

## Post harvest handling and characteristics of fresh-cut traditional vegetables sold in Nairobi–Kenya

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**Abstract:** Twenty one major supermarkets and ten independent green grocers in the city of Nairobi were surveyed for the types of fresh-cut traditional leafy vegetables (TLVs) sold. *Cleome gynandra*, *Solanum nigrum*, *Vigna unguiculata*, *Amaranthus spp.* and *Cucurbita spp.* were found to be the most common TLVs selling. *Amaranthus spp.* and *Solanum nigrum* were selling in all the sales outlets surveyed, while the rest were selling in only a few of the sales outlets. For vending, the vegetables were not afforded any formal packaging; instead the vegetables within each type were tied in bundles of similar average size and displayed in troughs or shelves. The average weight of the bundles ranged between 250g for *Cucurbita spp.* to 650g for *Vigna unguiculata*. The mean price per bundle was KSh 14.00. The edible portion per bundle averaged between 34.2% for *Vigna unguiculata* and 84% for *Cucurbita spp.* Most of the sales outlets sold proportions ranging between 94% and 97% of the total delivery of the vegetables. The major cause of deterioration of the vegetables during vending was wilting. However, it was indicated that significant losses also occurred through spoilage. The study concludes that TLVs are becoming important as commercial crops and as items of diets for Kenyans of all levels. Studies on simple postharvest handling to minimize the losses are however, required.

**KEY WORDS:** Traditional vegetables, postharvest handling, marketing, Nairobi-Kenya

### Introduction

A diversity of traditional green leafy vegetables (TLVs) are consumed in Kenya. According to (Maundu et al., 1999), about 200 plant species are used as leafy vegetables, most of them being collected from the wild, while a few have been fully domesticated and few more are semi-domesticated. The most commonly consumed TLVs currently include the *Amaranthus spp.* (Pig weed), *Vigna spp.* (Cowpea leaves), *Solanum spp.* (Black nightshade), *Cleome gynandra* (Cat's whiskers), *Cucurbita spp.* (Pumpkin leaves) and *Corchorus spp.* (Jute/Bush okra). These vegetables are either purchased or own grown in home gardens for consumption. The vegetables serve as useful sources of vitamin A, iron and zinc. These three nutrients are considered as the global problem nutrients currently. They are also reported to be rich in vitamin C, proteins, fiber and the minerals such as sodium, phosphorus, and calcium (Akindahunsi and Salawu, 2005; Orech et al., 2005). Recently, attention is being directed to the vegetables because of their high contents of phytochemicals such as phenolic compounds, flavonoids and glucosinolates. These chemicals possess strong antioxidant properties and have recently been implicated in prevention of diseases such as cancer, arteriosclerosis, diabetes and aging (Hertog et al., 1992; Adeoye et al., 2005). They are also currently being proposed for use in the management of HIV/AIDS.

It has been variously demonstrated that production of traditional leafy vegetables as small scale enterprises can be viable (Besong et al., 2001). The commercial production can serve as a useful tool for poverty reduction for women with little capital, limited access to land and

working under labour constraints (Lewis, 1997). The revenue generated contributes significantly to enhancement of household food security, access to family health care and enables women to attain some degree of financial independence within the family budget (IITA, 2003).

Production of TLVs is very simple and often requiring very little input, save for occasional farmyard manure application. The vegetables are harvested by three methods: plucking only the leaves and edible parts, picking the branches containing the leaves and edible parts; and cutting plants at close to the ground level or uprooting the plants. For marketing, the harvested vegetables are placed in bundles of sizes dependent on the method of harvesting.

Marketing and consumption of TLVs in Kenya has steadily changed over the past five or so years (Mwangi and Kimathi, 2006). The vegetables used to sell mainly in the informal open air markets in most of the urban centers and were presumed to be consumed mainly by the lower socio-economic groups of the population. Recently, however, the vegetables have showed up in increasing quantities in the formal markets, where the middle and higher socio-economic classes do their shopping. In these markets, TLVs are found competitively selling alongside their exotic counterparts like cabbage and spinach. This indicates a rekindled interest and therefore increased demand for the vegetables by urban dwellers of all socio-economic classes. The increase in demand has stimulated many entrepreneurs, especially women, to gain interest in small scale growing and trading with the vegetables. There currently exists in the country therefore, opportunity to use traditional leafy vegetables to expand

the local food base, improve health, enhance food security and generate income.

In Kenya, very little has been done to determine the most preferred types of traditional leafy vegetables by consumers, the sources of the vegetables that sell in the markets, the manner in which they are displayed for sale and the cost of specific vegetable types. The shelf life of the fresh-cut vegetables has also not been adequately investigated. The objective of this study was therefore to determine the main types of TLVs sold in the supermarkets and independent green grocers in Nairobi. The sources of the vegetables selling, mode of delivery to the stores, display for sale and the problems encountered in their marketing were also determined.

## Materials and Methods

Using a structured questionnaire previously pre-tested, a survey was carried out in 31 selected supermarkets and independent green grocers in Nairobi. The survey covered three groups of supermarkets; Nakumatt supermarket chain (10 units), Uchumi supermarket chain (11 units) and independent green grocer stores (10 units). The survey determined the types of TLVs sold, the source of the supplies, the mode of delivery to the stores, display for sale, shelf life in the store, cost of the vegetable type and the problems encountered by the stores during vending.

### Data analysis

Data were analyzed using MS Excel. Using the pivot table, depending on the type of data; means, standard deviations and/or frequencies were computed.

## Results and Discussion

The survey data are shown in Table 1. The average distance from supply ranged between 21.9 km for

*Amaranthus spp.* to 38.5 km for *Cleome gynandra*. The average number of bundles received by each store per day was highest for *Solanum nigrum* at 88.9 and lowest for *Cucurbita spp.* at 22.5. The weight of bundle was highest for *Vigna unguiculata* at 650g and lowest for *Cucurbita spp.* at 250g. The percent edible portion per bundle varied from 38.9% for *Amaranthus spp.* to 84% for *Cucurbita spp.* The price per bundle averaged KSh. 14.30. Finally the percentage of bundles spoiling per day was highest for *Amaranthus spp.* at 5.5% and lowest for *Cucurbita spp.* at 1.8%.

For 28 outlets, the vegetables were supplied directly by the grower with some of the green grocers also growing their own vegetables, which they supplemented with those from the growers. The main mode of transportation of the vegetables from the source to the stores was either a lorry or pickup truck. For transportation, the vegetables were either packaged in crates or just stacked in the trucks and covered. The vegetables were received at all the sale outlets between 08h00 -010h00. On arrival, the vegetables were displayed for sale either in refrigeration at 6-8°C or at ambient temperatures but with periodic sprinkling with cold water. The stores indicated that the vegetables could remain in sellable condition for up to 2 days, although most of the supermarkets strived to sell within the day of delivery. Of the 31 stores, only 5 reported selling all the vegetables they received. Others sold proportions ranging between 94% and 97%, the remainder being accounted for by spoilage (see Table 1). The major cause of spoilage of the vegetables while on display for sale was wilting. However, substantial losses also occurred through spillage. Leafy vegetables generally have large surface area to volume ratios, which promote transpiration. It has been reported that leafy vegetables are easily preserved by storing in polypropylene packages, at temperatures close to 0 °C (Favell, 1998). Packaging also helps to cut down on losses through spillage and moisture loss.

**Table 1:** The types and characteristics of traditional leafy vegetable sold in groceries in Nairobi.

	Mean distance from supply (km)	Mean no. of bundles received per day	Mean weight of bundle (g)	% edible portion of bundle	Price per bundle (KShs)	Bundles purchased by customers		% of Bundles spoil per day
						1-2	>2	
<i>Amaranth spp</i>	21.9 (8.1)	75.2 (57.8)	500 (140)	38.9 (21.7)	13.9 (2.2)	11	20	5.5 (3.2)
<i>Solanum nigrum</i>	31.4 (33.5)	88.9 (88.0)	470 (110)	49.3 (15.4)	14.4 (1.5)	5	26	3.5 (2.9)
<i>Cleome gynandra</i>	38.5 (64.4)	46.3 (32.6)	420 (160)	40.5 (20.3)	14.6 (1.9)	9	20	3.1 (2.6)
<i>Vigna unguiculata</i>	33.9 (20.8)	71.2 (46.5)	650 (180)	41.1 (15.2)	14.6 (1.8)	9	20	4.2 (3.7)
<i>Cucurbita Spp.</i>	21.9 (8.1)	22.5 ( 20.5)	250 (150)	84 ( 10.5 )	14.00 (1.6)	8	2	1.8 (1.1)

\* 1US \$ = KSh. 70.00 : Figures in parentheses represent standard deviation (SD)

The distance from supply is very important in vegetable production and marketing. The poor roads from the places of production and the mode of transport used are likely to effect a significant degree of perishability and change in sellable value as the vegetables arrive at the market.

It appears like during bundling for sale the proportion of the edible portion rather than the bulk of the bundle was the consideration. This can be deduced from the fact

that the smallest bundles were of those vegetable types with the highest percentage of edible portion. Also, although the bundle weight varied widely, the weight of edible portion only varied between 170g in *Cleome gynandra* to 267g in *Vigna unguiculata*. Finally, the price per bundle was similar for all bundles. This price compared quite well with the prices of the bundles of exotic vegetables like spinach and kales which were

selling alongside the TLVs. This shows that TLVs are slowly being accepted into the dietaries of the middle and higher income segments of the population, unlike in the past, when they were considered as food for the low income group.

The proportion of bundles lost per vegetable type was surprisingly low, considering the conditions under which these vegetables are marketed. This indicates then, that with proper postharvest handling, losses can substantially be minimized.

*Amaranthus spp.* and *Solanum nigrum* were selling in all the 31 stores studied, while *Cleome gynandra* and *Vigna unguiculata* were selling in 29 of the stores. *Cucurbita spp.* was selling in only 10 of the sales outlets. Consumers indicated preference for *amaranthus spp.* over all others, with most of them likening it to spinach. The other vegetables were less preferred than the *amaranthus spp.* because consumers indicated that they have some bitter taste.

Two types of amaranth; *amaranthus hybridus* and *amaranthus cruentus* were the only ones found selling. *Amaranthus hybridus* (referred to locally as kienyeji) with small leaves was selling in all the stores, while *amaranthus cruentus* (referred to locally as agriculture) with broad leaves was selling in 19 of the stores. There was a definite preference by the customers for *amaranthus hybridus* as compared to *amaranthus cruentus*, which probably explains why the type was more popular. The major reason for the differential preference was probably due to its broad leaves, *amaranthus cruentus* was perceived by the customers as *Amaranthus hybridus*, but which had been grown in sewerage or using sewerage water. It was therefore considered unhealthy for consumption. This was also found to be the case with other TLVs which had types/varieties with large leaves.

The results indicate that in 20 out of the 31 outlets, customers purchased two or more bundles of vegetable either of the same or different type (Table 1). Those who purchased bundles of two types indicated mixing a bundle of the low pungency types like *Amaranth* and *Cucurbita spp.* with the high pungency type like *Cleome gynandra* and *Solanum nigrum* during cooking to reduce pungency. Two bundles of vegetables represent an average of about 0.5kg of edible portion. This can therefore be presumed to be the quantity used for preparation of a meal for an average size family.

The main constraint to increased production, marketing and consumption of TLVs is the high perishability and the low storage capacity in the fresh form. This forces farmers to sell soon after harvest (Maundu *et al.*, 1999). Accordingly, the supermarkets strive to sell all the supplies on the day of delivery and whatever remains at the end of the day is discarded as having lost saleable value. Some groceries, however, especially those with refrigeration, are able to sell for up to 2 days as was noted in this study. Farmers deliver fresh harvests daily to the supermarkets, and every second day to the green grocers. This is costly for the small scale farmers who have limited resources. Simple postharvest handling practices therefore need to be developed to help the farmers cut down the cost of delivery of the vegetables to the vending points. The sellers will also benefit by having to sell the produce over a longer period, and by extension the consumers who lack refrigeration

facilities because they will not necessarily purchase vegetables for only one day's needs.

The main problems associated with marketing of the vegetables by the supermarkets and green grocers in terms of importance were indicated as: short shelf-life (30/31), inadequate supply (30/31), unreliable supply (21/31), late deliveries (15/31) and aversion by the consumer (e.g. grown using sewerage water) (9/31).

It was observed that the groceries could manage to sell vegetables of a worse condition than could the supermarkets, probably because of the type of customers who purchase from the former outlets. The main customers in most of the green grocers were medium to low income groups, who accepted lower quality produce as long as it was offered at lower prices than that prevailing in the supermarkets. Freshness of produce can be extended for limited periods by storage at low temperatures, modified atmosphere packaging, correct humidity and good sanitation. Low temperature handling and storage is, however, the most effective physical method of postharvest wastage control. Other methods of preservation can be considered as supplemental (Wills *et al.*, 1981 and Kays, 1991).

The study concluded that production, trade and consumption of traditional leafy vegetables in Nairobi are on increasing. Fresh-cut vegetables are currently selling competitively alongside their exotic counterparts in the modern supermarkets and groceries. Trade in fresh-cut traditional vegetables is, however, delimited by their short shelf life. It is therefore recommended that simple and affordable post harvest handling practices that extend shelf life even for limited periods are developed.

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