handle large volume of farm produce due to lack of transportation and storage facilities. In this circumstance, farmers will be forced to handle their farm produce anyhow. Lack of sensitization on post-harvest handling practices was another constraint and this implies that farmers who do not have adequate information on post-handling safety practices are more likely not to observe measures that prevent contamination of pumpkin products. Rather, et al. (2017) further buttress that, in developing countries, enforcement of food safety regulations is very weak in terms of on concentration of harmful substances in food due to the activities of food handlers.

Table 5: Perceived constraints faced by pumpkin farmers in post-harvest handling practices

Constraints	**Factors**			
	Volume/Income/sensitization	**Weak institutions/prices**	**Health officers/knowledge**	**Marketing activities**
Marketing activities along with observing post-harvest handling is difficult	-.251	.058	-.195	.678
The volume of farm produce	.535	-.474	-.448	.108
Lack of finance to construct modern storage facility	.687	-.393	-.352	.225
Fluctuation in prices	.140	.643	-.142	.115
Lack of government supports	.366	.588	.302	.265
Low knowledge on post-harvest handling	.467	.701	-.042	-.031
Poor access to credit facilities	.718	.193	-.379	.183
Lack of sensitization and campaign	.687	-.070	.237	.046
Low income from agricultural activities	.536	.111	.524	-.259
Nonchalant attitudes of the health officers	.408	-.285	.593	.055
Poor enforcement of post-harvest food safety policies	.365	-.014	-.415	-.655

Extraction Method: Principal Component Analysis.

Factor 2 (weak institution/prices) involves the following loading variables; lack of government supports (0.588) and Fluctuation in prices (0.643). Lack of institutional support from extension agents and government agencies constrained from observing safety measures that guarantee safety of pumpkin products. Furthermore, fluctuation in prices affected the ability of farmers to observe post-harvest safety measures as they are more likely to sell off their pumpkin immediately after harvest since they do not have modern storage facilities. In this instance, farmers sell their pumpkin leaves at lower prices. This supports report of Utiya, et al. (2020) that price changes affect farmers' real buying power and product safety during post-harvest handling practices. Factor 3 (health officers/knowledge) includes Low income from agricultural activities (0.524) and Nonchalant attitudes of the health officers (0.593). The low income from the farmers limited their power from ensuring post-harvest handling safety practices. This might be due to most of the pumpkin farmers are small holder farmers. Furthermore, health officer station in the study area were not concerned about the post-handling safety practices of the farmers. As a result, farmers who are not aware of the danger associated with handling practices will continue with their practices that compromise the safety of pumpkin products causing public health problem. Factor 4 (marketing activities**)** is

marketing activities along with observing post-harvest handling (0.678) which affected the post-handling safety practices. The large volume of farm products will not allow the farmers to ensure the safety of the pumpkin products as the farmers will be forced to handle their products anyhow.

CONCLUSION and RECOMMENDATIONS

Post-harvest food safety handling practices in pumpkin production is essential in reducing contamination leading to the safety of consumers. Farmers used different means of getting information about post-harvest food safety handling practices. The pumpkin famers had credible sources of information on post-harvest handling practices such as Fellow farmers, television, friends/neighbours, among others. However, pumpkin farmers encountered constraints such as volume/income/sensitization, weak institution/prices/ health officers/knowledge among other in post-harvest food safety handling practices. Relevant authorities should ensure that pumpkin farmers have access to training and adequate supports on post-harvest food safety handling practices to prevent contamination of pumpkins and ensure public health.

Acknowledgement

Immense appreciation goes to all the authors for their intellectual, financial and moral support throughout the research period.

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