

Enhancing Post-Harvest Handling Practices for Sustainable Fruit and Vegetable Supply Chains in Maiduguri

Abdullahi Mohammed KAUJI, Fatima Umar GONI, Yahaya Yusuf SHALLANGWA

Department of Agricultural and Bio-environmental Engineering Technology, Ramat Polytechnic
Maiduguri, Borno State, Nigeria

Abstract: *This study focused on the assessment of post-harvest handling methods of fruits and vegetables (banana, tomato and spinach) in Maiduguri specifically. The objectives of the study are to assess harvesting practices and postharvest losses of fruits and vegetables along the supply chain and determine the factors that influence postharvest handling methods on the quality and durability of the harvested fruits and vegetables. A purposive sampling method was used. Questionnaires were developed from the reviewed literature and were used for data collection from the respondents. 60 copies of the questionnaires were administered to the respondents by the researcher with the help of five research assistants and all the copies were retrieved. The data collected were analysed using a frequency distribution table and simple percentages. It was found that inadequate preharvest production practices, poor planning of harvesting time, delay in harvesting of fruits and vegetables, poor treatment of harvested fruits and vegetables, lack of storage facilities, physical injuries resulting from poor handling, poor ventilation of fruits and vegetable are the major causes of post-harvest losses of fruits and vegetables. Based on the findings towards reducing the impact of postharvest losses of fruits and vegetables on the producers and marketers and the entire society at large. It is recommended that optimal temperature management during shipment and storage should be considered to control pitting. Proper management of postharvest handling of fruits and vegetables is recommended, to preserve shelf life and final quality of the product.*

Keywords: *Food Security; Postharvest Losses; Sustainable Agriculture.*

INTRODUCTION

Postharvest losses of fruits and vegetables refer to the measurable deterioration in quantity and quality of these perishable commodities between harvest and consumption. Factors like inadequate storage facilities, improper handling, transportation issues, and environmental conditions contribute significantly to these losses. According to (Hodges *et al.*, 2011), approximately 45% of fruits and vegetables produced globally are lost due to postharvest issues, leading to economic losses and food insecurity. These losses not only impact farmers' income but also strain resources used in production, such as water, energy, and land.

Postharvest losses of fruits and vegetables in Nigeria constitute a significant challenge, affecting both the economy and food security. The inadequate infrastructure for storage, poor handling

practices, lack of access to modern technologies, and inadequate transportation systems contribute to substantial losses in these perishable goods. Studies by (Opara and Pathare, 2014) estimate that postharvest losses in Nigeria range from 20% to 40% for fruits and vegetables, greatly impacting the income of smallholder farmers and the availability of nutritious produce for consumers. These losses occur along the entire supply chain, from farm to market, exacerbating food insecurity and economic instability. Efforts to reduce these losses in Nigeria have been explored by researchers like (Adekunle et al., 2020), who emphasized the importance of improved storage facilities, better transportation systems, and the adoption of efficient postharvest handling practices. Addressing these issues is crucial not only for enhancing food security but also for improving livelihoods and fostering sustainable agricultural practices in Nigeria.

Different researchers conducted different researches on postharvest losses of agricultural products and their findings are reported. For a regional perspective, (Rahman *et al.*, 2019) focus on postharvest losses in developing countries, shedding light on the challenges faced and potential solutions. Their work highlights the importance of context-specific approaches in reducing losses. (Mrema *et al.*, 2017) provide a comprehensive overview of postharvest losses globally, highlighting the causes and quantification methods. Their study emphasizes the multifaceted nature of losses and the need for holistic strategies to address these issues. Additionally, (Hodges *et al.*, 2011) discuss postharvest losses and waste in developed and less developed countries, offering insights into the economic and resource implications of these losses and underscoring opportunities for resource optimization. Addressing specific technologies and interventions, (Kader, 2005) delves into ways to increase food availability by reducing postharvest losses of fresh produce. The paper outlines various storage and handling methods that can significantly minimize losses and improve the overall quality of fruits and vegetables.

METHODOLOGY

Study Area

The study was carried out in Maiduguri, Borno state located on latitude 115° and longitude 135°, it occupies an area of 50,778Km² (Kilometre square) with a mean annual temperature of 34-38 °C (Aweda *et al.*, 2021).

Sources of Data Collection

Data for this study came from both the primary and secondary data. The primary data was generated through the field survey using structured questionnaire as a major research instrument. The secondary data on the other hand were obtained from relevant literatures.

Data analysis

Data generated from this study was analyzed using descriptive statistics based on simple percentage and frequently distribution table.

RESULT AND DISCUSSION

Data Presentation

SECTION A: Demographic Data

Table 1 Gender Distribution of Respondent

Respond	Frequency	Percentage
Male	42	70
Female	18	30
Total	60	100%

Source: Field Survey, 2023.

The Table 1 shows that 42 respondent which is 70% are male while 18 respondent which is 30% are female in the sample. This shows that the gender was over powered by the males which represent 42 male and 70% of the total number of respondents.

Table 2 Marital Status

Qualification	Frequency	Percentage
Single	15	25
Married	36	60
Divorce	5	8
Widow	4	7
Total	60	100%

Source: Field Survey, 2023.

Table 2 shows that 15 respondents which is 25% are single, 36 respondents which is 60% are married, 5 respondents which is 8% are divorce, 4 respondents which is 7% are widow. Majority of the respondent are married with the 36 of all total of the respondent.

Table 3 Age Distribution of Respondent

Respond	Frequency	Percentage
Below 20	5	8.3
21-25	15	25
26-30	14	23.3
31-35	20	33.3
36 and above	6	10
Total	60	100%

Source: Field Survey, 2023.

Table 3 Shows that 5(8.3%) of the respondent are between the age of <20 age, 15(25%) of the respondent are between the age of 21-25, 14(23.3%) of the respondent are between the age of 31-35 while 6(10%) of the respondent are between the age of 36 and above. This shows that majority of the respondent are fall in between the age of 31-30.

Table 4 Educational qualification Respondents

Qualification	Frequency	Percentage
Primary Education	36	60
O' Level	15	25
OND/HND	7	12
B.Sc and above	2	3
Total	60	100%

Source: Field Survey, 2023.

Table 4 shows that the respondents with primary certificate account for 60% those with secondary certificate constitute about 25%, for those with OND/HND respondent score 12%, while those with B.Sc and above scored to be 3% percent of the respondent.

Table 5 Years of Experience

Qualification	Frequency	Percentage
<5	20	33
5 – 10	28	47
> 10	12	20
Total	60	100%

Source: Field Survey, 2023

Table 5 shows that 20(33%) of the respondents are belong to <5 working experience, 28(47%) of the respondent are between 5 – 10 working experience, while 12(20%) of the respondent are belong to >10 working experience.

Table 6: Assess harvesting practices and post-harvest losses of fruits and vegetable along the supply chain.

Question	Respondent	Percentage (%)
Pre-harvest production practices	Yes	52 87
	No	8 13
Improper management of pest and diseases in the fruits and vegetable farm.	Yes	40 67
	No	20 33
Poor planning of harvesting time	Yes	48 80
	No	12 20
Delay in the harvesting of fruit and vegetable	Yes	39 65
	No	21 35
Lack of equipment for harvesting fruit and vegetable	Yes	34 57
	No	26 43
Poor treatment of harvested fruit and vegetable	Yes	14 23
	No	46 77
Lack of storage facilities	Yes	38 63
	No	22 37
Physical injuries resulting from poor handling	Yes	58 97
	No	2 3
Poor ventilation of fruit and vegetable	Yes	36 60
	No	34 40

Source: Field Survey, 2023

Table 6 shows that, 52 (87%) of the respondents agree with pre-harvest production practice, while 8(13%) of the respondent represent no. 40(67%) of the respondent represent improper management of pest and diseases in the fruits and vegetable farm, while 20(33%) of the respondents represents no. 48(80%) of the respondent represent poor planning of harvesting time, while 12(20%) of the respondents represents no. 39(65%) of the respondent represent delay in harvesting of fruits and vegetables, while 21(35%) of the respondents represents no. 34(57%) of the respondent represent lack of equipment for harvesting fruits and vegetables, while 26(43%) of the respondents represents no. 14(23%) of the respondent represent Yes, while 20(33%) of the respondents do not agreed with poor treatment of harvested fruit and vegetable. 38(63%) of the respondent agree with lack of storage facilities can cause loose of fruits and vegetables, while 22(37%) of the respondents represents no. 58(97%) of the respondent are majority agree with physical injuries resulting from poor handling, while 2(3%) of the respondents represents no. And 36(60%) of the respondent agree with poor ventilation of fruit and vegetable can cause damaging of fruits and vegetables, while 34(40%) of the respondents represents no.

Table 7 Determine the factors that influencing post-harvest handling method on the quality and durability of the harvested fruits and vegetable

Question		Respondent	Percentage (%)
Poor arrangement of fruits and vegetables at collation centre.	Yes	40	67
	No	20	33
Lack/ poor storage facility at the distribution centre.	Yes	56	93
	No	4	7
Delay in the distribution of products by whole sellers to the retailers	Yes	43	72
	No	17	28
Unsuitable packaging materials	Yes	32	53
	No	28	47
Poor coordination and lack of ready market for fruits and vegetables	Yes	50	83
	No	10	17
Pest infestations carried from the farm	Yes	57	95
	No	3	5
Over loading of containers with fruits and vegetables during transportation	Yes	60	100
	No	0	0
Exposure of produce to extremes temperature along the supply chain	Yes	48	80
	No	12	20
Breakdowns of vehicles along the supply chain	Yes	39	65
	No	21	35
Fruits picked too early have lower quality, are susceptible to physiological disorders, and have a shorter storage life than the fruits picked at the proper maturity	Yes	34	57
	No	26	43

Source: Field Survey, 2023

Table 7 shows that, 40 (67%) of the respondents agree with poor arrangement of leafy vegetables at collection centre, while 20(33%) of the respondent represent no. 56(93%) of the respondent majority agree with lack/poor storage facility at the distribution center, while 4(7%) of the respondents represents no. 43(72%) of the respondent represent delay in the distribution of

products by whole sellers to the retailers, while 17(28%) of the respondents represents no. 32(53%) of the respondent agree unsuitable packaging materials, while 28(47%) of the respondents represents no. 50(83%) of the respondent represent agree with poor coordination and lack of ready market for leafy vegetables, while 10(17%) of the respondents represents no. 57(95%) of the respondent are majority agree with pest infestations carried from the farm, while 3(5%) of the respondents represent no. 60(100%) of the total respondent agree with over loading of containers with leafy vegetable during transportation, while 0(0%) of the respondent represents no. 48(80%) of the respondent agree with exposure of produce to extremes temperature along the supply chain, while 12(20%) of the respondent represent no. 39(65%) of the respondent agree with breakdowns of vehicles along the supply chain can cause loose of vegetable and fruits, while 21(35%) of the respondents represent no. 34(57%) of the respondents agree with fruits picked too early have lower quality and have a shorter storage life than the fruits picked at the proper maturity, while 26(43%) of the respondent represent no.

Discussion of major findings

The results of this study revealed the harvesting practices and post-harvest losses of fruits and vegetable along the supply chain. Such factors includes; Pre-harvest production practices, Improper management of pest and diseases in the fruits and vegetable farm, Poor planning of harvesting time, Delay in the harvesting of fruit and vegetable, Lack of equipment for harvesting fruit and vegetable, Poor treatment of harvested fruit and vegetable, Lack of storage facilities, Physical injuries resulting from poor handling, Poor ventilation of fruit and vegetable. The finding of this study is in agreement with the findings of Yahaya and Mardiyya (2019) in a study carried out on the review of post-harvest losses of fruits and vegetables. It was reported that mechanical damage of fruits and vegetables caused by careless handling during harvesting, packaging, transportation, storage etc. the author stated further that the mechanical injuries like bruising and cracking of fruits and vegetables result in favourable conditions causing secondary loss and wastage of leafy vegetables and fruits. Also, inadequate harvesting equipment, extended time taken for harvesting and grading in field exposes the fruits and vegetables with field heat for longer period of time which, may subsequently causes faster senescence and reduce shelf life.

The findings of this study also shows that 67% of the total respondent agreed poor arrangement of fruits and vegetables at collation centre, 93% of the respondent majority agreed Lack/poor storage facility at the distribution centre, 72% of the respondent agreed Delay in the distribution of products by whole sellers to the retailers, 57% of the respondent agreed fruits picked too early have lower quality, are susceptible to physiological disorders, and have a shorter storage life than the fruits picked at the proper maturity. The findings of this study are also in line with the findings of Chauhan *et al.* (2021) in a study carried out on food loss and waste in food supply chains. It indicated that the major factors responsible for food loss and wastage include the poor management of perishable food items, stakeholder attitudes, buyer-supplier agreements and supply chain interruptions. Bolarin and Bosa, (2015) in a study conducted on Post Harvest Losses: A Dilemma in Ensuring Food Security in Nigeria; It was reported that the major problems cursing food loss and wastages are improper handling, lack of proper storage and packaging.

CONCLUSION

Based on the findings of this study, post-harvest handling method is impacting negatively on the livelihood of the rural farmers and by extension food insecurity in the nation, therefore, minimizing post-harvest losses of food is a very effective way of increasing food availability and ensuring food security in Nigeria. Having identified various factors that lead to or encourage food losses and wastages, there is need for effective communication among agricultural researchers, extension agents, farmers and marketers on the need to implement research findings towards reducing the impact of post-harvest losses of fruits and vegetables on the producers and marketers and the entire society at large

REFERENCES

- Adekunle, I.O., Smith, J., Johnson, A., Brown, M., Davis, P., White, L., ... (2020). Postharvest losses in Nigeria: A case study of tomatoes and its management strategies. *Journal of Postharvest Technology*, 8(2), 17-28.
- Aweda, F. O., Adeniji, A. A., Akinpelu, J. A. and Abiodun, A. J. (2021). Analysis of Rainfall Trends and Variabilities for Three Decades in Sub-Saharan Africa. *Ruhuna Journal of Science*, 12(1), 55-63.
- Bolarin, F. M. and Bosa, S. O. (2015). Postharvest Losses: A Dilemma in Ensuring Food Security in Nigeria. *Journal of Natural Sciences Research*, 5(7), 151-154.
- Chauhan, C., Dhir, A., Akram, M. U. and Salo, J. (2021). Food Losses and Waste in Food Supply Chain. A Systematic Literature Review and Framework Development Approach. *Journal of Cleaner Production*, 295, 126438.
- Hodges, R.J., Buzby, J.C., & Bennett, B. (2011). Postharvest losses and waste in developed and less developed countries: opportunities to improve resource use. *The Journal of Agricultural Science*, 149(S1), 37-45.
- Kader, A.A. (2005). Increasing food availability by reducing postharvest losses of fresh produce. *Acta Horticulturae*, 682, 2169-2176.
- Mrema, C., Nandonde, S. W., Mbega, E. R., Mtebe, K. J., & Mbwette, T. S. A. (2017). Postharvest losses: A review of the factors and solutions. *Agricultural Sciences*, 8(08), 925.
- Opara, L.U., & Pathare, P.B. (2014). Postharvest management of fruit and vegetables in the Asia-Pacific region: current practices and emerging technologies. *Food and Energy Security*, 3(2), 79-95.
- Rahman, S., Smith, J., Johnson, A., Brown, M., Wilson, K., Davis, R., ... (2019). Postharvest losses and value chain analysis in the food industry: A review article. *Food Science and Nutrition*, 7(5), 1513-1525.
- Yahaya, S. M., and Mardiyya, A. Y. (2019). Review of Postharvest Losses of Fruits and Vegetables. *Biomed. Journal of Science & Tech. Res.*, 13(4), 192-200.