INVESTIGATING HUMAN PERCEPTION ON EXTENT OF POSTHARVEST SPOILAGE OF POTATO IN TWO LOCAL GOVERNMENT AREAS IN OGUN STATE, NIGERIA

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ABSTRACT

Potato (*Solanum tuberosum* L.) is a globally important crop that plays a vital role in providing food and income for many populations. Several factors have been identified as limiting the realization of food security in many countries around the world. Increasing food availability thus involves not only increasing agricultural productivity, but also reducing food losses. This study focused on evaluating the incidence of potato postharvest spoilage among local store owners in Ijebu North and Ijebu Ode local governments using a descriptive design methodology. Supermarkets and local store owners in Ijebu North and Ijebu Ode local governments were included as participants, and data was collected using structured questionnaires. A sample size of 150 respondents was used; the collected data were analysed using descriptive statistics in SPSS. The findings of the study indicated that potato postharvest spoilage predominantly occurs during the wet seasons. It was observed that proper handling of potatoes during storage and the use of suitable storage areas can help reduce the incidence of potato rot diseases. In conclusion, Potato rot disease is a significant problem for potato farmers in Nigeria, and it can have devastating effects on their livelihoods. The disease has the potential to reduce crop yields, deteriorate potato quality, and even lead to complete crop failure. Therefore, implementing appropriate measures such as proper handling and proper storage practices are crucial for mitigating the occurrence and impact of potato rot diseases thus promoting food security in Nigeria.

Keywords: Food security, human perception, postharvest handling, preservatives, storage

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most significant food crops worldwide, with an annual production of approximately 300 million tons. Potatoes are versatile and can be consumed in various forms, including chips, fresh, porridge, and livestock feed. They provide high food yield per unit area and play a crucial role in nutrition and income generation for families (Ayalew *et al.,* 2014) However, a large percentage of this potato are also not available for consumption due to poor postharvest handling (Jimoh *et al.,* 2018). Post-harvest handling in developed countries results in the destruction of about 20-25% of harvested fruits and vegetables, including potatoes, due to fungal microorganisms (Bhardwaj *et al.,* 2019). Fungi like *Penicillium expansum, Mucor piriformis,* and *Alternaria sp.* degrade fruit quality, reducing market value and making them unsuitable for consumption. The use of synthetic fungicides has led to the emergence of resistant microorganisms harmful to humans and the environment. The use of plant extracts as eco-friendly alternatives for preserving potatoes has not been fully explored over time (Bangar *et al.*, 2021; Nxumalo *et al.*, 2021; Vlaiculescu & Varrone, 2022).

Various techniques and methods have been developed to prevent food spoilage and ensure food security. These include the use of preservatives, refrigeration, pasteurization, canning, dehydration, and modified atmosphere packaging. In addition, advances in food technology and biotechnology have led to the development of new methods such as irradiation and genetic modification (Opara and Mazhar, 2016; Alegbeleye *et al*., 2022; Ali *et al*., 2024).

However, it is important to note that some of these methods have raised concerns regarding their safety and impact on the environment. For example, the use of preservatives and other chemicals may pose health risks, while the use of irradiation and genetic modification may have unknown long-term effects (Singh *et al.,* 2018; Singer *et al*., 2021; Singh *et al*., 2023). Various methods have been developed to preserve food, including thermal processing, dehydration, fermentation, and the use of chemical preservatives. However, there are concerns about the safety and environmental impact of some of these methods. For example, chemical preservatives such as sodium benzoate and potassium sorbate have been linked to health issues and are not suitable for all food products (Ramos *et al.,* 2013; Chipley, 2020, Sama *et al*., 2023). Additionally, the use of natural preservatives such as essential oils and plant extracts has gained interest due to their potential health benefits and low environmental impact (Burt, 2000; Al-Maqtari *et al*., 2021).

Proper packaging can also help prevent food spoilage by providing a barrier against oxygen and moisture, which can contribute to microbial growth and chemical reactions that cause food to spoil (Baldwin *et al.,* 2011).

Advances in packaging technology, such as active packaging, which incorporates antimicrobial agents or oxygen scavengers, can help extend the shelf life of food products (Azevedo *et al*., 2022). Overall, the development and implementation of effective food preservation and packaging techniques can help ensure food security by reducing food waste and increasing the availability of safe and nutritious food especially in developing countries such as Nigeria.

Food insecurity in Nigeria is more being promoted by postharvest spoilage due to poor postharvest handling and lack of adequate postharvest facility. Therefore, it is important to continue research in this area to develop safe and effective methods for preventing food spoilage and ensuring food security. This includes the development of new technologies, as well as the implementation of sustainable practices such as reducing food waste and improving food distribution. The aim of this research is to evaluate the incidence of potato postharvest spoilage among local store owners in Ijebu North and Ijebu Ode local government areas in Ogun State Nigeria. Quantifying the extent and degree of postharvest spoilage is crucial for increasing food availability and preserving potatoes, addressing one of the limiting factors in achieving food security.

MATERIALS AND METHODS
Study area
Ijebu North is a Local Government Area located in Ogun State, Nigeria. It is situated at coordinates 6°57′N 4°00′E, specifically in the town of Ijebu Igbo. The region experiences a typical climate characterized by moderate temperatures and humidity, with alternating wet and dry seasons. The wet season typically spans from April to October/November, while the dry season lasts from October/November to April (Figure 1).
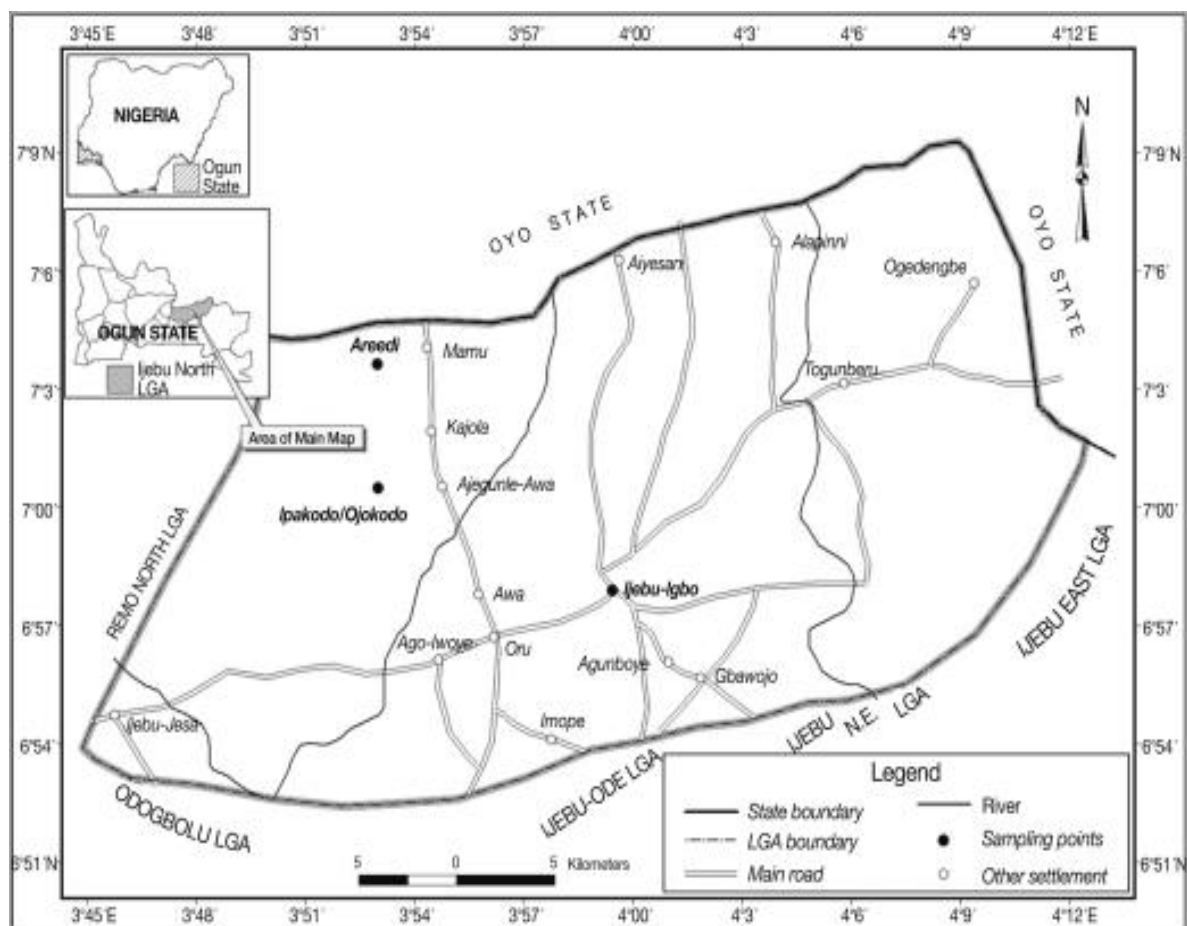

Figure 1: Map of the study area

The study area, being part of Ogun State, is situated within the South-western Basement Complex of Nigeria. It is representative of both the migmatite gneiss complex and the older granite formations, which exhibit distinct geological characteristics. The common lithologies found in the region include amphibolites, migmatite gneisses, granite, and pegmatites. The migmatite-gneiss complex predominates in the southwest and southeast parts of the area, while older granite formations dominate the north, east, and certain parts of the west (Adekoya *et al.,* 2017).

Data collection
For this study, a combination of non-random and purposive sampling techniques was used.

To gather data on potato rot disease incidence among local store owners, purposive sampling technique was employed in the choice of markets for this study while, simple random sampling technique was adopted for collection of data from 150 sweet potato sellers in markets within Ijebu North and Ijebu Ode local governments, Ogun State, Nigeria based on primary source of data through administration of data.

The validity of the questionnaire was established through the process of construct validity, which involved the input and feedback from experts in the field. The questionnaire was modified and refined based on the suggestions and recommendations of the experts (Hair *et al*., 2019).

Data analysis
The collected data was subjected to data analysis to extract meaningful insights and draw conclusions. The analysis process ensured that the data obtained from the respondents were valid, reliable, and accurately represented the information collected.The Statistical Package for Social Sciences (SPSS) version 20.0 (IBM Corp, 2011) was used to do statistical analysis.

RESULTS AND DISCUSSION
The gender of the potato traders revealed that 52.7% were male while 47.3% are females. On the age distribution of the store owners 32.7% are between 20-30 years, 55.3% are 31 – 40 years while the remaining 12% are 41 and above. This shows that many of the potato traders are relatively young in age which point to the fact that this business might have been addressing unemployment within the geographic space this study was conducted. Figure 2 showed that 42% of the traders attended primary school, while another 42% attended secondary school. Those who have N.C.E certificate amount to 10% while OND and HND holders are 2 and 4%, respectively. On job position, majority (80%) of the sellers own the business, 14% are managers while 9% are the supervisors. This shows that majority of the potato traders are the owners of the business.
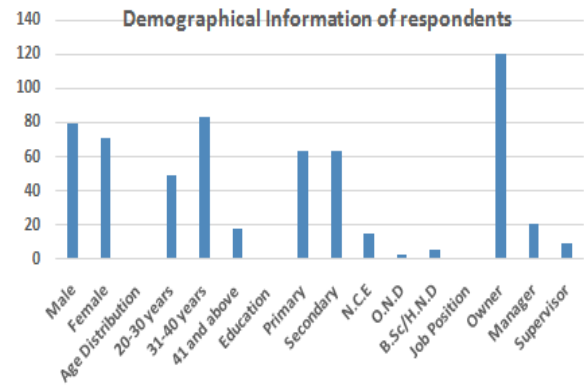

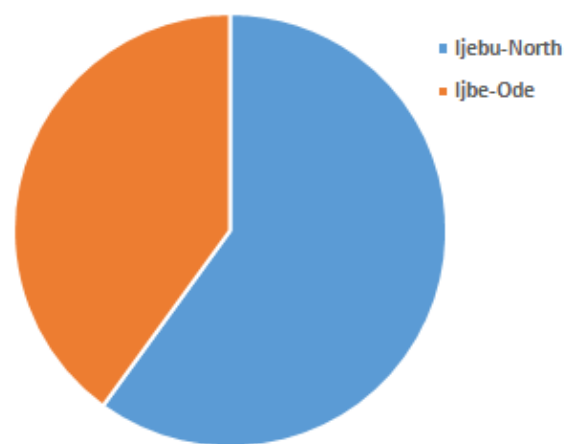**Figure 2: Demographical information of respondents**

Figure 3: Local Government Areas of market

Various markets within the two local governments (Figure 3) in which potato seller display their goods where questionnaires were administered include Ago Iwoye (16%), Awa (12%), Ijebu-Igbo (18%), Oru (6%), Itamerin (6%), Ilaporu (2%), Oke-Aje (16%), New Market (12%) and Ita-Ale market (12%) respectively (Figure 4). This affirms the wide spread of potatoes sales in the study area.
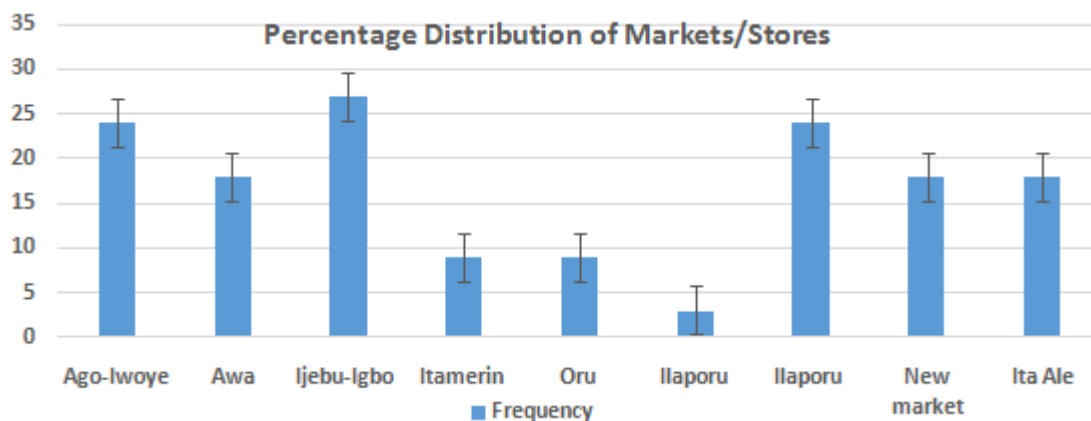

Figure 4: Percentage distribution of markets/stores

Duration the local potato stores owners have been in potato sale business

The results of this study revealed the number of years the respondents have spent in the Potato business (Table 1). It shows that 54% of the sellers have spent between 1-5 years in the business, 28% have spent 6-10 years, 14% have spent 11-15 years while 4% have spent above 15 years. This indicates that more than half of the respondents have been in the potato business for more than a year thus could give reliable information.

Table 1: Years spent in potato business

Years	Frequency	Percentage
1-5 years	81	54.0
6-10 years	42	28.0
11-15 years	21	14.0
Above 15 years	6	4.0
Total	**150**	**100.0**

Table 2: Quantification of potato postharvest spoilage in sale stores

Variables	Responses	Freq.	%
Quantity of potatoes purchased per sale	1 basket	18	12.0
	1 sack	84	56.0
	2-5 sacks	39	26.0
	Above 5 bags	9	6.0
	Total	**150**	**100.0**
Frequency of potato spoilage	Weekly	48	32.0
	Monthly	48	32.0
	Never	54	36.0
	Total	**150**	**100.0**
Seasons Potato spoilage occurs the most	Dry seasons	84	56.0
	Rainy seasons	54	36.0
	Harmattan seasons	12	8.0
	Total	**150**	**100.0**
Source of Potato Purchase	Self-farming	28	18.7
	Purchase from direct farming	88	58.7
	Middlemen	34	22.7
	Total	**150**	**100.0**
Quantity of Potatoes that gets spoilt	1 basket	60	40.0
	10-20 pieces	28	18.7
	Less than 10 pieces	62	41.3
	Total	**150**	**100.0**
Duration of potato spoilage	Less than 10 days	83	55.3
	10-20 days	19	12.7
	3 months	48	32.0
	Total	**150**	**100.0**

Quantification of spoilage of potato and duration of spoilage in sale stores

Table 2 shows the rate at which the potatoes sold by the traders become rotten. On the quantity of purchased per sale, 12% of the sellers purchase one basket, 56% purchase one sack, 26% purchased between two to five sacks while the rest (6%) purchased more than five bags. Potato spoilage is experienced by 32% of the traders weekly, 32% experienced it monthly while 36% of the respondents said they never witnessed potato spoilage. In relation to seasonal variation affecting potato spoilage, 84% of the respondents said spoilage of potato takes place more during the dry season, 36% said it occur more during the raining season while 8% responded that this spoilage occurred more in the harmattan season.

On the source of potato purchase, 18.7% said it is through self-farming, 58.7% purchase it directly from the farm while the remaining 22.7% buy from middle men. This shows that majority of the potato traders source their good directly from the farm.

The Table further showed the amount of potatoes that gets spoilt after purchase. About 40% of the participants said the number of potatoes that gets spoilt amounts to one basket. Other are between 10 to 20 pieces (28%) and less some respondent (41.3%) said it is about 10 pieces. When asked how long it takes for the purchased potatoes to get spoilt, 55.3% of the traders responded that it took less than 10 days. Meanwhile, 12.7% of them said it takes between 10-20 days while 32% said it takes 3 months.

Storage method and treatment of potato after purchase

Storage of the purchased potatoes is necessary to avoid emergence ofrottenness of the tuber crop (Table 3). From the data obtained, 26% of the sellers responded to the storage of potatoes on the floor, 52% store it in sacks while the rest (22%) spread under the sun. this showed that a higher percent of the sellers made use of sacks as a storage method for their potatoes. Another local preservative method they employ is storing in a cool place (54%). The trader claimed that these preservation methods are affective for less than two weeks (40.7%), two to three weeks (30.7%) and for one month (28.7%). The use of artificial fungicides is a practice that has been adopted by some of the potato sellers in treating rot in potatoes in order to enhance storage and make the potatoes last long. On the frequency of application of these fungicides, the respondents claimed to apply it always (8%), weekly (38%) and occasionally (14%) (Table 3).

Table 3: Storage method and treatment of potato after purchase

Variables	Responses	Frequency	Percentage
Storage of Potatoes after purchase	On the floor	39	26.0
	In the sack	78	52.0
	Under the sun	33	22.0
	Total	**150**	**100.0**
Other Local Preservation Method of potato	Cool dry place	81	54.0
	In the sack	35	23.3
	Sun drying	34	22.7
	Total	**150**	**100.0**
How long local method works	Less than 2 weeks	61	40.7
	2-3 weeks	46	30.7
	1 month	43	28.7
	Total	**150**	**100.0**
The Use of Artificial fungicides in treating potatoes	Always	12	8.0
	Weekly	57	38.0
	Occasionally	21	14.0
	Never	60	40.0
	Total	**150**	**100.0**

Table 4: Analysis of the factors causing potato rot in the study area

Variables	Strongly Agree		Agree		Disagree		Strongly Disagree	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Potato spoilage occur more during Harmattan seasons	24	16.0	42	28.0	78	52.0	6	4.0
Potato stays longer during rainy seasons	18	12.0	72	48.0	30	20.0	30	20.0
Potatoes gotten from the farm are less likely to get rot	45	30.0	36	24.0	54	36.0	15	10.0
Poor ventilation and low humidity increases potato rotting	48	32.0	42	28.0	54	36.0	6	4.0
Adequate ventilation reduces the rate of pathogen on potatoes	51	34.0	54	36.0	42	28.0	3	2.0
When the humidity is high, the rate of rotten potatoes increases	30	20.0	72	48.0	42	28.0	6	4.0
Potatoes that stay long are likely to get rot	45	30.0	75	50.0	27	18.0	3	2.0
Potatoes not sold in time are likely to spoilt when affected by pathogens	33	22.0	99	66.0	15	10.0	3	2.0
Poor handling of potatoes enhances it to get rotten easily	42	28.0	84	56.0	24	16.0	24	16.0
Exposure of potatoes to water surface area makes it get rotten easily	99	66.0	27	18.0	21	14.0	3	2.0

Analysis of the factors causing potato postharvest spoilage in the study area

More than half of the respondents disagreed (52%) that potato rot occurs during Harmattan season, 16% strongly agreed while 28% agreed (Table 4). In rainy seasons, 12% of the traders believed that potatoes stay longer and 48% agreed. However, 20% of the respondents disagreed to this. On the likelihood of potatoes from farm getting spoilt, 30% strongly agreed and 24% agreed while 36% disagreed that potatoes gotten from the farm are less likely to get rot. Poor ventilation and low humidity is believed to be responsible for potato rotting by 32% of the traders. Meanwhile, 36% disagreed to this assertion.

This present work also revealed that lack of ventilation is another cause of potato rot, (36%) of the respondents agreed while (34%) strongly agreed to this. On the other hand, 28% disagreed, believing that adequate

ventilation does not reduce the rate of pathogen on potatoes. Also, 20% of participants strongly agreed that the rate of potato rot increases with high humidity, 48% agreed to this but 28% disagreed.

It was strongly agreed (30%) and agreed (75%) by the sellers that potatoes that stay long are likely to get rotten. On the contrary, 18% disagreed to this question. In another question, the traders strongly agreed (22%) and agreed (66%) that potatoes not sold in time are likely to get when affected by pathogens of which 10% perceived not to be so.

On the effect of poor handling of potatoes, 28% strongly perceived that it is a major factor causing potato rot and 56% also agreed. Meanwhile, 16% of the traders disagreed that poor handling of potatoes makes it get rotten easily. Lastly, the exposure of potatoes to water was (66%) strongly agreed to be responsible for its rot and 18% agreed to this (Table 4). On the other hand, 14% of the traders did not agree with the fact that potato exposure to water is a causative factor of potato rot disease.

Potato spoilage poses a significant threat to store owners and farmers in Nigeria, as infected potatoes can quickly spread the disease and result in substantial economic losses (Adedire *et al*., 2023). It is crucial for store owners to carefully inspect purchased potatoes, store them in appropriate conditions, and maintain proper hygiene practices to minimize the risk of disease incidences and to improve the postharvest shelf life of the potatoes.The incidence of potato spoilage in Nigeria may be underestimated due to inadequate data collection and reporting systems in many regions. Therefore, continued research and attention from policymakers are necessary to address this issue effectively. According to Afolabi and Adegbite (2013) A study focusing on *Fusarium wilt*, a specific type of potato rot disease, revealed its widespread occurrence in Nigeria, particularly in potato-growing regions and this infection is due to lack of proper postharvest handling. These findings highlight the significant challenge posed by potato spoilage to the potato industry and food security in Nigeria and emphasize the importance of developing improved disease management strategies, improved postharvest technology, to mitigate its economic and social impacts. The current findings on potatoes spoilage (64%) experienced weekly and monthly by sellers is in agreement with the work done by Adedire *et al*. (2023) who affirm spoilage of sweet potatoes in relation to storage and that spoilages from the use of sacks and root cellars have significant effect on total spoilage of sweet potato in Plateau State than other methods of storage.

The current work which attributed spoilage of potatoes to poor ventilation and exposure to water surface is corroborated by the findings of Adebayo-Tayo *et al*. (2012) who related spoilage of food crops with microorganisms and other works done by Osafo *et al*. (2022), Fayinminu *et al.* (2024).

CONCLUSION

In conclusion, this study reveals that potato spoilage poses significant challenges to potato sellers in Ijebu-north and Ijebu-Ode local governments in Ogun State, Nigeria, leading to reduced yields, poor potato quality, and potential crop failure. However, the disease is influenced by factors such as the lack of disease-resistant varieties, poor soil health, inadequate crop management practices, and limited awareness among sellers.

This study conclude that potato rot disease is a significant challenge for potato farmers in Nigeria andthere is urgent need for improved disease management strategies to mitigate the economic and social impacts of this disease on the potato industry in Nigeria. Consequently, it is imperative for policy holders in Ogun State and Nigeriaat large to either provide affordable modern storagefacilities or educate sweet potato sellers on best way to use theirfrequently adopted methods of storage.

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