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Utilization of improved post-harvest techniques of leafy vegetables among farmers in Ojo local government area of Lagos state, Nigeria

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Abstract: This study determined the utilization of improved post-harvest techniques of leafy vegetables among farmers in Ojo Local Government Area of Lagos State. Simple random sampling technique was used to select 150 respondents for the study. Data were collected using a structured questionnaire and analyzed using frequency counts, percentages, mean and Pearson Product Moment Correlation Coefficient (PPMC) at p=0.05. Most respondents were female (84.7%), married (70%), had secondary education (65.3%) and 78.7% had less than 10 years' experience. Harvesting of vegetables according to proper maturity index (84.7%), collection of vegetables from the field on time (88.7%) and keeping the harvested produce in a shady place (86.7%) were the most utilized improved harvesting techniques. In terms of storage, 85.3% of the respondents assembled harvested vegetables under tree shade always, 70.7% of the respondents used Bamboo baskets for packing their produce always. There was a significant relationship between respondents' level of education (r=0.161), farming experience (r=0.083) and farm size (r=0.158) and their utilization of improved postharvest techniques of leafy vegetables. Low level of education characterized the respondents hence, they should be encouraged to pursue reasonable level of formal education. Adult education should also be revamped to enable farmers acquire basic functional literacy to improve their production.
Keywords: Postharvest techniques, Leafy vegetables, Vegetable farmers

INTRODUCTION

African Leafy vegetables are mostly gathered from the wild (Maseko *et al,* 2018). They have important advantages over exotic vegetable species, because of their adaptability to marginal agricultural production areas and their ability to provide dietary diversity in poor rural communities (Maseko *et al*, 2018). Leafy vegetables play a significant role in the food security of smallholder farmers in rural, peri-urban and urban areas (Gogo *et al*, 2016). This group of vegetables also referred to as greens or pot-herbs, are popular around the world, especially in Asia, and they include spinach beet, spinach, lettuce, amaranth, fenugreek and Chinese cabbage (Dhaliwal, 2017). In the human diet, leafy vegetables serve as vital sources of fibre, minerals (like iron, calcium and phosphorous) and vitamins which is the reason why dieticians recommend daily consumption of at least 116g of it in a balanced diet (Dhaliwal, 2017). Moreso, Arasaretnam *et al* (2018), reported that leafy vegetables are essential for life because they are composed of essential major elements such as calcium, magnesium, potassium and sodium. They create employment opportunities for women and youth in the society, hence providing a viable option for alleviating food insecurity (Qiuab *et al*, 2017). They are increasingly being recognized as sources of improved nutrition and food supply (Ramatsitsi and Palane Dub, 2020).

However, among all vegetable species, the leafy vegetable groups show the highest rate of respiration, which has the function of releasing energy from stored chemical compounds in the plant (Alvino and Barbieri, 2016). The depletion of energy reserves leads to the reduction of shelf life of the product because, during the shelf life, the fresh product loses water continuously (transpiration), which causes a moisture reduction of tissues and thus an irreversible loss of turgor (Acedo *et al*., 2016). Water loss is the major cause of postharvest losses in leafy vegetables. Fresh vegetables are extremely perishable due to their relatively short shelf life (Acedo *et al*., 2016; Wagner *et al*., 2020). Alvino and Barbieri (2016) commented on their perishability, stating that they become perishable because once harvested, they can only be stored for a while before displaying undesirable symptoms such as reduction of greenness and appearance of yellowed leaf areas and loss of flavour and aroma. Vegetables can change hands so many times in the postharvest sector, therefore, a high level of management is necessary to ensure that quality is maintained. Each time someone fails to be conscientious in carrying out his or her assigned responsibility, quality is irreversibly sacrificed (Wagner *et al*., 2020).

Moreover, post-harvest losses of vegetables are serious in developing countries due to low knowledge, poor techniques, inadequate facilities for product handling, processing and poor marketing systems (Acedo *et al*., 2016). The corresponding loss of food and economic opportunities contributes to poverty, food insecurity and malnutrition, which mostly affect smallholders who dominate vegetable production. Post-harvest handling includes all steps involved in moving a commodity from the producer to the consumer including harvesting, handling, cooling, curing, ripening, packing, packaging, storing, shipping, wholesaling, retailing and any other procedure that the product is subjected to (Wagner *et al*., 2020). Poor post-harvest handling can result in loss of appreciable amounts of the nutrients present in the vegetables at harvest. It is therefore important to employ appropriate post-harvest handling practices and technologies to preserve the quality of vegetables after harvest.

Harvesting, handling, grading and packaging of vegetables to ensure optimum product quality at the marketplace requires special skills. It makes little difference what the quality is at harvest if it is reduced by poor handling, packaging or storage conditions. This is because the price received for the product is determined by its quality at the marketplace (Wagner *et al*., 2020).

Globally, different post-harvest food loss and waste assessment methodologies have been practiced by various researchers, but there is inadequate information to identify appropriate solutions to reduce the losses, adopt cost-effective practices and make profitable post-harvest agri-business investments (Kitinoja, 2016).Knowing farmers' post-harvest techniques of leafy vegetables in Lagos state systems will allow researchers, extension agents and farmers to adopt practical and efficient technique that will meet the present and future farming needs in the study area given the state's potential for increasing food security.

In sub-Saharan Africa, 30–80% of horticultural crops are lost after harvest, in part due to a lack of awareness about good harvesting and packing practices and a lack of storage facilities. Improper postharvest handling also can cause the nutritional value, quality and shelf life of fresh produce to decline, and may compromise the safety of the food supply. To assist people involved in different aspects of horticultural production to evaluate and address postharvest losses, the University of California - Davis and the Postharvest Education Foundation in collaboration with – The World Vegetable Center organized two Horticultural Postharvest Training Courses at AVRDC's Regional Center for Africa in Arusha, Tanzania from 7-13 October and 14-20 October 2012. The Training of Trainers (ToT) course aimed to develop the skills and knowledge of horticultural professionals (university faculty, agriculture ministry staff, entrepreneurs, producers, etc.) from various countries in sub-Saharan Africa to reduce postharvest losses and improve market access and incomes for small-scale horticultural crop farmers, most of whom are women. It is against this backdrop that this study focused on assessing the utilization of improved post-harvest techniques of leafy vegetables among farmers in Ojo Local government area of Lagos state. The specific objectives addressed in the study include to; describe the socioeconomic characteristics of leafy vegetable farmers in the study area; ascertain the use of improved post-harvest techniques of leafy vegetables among respondents in the study area and identify the constraints faced by respondents in the adoption of improved post-harvest techniques in the study area.

METHODOLOGY

Ojo Local Government Area of Lagos State located at 6 ° 28′N 3 ° 11′E, was created in 1989, with a landmass of 182sq km and about 30% of it can be described as riverine. Some of the locations where urban agriculture takes place include Iyana Iba, Agboroko, Lagos State University (LASU) campus and, Ojo Cantonment (Akinmoladun and Adejumo, 2011). The LGA is diverse in terms of land use, ethnicity, and income distribution. The population of the study comprised all leafy vegetable farmers in the study area. A two-stage sampling procedure was used to select respondents for the study. In the first stage, Iyana-Iba, Lagos State University campus and Ojo cantonment areas were purposively selected due to high concentration of leafy vegetable farmers. In the second stage a 30% proportionate sampling of all the leafy vegetable farmers was done from each of the three locations to have a sample size of 150 leafy vegetable farmers for the study. Data for the study were gathered through administration of structured questionnaire. Utilization of improved postharvest techniques among respondents was measured on a 4-point scale of always, occasionally, rarely and never. Items were developed covering harvesting, storage, packaging and transportations as postharvest operations. Severity of the constraints was established in the study through ranking using mean values. Data were analyzed using frequency counts, percentages, mean and Pearson Product Moment Correlation (PPMC).

RESULTS AND DISCUSSION

Socioeconomic characteristics

The age distribution of farmers in the study area is shown in Table1. Majority (66.7%) were between the age range of 41-50, female dominated, and many (70%) married. Majority (65.3%) of the respondents had up to secondary level of education, farming experience of 10years and below (78.7%) with farm size below one hectare among most (82.7%) of them. Lagos is a state of aquatic splendor with the limited land placed into industrial and urban development, this may account for small farm size among respondents. Umar *et al*., (2015) reported that the age of individuals affects their mental attitude towards new ideas. This can be used to infer that the age of the respondents plays a major role in their adoption of improved post-harvest techniques. Fapojuwo *et al*., (2021) argued that the hectic nature of agricultural activities enables male to get much involved in the job thereby dominating the agricultural workforce. Vegetable production however in the study area was female dominated, this may be due to less hectic nature of the venture, low inputs and capital requirements for vegetable production. Gogo *et al* (2018) established that African leafy vegetable production is primarily by women who were mainly small holder farmers.

Level of education was low among respondents; this could be due to less premium placed on girl-child education and the ravaging effect of cultural belief. According to Najafi (2003) educational attainment is very important because it could lead to awareness of the possible advantages of modern farming techniques which in turn would enhance household food production.

Table 1: Distribution of respondents based on personal characteristics

Variables	Frequency	Percentage	Mean	Standard Dev.
Age (years)			38.5	±9.79016
≤40	38	25.3		
41-50	100	66.7		
51-60	10	6.7		
>60	2	1.3		
Sex				
Male	23	15.3		
Female	127	84.7		
Marital Status				
Single	35	23.3		
Married	115	70		
Divorced	3	2.0		
Widow/widower	7	4.7		
Level of education				
No formal Edu	3	2.0		
Primary	23	15.3		
Secondary	98	65.3		
Higher institution	26	17.3		
Farming experience			8.16	±5.55032
≤10	118	78.7		
11-20	25	16.7		
>20	7	4.7		
Types of leafy vegetable grown				
Fluted pumpkin (Ugwu)				
Bitter leaf	42	28		
Waterleaf	28	18.7		
Amaranthus (Green)	20	13.3		
Celosia (Shoko)	40	27		
	20	13.3		
Farm size			0.61	±1.65152
< 1 ha	124	82.7		
1-5 ha	26	17.3		

Source: Field Survey, 2021

Improved post-harvest techniques used by the respondents

Harvesting Techniques

Respondents indicated that timely collection of vegetables (88.7%) and keeping of harvested produce in shady place (86.7%) were part of the frequently used improved postharvest techniques during harvesting from the field. Table 2 shows majority (84.7%) of the respondents always harvest vegetables according to proper maturity indices. Timely collection of vegetables among the respondents could be aimed at reducing the incident of pest infestation which often reduces the economic value of the products. Also, the timely collection will help guard against lignification and to make the product attractive to consumers as some consumers look out for fresh and tender vegetables. Keeping under shade as indicated by respondents would help to reduce perishability and in turn improves shelf life. Fruits and vegetables should be harvested very carefully after observing the appropriate maturity level and quality because lower or upper maturity level of produce reduce the storage life and enhance the spoilage (Siddiqui *et al*., 2014; Ahmad *et al*., 2014).

Storage Techniques

Results in Table 2 shows assembling harvested vegetables under tree shade (85.3%) and frequent sprinkling of water on harvested vegetables (75.3%) were the mostly used storage postharvest techniques among respondents. These storage techniques do not require any sophistication and have been part of the common ways by which leafy vegetables are stored on and off farms. The ZECC technique was not well used by respondents as only 10% always used it. This may be due to metropolitan nature of

the study area, where charcoal may not be in surplus supply for energy purpose. The Zero Energy Cool Chambers (ZECC) is a type of evaporative cooler which are simple and inexpensive ways to keep vegetables fresh without electricity (Odesola and Onwuka, 2009).

Packaging Techniques

The use of polysacks and ventilated crates for packing harvested produce was used by 54% of the respondents always. The use of Bamboo baskets was a well-accepted technique among the respondents as most (70.7%) of them used it always in the study area, this however could be due to availability of the materials locally. Gunny bags in the packaging of harvested leafy vegetables was popular among respondents, majority (65.3%) of them. It could be inferred from the results that ease of getting materials was the basis for the packaging techniques used by respondents. Some of the materials can be put into continuous use from one farming season to another once procured. This way ensuring reduction in production cost and possible increase in profit margin.

Transportation Techniques

Generally, most of the respondents (98%) transport their produce to the market from their farms to the market using cars and motorcycles, although at varying frequency, 38% always, 40% occasionally while 20% rarely used the means. Considering safe loading of harvested produce, 94% of the respondents established that they always record safe loading of their produce. In terms of safe offloading, 78.7% of the respondents alluded that they recorded safe offloading of their produce always. This could be attributed to closeness to market and availability of motorable metropolitan roads.

Table 2: Distribution of respondents by use of improved Post-Harvest Techniques

Technologies	Always	Occasionally	Rarely	Never
Harvesting				
Harvesting at proper maturity indices	127(84.7)	6(4)	3(2)	14(9.3)
Collection of vegetables from the field in time	133(88.7)	17(11.3)	-	-
Keeping harvested produce in a shady place	130(86.7)	14(9.3)	6(4)	-
proper cleaning or washing or cleaning before marketing	101(74)	11(7.3)	14(9.3)	14(9.3)
Sorting of vegetables	110(73.3)	28(18.7)	6(4)	6(4)
Grading of vegetables	116()77.3	20(13.3)	8(5.3)	6(4)
Cooling of vegetables	85(56.7)	31(20.7)	6(4)	28(18.7)
Curing of vegetables	98(65.3)	24(16)	18(12)	10(6.7)
Storage				
Controlled Atmosphere Storage (CAS)	20(13.3)	14(9.3)	24(16)	92(61.3)
Zero Energy Cool Chambers	15(10)	20(13.3)	29(19.3)	86(57.3)
Use of Charcoal system to produce cold storage	28(18.7)	9(6)	17(11.3)	96(64)
Assembling harvested vegetables under tree shade	128(85.3)	14(9.3)	5(3.3)	3(2)
Blanching	48(32)	36(24)	18(12)	48(32)
Frequent sprinkling of water on harvested vegetables	113(75.3)	21(14)	-	16(10.7)
Packaging				
Modified Atmospheric Packaging	22(14.7)	19(12.7)	23(15.3)	86(57.3)
Active Packaging Technology	10(6.7)	11(7.3)	23(15.3)	106(70.7)
Use of ventilated crates and polysacks	81(54)	22(14.7)	14(9.3)	33(22)
Bamboo baskets	106(70.7)	14(9.3)	3(2)	27(18)
Gunning bags	98(65.3)	12(8)	12(8)	28(18.7)
Transportation				
Transportation using cars or motorcycles	57(38)	60(40)	30(20)	3(2)
Safe loading	141(94)	9(6)	-	-
Safe unloading	118(78.7)	26(17.3)	6(4)	-

Source: Field Survey, 2021

Constraints faced by the respondents in the use of improved Postharvest techniques

Table 3 reveals constraints facing respondents in the utilization of improved postharvest techniques of leafy vegetables in the study area. These are unpredictable climate (**$\underline{x}$**= 3.72**),** lack of extension support services (**$\underline{x}$** = 3.59**)** and high cost of labour (**$\underline{x}$** = 3.56**)**. Unpredictable climate, lack of extension support services and high cost of labour ranked 1st, 2nd and 3rd respectively. Unpredictability of climate has imposed high risk and uncertainty on every facet of agriculture. The awareness level of climate smart agriculture among farmers is still low, this however remains the option to combat the production

uncertainty associated with climate. Lack of extension support services in the study area could be attributed to the wide extension-farmer ratio in most states in Nigeria, Lagos not an exception. Lagos state prides itself with less than 90 (Ninety) functional village extension agents (LSADA, 2017). High cost of labour in metropolis of Lagos cut across all economic activities employing labour. This could be due to high cost of living, dearth of farm labour and availability of alternative jobs in the study area.

Table 3: distribution of respondents by constraints faced in the use of improved postharvest techniques

Constraints	Mean score ($\underline{x}$)	Rank
Non-availability of improved seeds	3.46	5th
Unpredictable climate	3.72	1st
Lack of extension support services	3.59	2nd
Inadequate storage and processing facilities	2.99	8th
High cost of labour	3.56	3rd
High cost of inputs	3.48	4th
Absence of crop insurance coverage	3.23	7th
High cost of transportation	3.37	6th
Middlemen malpractices	2.59	9th

Source: Field survey 2021

Relationship between respondents' socioeconomic characteristics and level of utilization of improved postharvest techniques

There was a significant relationship between respondents' level of education ($r = 0.161$, $P < 0.05$), farming experience ($r = -0.083$, $P < 0.05$) and farm size ($r = 0.158$, $P < 0.05$).and level of utilization of improved postharvest techniques. This implies that level of education of respondents is a determining factor to their utilization of improved postharvest techniques. The higher the level of education, the more likelihood that farmers will adopt an innovation. Farming experience and size of farmland are probable factors that can affect the adoption of innovation among farmers. Farmers with high farming experience tend to embrace new practices. Smallholder farmers often times are not desirous of adopting new techniques compared to large/commercial holders.

Table 4: Correlation between selected personal characteristics of the respondents and their level of utilization of improved post-harvest techniques

Variables	r-value	p-value	Decision
Level of education	0.161	0.002	Significant
Farming experience	-0.083	0.005	Significant
Size of farmland in hectares	0.158	0.015	Significant

Source: Field survey, 2021

CONCLUSION AND RECOMMENDATION

Majority of the leafy vegetable farmers are in their middle age with low level of education and are smallholders. Improved postharvest techniques utilized by the farmers covered different postharvest activities such as harvesting techniques, storage techniques, packaging techniques and transportation techniques. The use of improved postharvest techniques among respondents was constrained by unpredictable climate, lack of extension support services and high cost of labour among others. Farmers therefore should be encouraged to pursue reasonable level of formal education. Adult education should also be revamped to enable farmers acquire basic functional literacy to improve their production.

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