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Postharvest Barriers, Marketing, and Consumer Preferences of Indigenous Green Leafy Vegetables (IGLVs) in urban Greater Accra, Ghana

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Abstract

Indigenous Green Leafy Vegetables (IGLVs) are underutilized but grown extensively in peri-urban gardens in Ghana. They provide affordable vitamins, dietary fiber, and bioactive substances that contribute to health benefits. However, challenges in post-harvest management, marketing, and consumption limit their usage. This study aimed to identify challenges in post-harvest management, consumer preferences, and perceived benefits associated with the consumption of IGLVs in urban areas of Greater Accra. A quantitative survey was used to retrieve data from 150 participants, consisting of 80 urban consumers of IGLVs and 70 retailers of IGLVs. Descriptive analysis (frequencies, percentages), and the chi-square test were used to determine significant associations. The study showed that cocoyam leaves, jute mallow, waterleaf, moringa, baobab leaves, and roselle are the most marketable IGLVs in urban Greater Accra Region. It was also observed that almost 21% of the respondents consumed IGLVs daily, 32.5% at least once a week, of which 40% cited health and nutritional benefits as their motivation for consumption. More than half (59 %) of the respondents indicated their non-preference for already processed IGLVs due to contamination, nutritional loss, and the use of unsafe preservatives. It was also observed that the availability and marketability of IGLVs are affected by the primary post-harvest management obstacles of contamination and storage conditions, particularly during the dry seasons. Finally, 45% of the respondents suggested that encouraging farmers and using media to promote IGLVs could increase consumption in urban Greater Accra. The study recommends an urgent need for increased research to address identified post-harvest challenges to increase the consumption of IGLVs in Ghana.

Keywords: Consumption, Indigenous, Marketing, Post-Harvest Handling, Processing

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INTRODUCTION

After decades of decline, hunger and malnutrition are on the rise and affect one in every four people. Today, the ability to access sufficient, nutritious, healthy, and affordable food sustainably is an enormous challenge facing humanity (Biodiversity International, 2017). As the world's population is expected to increase by more than 30% by 2050, world leaders have called for diversifying diets to include indigenous green leafy species. Indigenous green leafy vegetables (IGLVs) are among the numerous crops that are often referred to as neglected, underutilized, or 'orphan' crops. They are often domesticated, semi-domesticated, or wild species. These kinds of leafy vegetables constitute about a tenth of the world's plants, often regarded as weeds (Guarino,1997). Unlike the main staple crops, IGLVs are resistant to unfavorable climate conditions and can do well in poor soils. Due to this, they are predominantly grown by smallholder farmers who do not have the means to adopt high-input agricultural practices. This makes them potential food security crops and a source of income for many households (Pedulosi et al., 2013). Despite their abundance, IGLVs remain largely underutilized due to constraints such as traditional negative perception and processing time (Shayanowako et al., 2021).

IGLVs are known to be rich sources of vitamins, minerals, proteins, iron, copper, potassium, iodine, zinc, beta-carotene, folate, selenium, and other health-protecting properties that addresses diseases such as diarrhea, hypertension, eye, and kidney ailments (Okeno et al., 2002). These characteristics make IGLVs ideal for enhancing the nutritional status of rural and urban dwellers (Chadha, 2003). Despite this, many people around the world have switched from these nutrient-dense IGLVs in favor of eating more refined carbohydrates, saturated fats, and foods with added sugars or sweeteners, in addition to legumes and vegetables. This shift, originating from globalization and urbanization, has led to serious global health consequences of hunger and malnutrition among children and adults (Kasimba et al., 2019).

Ghana, like many other sub-Saharan African countries, is home to about 100 species of IGLVs, most of which either grow in the wild or are grown by smallholder farmers (van Zonneveld et al., 2021). However, very few of these species have been documented. These include Amaranth (*Amaranthus spp.L)* 'Alefu', Eggplant leaf (*Solanum macrocapon), 'Gboma',* Baobab leaf (*Adansonia digitate), 'Kuka' / 'Tokara' / 'Nufoten',* Runner bean (*Phasealus cocaneus*) 'Aduhahan', Cocoyam (*Xanthosoma spp./ Colocasia spp.)* leaves 'Kontomire, Jute mallow (*Corchorus olitorius*) 'Ayoyo' / 'Ademe', Kenaf (*Hibiscus cannabinus*) 'Berese, *Moringa oleifera*, Roselle (*Hibiscus sabdariffa* L. *sabdariffa*).

IGLVs are consumed in particular regions in Ghana due to cultural preferences, availability, and suitable weather conditions. However, some IGLVs are common throughout the country due to the rapid movement of people to other parts of the country in search of better economic opportunities (Clark et al., 2016). Despite their enormous agronomic, environmental, and nutritional potentials, the challenges with their post-harvest management, utilization, marketing, and consumption have not been thoroughly investigated. This neglect by researchers and policymakers could be due to underestimation and under-exploitation of their potential (Pedulosi et al., 2013).

Various studies on IGLVs have focused on their nutritional values (Glew et al., 2009), usage in preparing Ghanaian dishes (Darkwa & Darkwa, 2013), and potential for commercialization (Amisah et al., 2002). Although these studies affirm the significance of IGLVs in Ghana, data on challenges in post-harvest management, marketing, and consumption of IGLVs within urban settings are scarce. The objectives of the study were to identify these challenges in post-

harvest management, consumer preferences, perceived benefits associated with the consumption of IGLVs, and ways to improve their consumption in urban Greater Accra

This study contributes to ongoing literature by advancing knowledge on the key obstacle that hinders the consumption of IGLVs by urban dwellers. Second, this paper exposes the key post-harvest factors that affects the quality of the IGLVs sold in urban markets. Third, this paper contributes to the formulation of policies that will increase deliberate cultivation, increase the commercial value of IGLVs in urban areas, inform the public of their nutritional and health benefits, and reduce post-harvest contamination from farm gate to plate.

METHODOLOGY

Sample Size Determination

Greater Accra is the smallest of Ghana's 16 administrative regions. However, it is the most urbanized region with numerous shopping malls, restaurants, and supermarkets. Apart from these, it also has traditional markets where IGLVs are marketed. The study estimated about 65 IGLV retailers in each of the four targeted markets (260) and about 500 IGLVs consumers residing in highly urbanized communities within the Greater Accra Region. The study adopted the Cochran formula for finite population at 10% margin of error at 95% confidence level to obtain a sample size of 70.33 and 80.70 for the retailers of IGLVs and consumers of IGLVs respectively.

Cochran Formula for finite population

$$n = \frac{n_o}{1+\frac{n_o-1}{N}}$$

Where

n_o: the calculated sample size, $= \frac{Z^2 \cdot \rho \cdot (1-\rho)}{e^2}$

Z = Z score corresponding to the desired confidence level (1.96)

ρ = estimated proportion of the population (0.5)

1-*P* = proportion of population without the attribute

e = acceptable margin of error (0.01)

N = known population size

For an estimated 260 retailers from four targeted markets,

$$n_o = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.10)^2}$$

$$= \frac{3.8416 \times 025}{0.01}$$

$$= \frac{0.9604}{0.01}$$

$$= 96.04$$

$$= \frac{9604}{1+\frac{96.04-1}{260}}$$

$$\frac{9.604}{1.36554}$$

$$\approx 70.33$$

For estimated consumers of N = 500,

$$\frac{9604}{1+\frac{96.04\ -\ 1}{500}}$$

$$500$$

$$\frac{9.604}{1.19008}$$

$$\approx 80\ 70$$

Sampling Technique

Retailers of IGLVs were randomly selected from four markets (Madina, Mallam Atta, Nima, and Anyaa). These markets were selected because they are traditional markets situated in urbanized communities within the Greater Accra Region were retailers of IGLVs can be found. Developed questionnaires were used to gather information on the source of IGLVs, the reasons for the marketing of a particular IGLV, the post-harvest management practices used, including the mode of preservation, factors that could affect the quality of the IGLVs from the farm gate to the market centers, as well as opinions on how to improve the consumption of IGLVs. Regarding urban consumers of IGLVs, structured questionnaires were used to glean information on their knowledge of IGLVs, the range of IGLVs consumed, rate of consumption, reasons for consumption, form of consumption, utilization of IGLVs, barriers to the consumption of IGLVs, and other preferred forms of IGLVs. The questionnaires was administered online using Google Forms.

Statistical Analysis

Clean data were uploaded to an IBM Statistical Package version 23 (SPSS Inc.) and analyzed. Categorical responses were assigned numerical codes and counted using frequencies. Open –ended responses were grouped and coded based on inductive thematic themes to enhance data validity. Descriptive scoring procedures (frequencies, percentages, and means), and Chi-square test was used to explore the association between duration of IGLV consumption and perceived benefits, IGLV processing, the most marketed IGLV, reasons for marketing a particular IGLV, and ways to improve IGLV consumption.

RESULTS AND DISCUSSIONS

Demographic Characteristics of the Respondents

Approximately 52.5% of the respondents were women and 47.5% were men (Figure 1). This is attributed to the fact that in Ghana, women are mostly assigned the duty of purchasing and cooking for their households and are found to be better vegetable consumers per week than

their male counterparts in all agro-ecological zones in Ghana (Amo-Adjei et al., 2015). However, the relatively high number of male respondents suggested an increase in male participation in the buying and cooking of household foods (Arnot et al., 2012).

Most (57.5%) of the respondents were within the youth category (25-35 years) (Figure 1). This relatively high rate of participation in this survey by young people could be due to the mode of administration of this survey using online Google Forms and because the Greater Accra Region is found to have the most youthful population in Ghana (Kawaguchi et al., 2022). Approximately 93.8% of the survey respondents have completed or are pursuing tertiary education (Figure 1). Thus, the data generated by the study (in terms of age and educational status) are relevant for the future consumption outcome of IGLVs in urban centers.

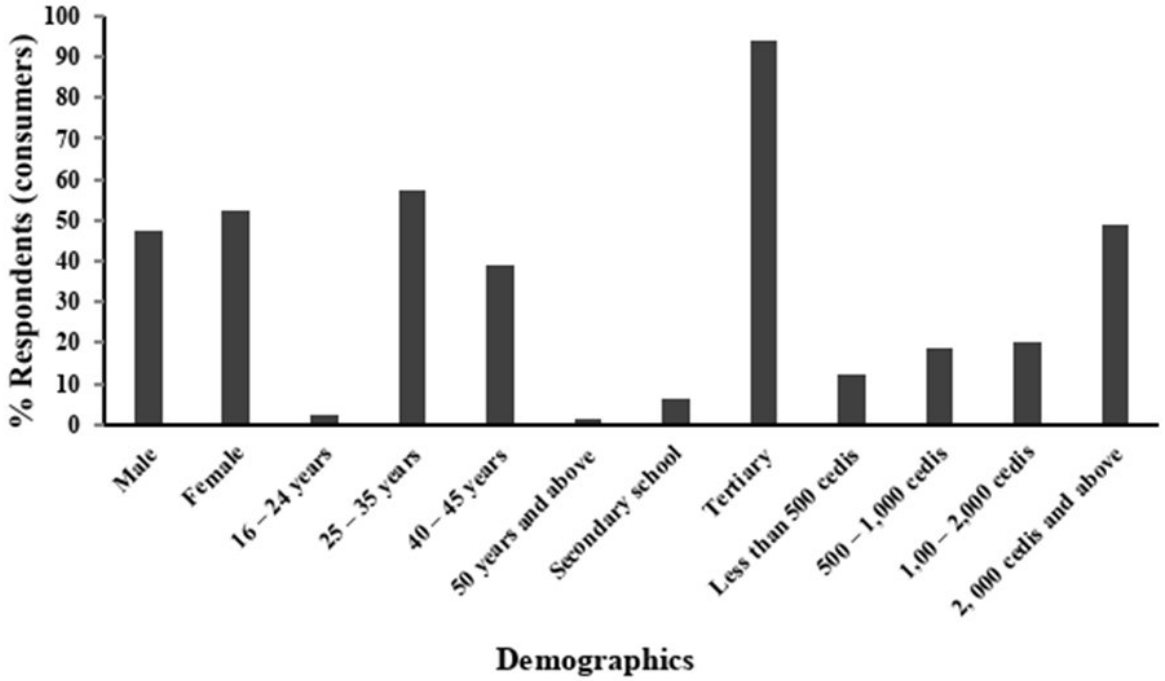


Figure 1: Demographics of respondents

Post-Harvest Barriers Affecting IGLV Consumption

The main barriers to post-harvest management described by 34.8 % of retailers to affect IGLV marketing and consumption in the Greater Accra urban area were poor post-harvest handling and storage, followed by the cost of IGLV due to seasonality (28.8%), leaf contamination (due to the type of water used in cultivation) (19.7%) and processing time (9.1%) of these leaves (Figure 2). The quality and marketability of these leaves are affected by high temperatures, inadequate post-harvest storage facilities, inadequate labour, and inappropriate methods of transportation of leaves to the market centers. This is because inadequate post-harvest handling causes physiological damage. Nwanekezie et al. (2014), in their previous study, also established the negative impact of post-harvest management on IGLV. They concluded that at high temperatures, the rate of metabolism of nutrients in harvested leafy vegetables increases, resulting in loss of nutrients such as minerals.

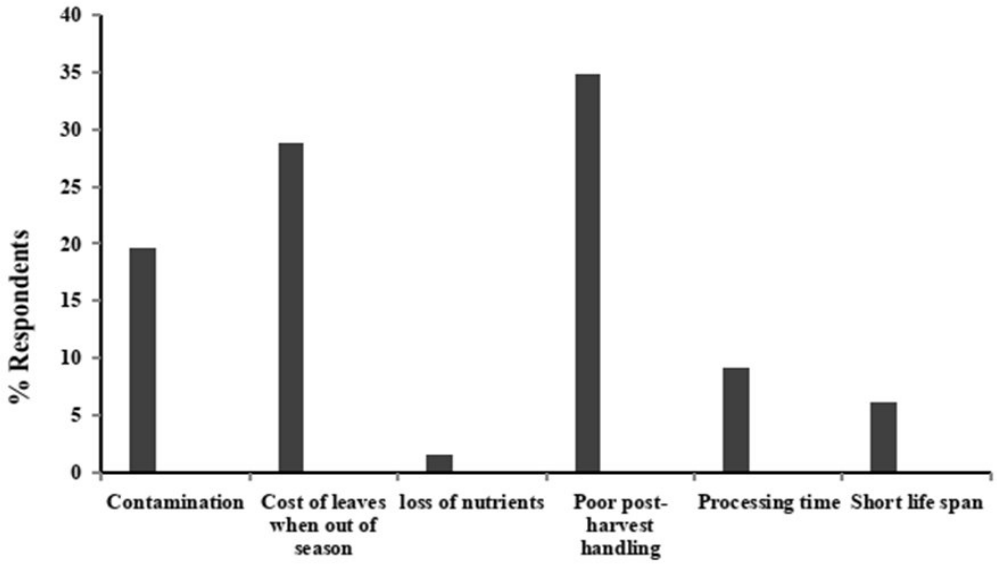


Figure 2: Post-harvest barriers that affect the consumption of IGLVs

Marketing of IGLVs

The perishable nature of IGLVs makes effective and ready marketing crucial for both farmers and retailers of the product. The study indicates that the marketing of IGLVs in urban centers in the Greater Accra Region is carried out mainly by women (98.6%), and most of their marketing is carried out through open markets and street vending, with 59.4% of the leafy vegetables sold sourced outside of Accra. The study also found that cocoyam leaves (*Colocasia esculenta* L. Schott) are the most marketed IGLVs in the markets visited (40.6%) although it is mainly cultivated in the forest zones of Ghana (Figure 3). Retailers (57.6%) attributed this to its high demand and the perceived enormous benefits associated with its consumption that have been widely broadcast. Traditionally, cocoyam leaves are widely used as part of food culture in Ghana.

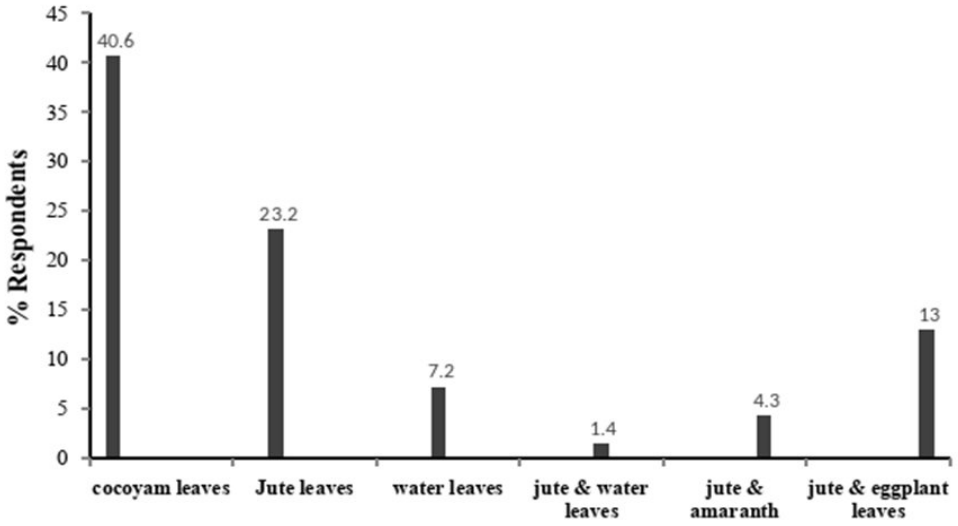


Figure 3: Most marketed IGLVs by retailers

A computational crosstab aimed at exploring the association between the source of IGLV and the type of IGLV sold by the retailers (***p-value <0.0001)*** showed that cocoyam leaves are mostly sourced outside of Accra (Table 1) and the motivation to sell this particular vegetable is due to high demand *(p-value = 0.003)* (Table 2).

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Table 1: Association between the source and kind of IGLVs marketed by retailers

			Kind of IGLVs marketed?							Total
			Cocoyam	**Jute**	**Waterleaf**	**Jute + Waterleaf**	**Jute + Amaranth**	**Jute + Eggplant**	**Jute + Amaranth + Eggplant**	
Source of leafy vegetables marketed?	Outside Accra	Count	26	4	5	0	1	4	1	41
		% of Total	**37.7%**	5.8%	7.2%	0.0%	1.4%	5.8%	1.4%	59.4%
	Within Accra	Count	2	12	0	1	2	5	6	28
		% of Total	2.9%	17.4%	0.0%	1.4%	2.9%	7.2%	8.7%	40.6%
Total		Count	28	16	5	1	3	9	7	69
		% of Total	40.6%	23.2%	7.2%	1.4%	4.3%	13.0%	10.1%	100.0%

Table 2: Motivation for the marketing of particular IGLVs by retailers

			IGLVs commonly marketed by retailers							Total
			Cocoyam	Jute	Water leaf	Jute + Waterleaf	Jute + Amaranth	Jute + Eggplant	Jute + Amaranth + Eggplant	
Motivation for marketing IGLVs	High demand	Count	19	7	0	1	3	4	4	38
		% of Total	**28.8%**	10.6%	0.0%	1.5%	4.5%	6.1%	6.1%	57.6%
	High-profit margin	Count	3	0	0	0	0	0	0	3
		% of Total	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%
	Readily available	Count	2	6	0	0	0	5	3	16
		% of Total	3.0%	9.1%	0.0%	0.0%	0.0%	7.6%	4.5%	24.2%
	Traditional food	Count	3	3	3	0	0	0	0	9
		% of Total	4.5%	4.5%	4.5%	0.0%	0.0%	0.0%	0.0%	13.6%
Total		Count	27	16	3	1	3	9	7	66
		% of Total	40.9%	24.2%	4.5%	1.5%	4.5%	13.6%	10.6%	100.0%

Due to the open nature of most of our food markets, the effects of direct sunlight, dust, heat and the distance from the farm gate to the market centers have been quoted as the main factors that affect the quality and safety of leafy vegetables (Figure 4). It also emerged that 68.2% of the retailers of the IGLVs were unable to sell all their goods in a day. Most of them resorted to sprinkling the leaves with water to keep them fresh (Figure 5). A similar indigenous practice has been reported in Kenya. However, this often results in economic, quantitative, and nutritional losses (Gogo et al., 2017). Literature has also shown that storing some of these leafy vegetables above their freezing point but at reduced refrigeration temperatures slows their physiological changes, causing a chilling effect that results in dullness, browning, pitting, and decay (Lukatkin et al., 2012). Currently, data on the ideal storage temperature for IGLVs (especially those grown in tropical zones) are limited.

Hence, urgent research attention must be directed at the development of devices or tools that can be used by smallholder farmers (on their farms) and retailers (in the market outlets), to reduce post-harvest nutritional losses and to ensure the maximum nutritional benefits for urban consumers.

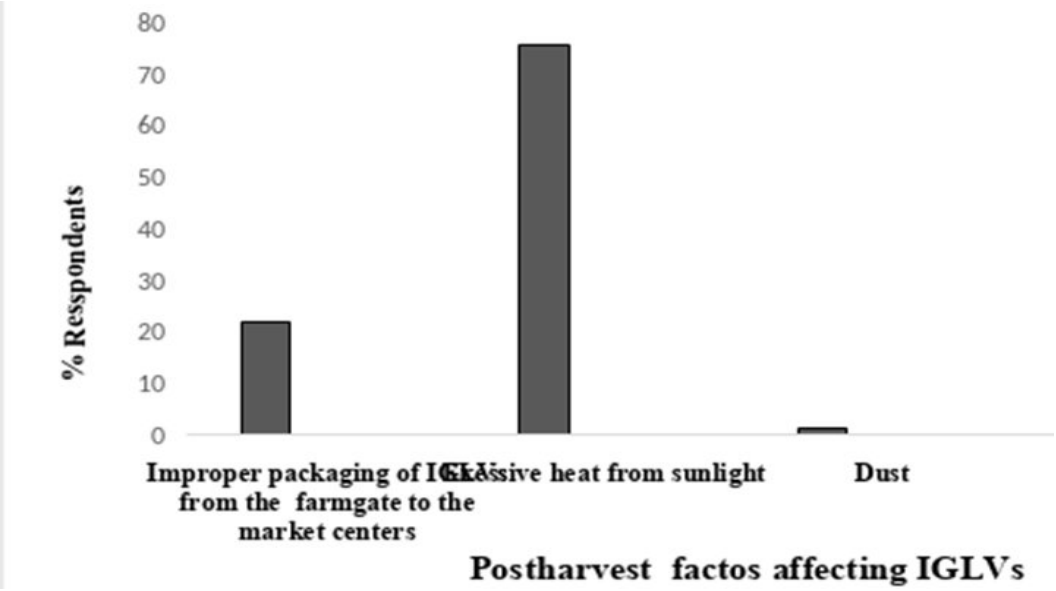


Figure 4: Factors that affect the quality of IGLVs sold by retailers

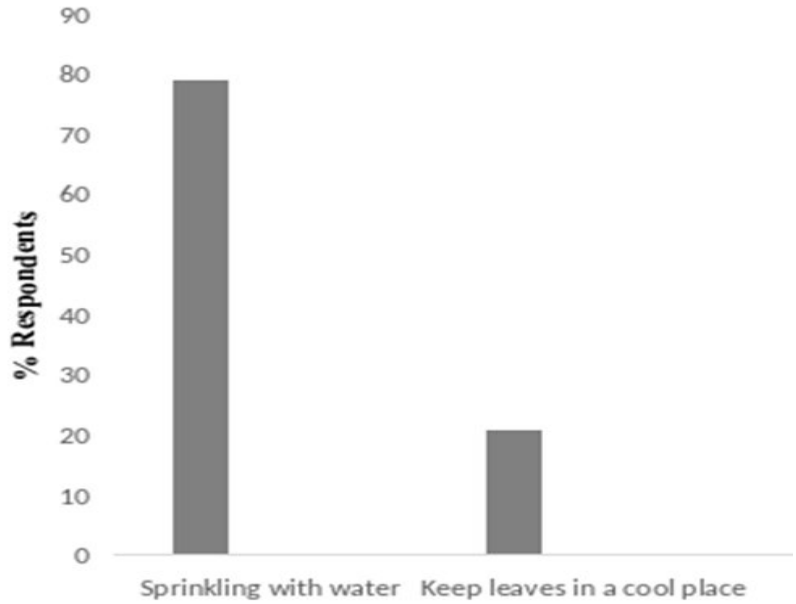


Figure 5: Storage practices by retailers when IGLVs are not sold in a day

Range of IGLVs consumed

Data collected from respondents indicated that cocoyam leaves (*Xanthosome satgittifolium),* jute mallow (*Corchorus olitorius*), eggplant leaves (*Solanum macrocarpon),* waterleaf (*Talinum sabdariffa*), moringa (*Moringa olefera*), Amaranth, Baobab leaves *(Adansonia digitata*), and roselle (*Hibiscus sabdariffa*) are the IGLVs consumed by most residents in urban

Greater Accra (figure 6). This finding corroborates the initial work of Atuna et al., (2022), who reported that okra, garden eggs, cocoyam leaves, jute mallow leaves, baobab leaves, roselle, amaranth and kenaf are the most widely consumed IGLV in Ghana.

The relatively high patronage of cocoyam (*Xanthosoma sagittifolium*) leaves is attributed to the fact that this IGLV serves as a complement to a variety of foods such as rice, yam, plantain, 'banku' or 'kenkey' while the popularity of jute (*Corchorus olitorius)* mallow leaves stems from its use as a good complement and/ or replacement for okra, which is one of the most consumed vegetables in Ghana (Atuna et al., 2022). Apart from cocoyam (*Xanthosoma sagittifolium*) leaves that are mostly cultivated outside of urban Accra, mallow jute leaves, eggplant leaves, roselle, and amaranth are grown in Accra and are therefore readily available in most local markets. However, these represent only about 5% of the total IGLVs available in Ghana although the popularity of the other IGLVs are high (Asase et al., 2018)

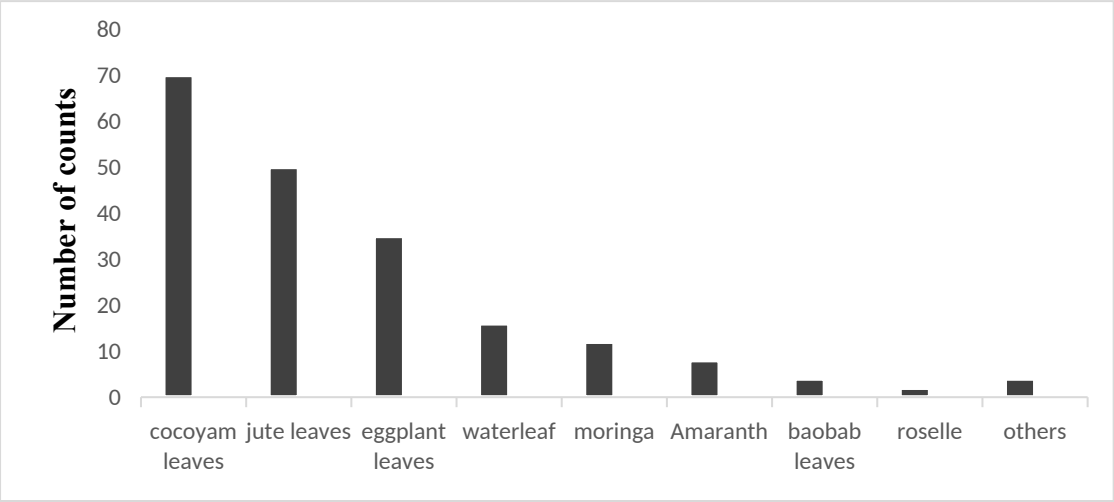


Figure 6: Range of IGLVs Consumed

Frequency of Consumption

Approximately 32.5% of the respondents stated that they consume a form of IGLV once a week which is twice the number of respondents (16.3%) who consumed a form of IGLV twice a week. 21.3% of participants reported daily consumption of IGLV (Figure 7). Compared to the daily consumption findings of 21-35% and 39% by Nti et al.,(2011) and Atuna et al. (2022), the findings of this study are comparatively lower. This emphasizes that the consumption of these leaves will be much higher in other regions where they can be easily collected from surrounding bushes than in urban centers where they are typically sold at higher prices because of seasonality. Second, the markets in urban Accra are flooded with exotic vegetables, providing consumers with a wide variety to choose from. This substantiates the findings of earlier works by Moyo et al. (2021), who noted that despite the known anti-inflammatory and anti-cancer properties of IGLVs, their consumption among urban dwellers is minimal due to the availability of exotic vegetables, distance to market centers, and the occupation of urban dwellers (Gido et al., 2017).

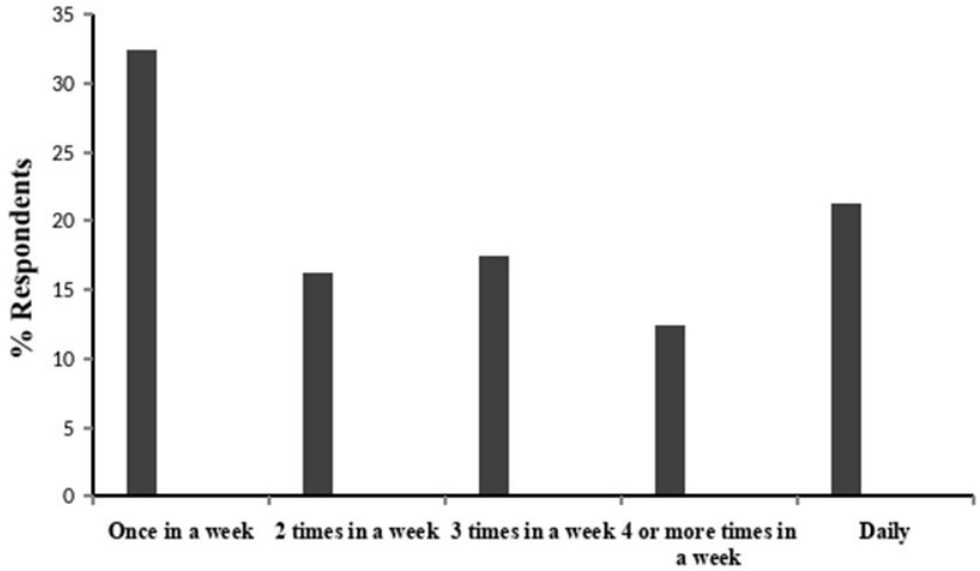


Figure 7: Frequency of consumption of IGLVs

Perceived Reasons for the Consumption of Iglvs

Almost 91.8% of the respondents in the survey indicated that they have been consuming IGLVs since childhood. Only 7.2% of the respondents claimed to have started consuming IGLVs after learning about the numerous benefits of these leaves. Approximately 40% of the respondents claimed the derived health and nutritional benefits as their motivation to consume IGLV. Other respondents' (9.6 %) reason for consuming a form of IGLV in urban Accra was due to its association with their ethnicity or tradition (Figure 8). For example, respondents from the Northern or Volta region of Ghana who have migrated to Greater Accra areas will continue to consume jute mallow because it is cultivated and consumed widely by indigenes from these regions. A similar finding was reported by Kimiywe et al. (2007), who noted that ethnicity greatly influences the kind of IGLV consumed in urban and peri-urban Nairobi.

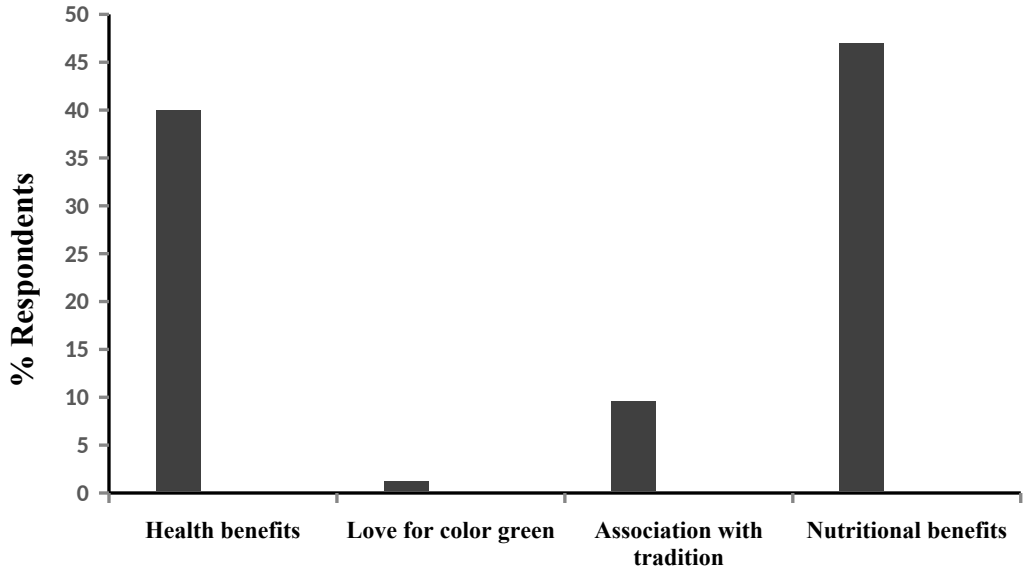


Figure 8: Perceived reasons for IGLV consumption

The Association Between the Most Preferred IGLV, the Length of Consumption, and The Derived Benefits

The numerous benefits associated with the consumption of IGLVs cannot be overemphasized. However, the nutritional and health benefits associated with the consumption of IGLVs cannot be achieved without a consistent consumption interval maintained over a period of time. Data obtained from the survey showed that most of the respondents started to consume these IGLVs since childhood (91.1%), while 7.6% of the respondents attributed their reason for consumption to the acquisition of the health and nutritional knowledge associated with their consumption. A computational analysis (Table 3) to determine the association between the type of IGLV consumed, the length of consumption, and the stated benefits was significant (**p<0.0001**).

Table 3: A computational analysis of the association between the most consumed IGLV, the length of consumption, and the stated benefits

	Since I was a child	**After I acquired knowledge of its benefit**	**Other**		
Variable	**n (%)**	**n (%)**	**n (%)**	**Total**	***p-value***
IGLV CONSUMED THE MOST					**<0.0001**
Cocoyam leaves	**17 (21.5)**	0	0	**17 (21.5)**	
Eggplant leaves	1 (1.3)	0	0	1 (1.3)	
Baobab leaves	1 (1.3)	0	0	1 (1.3)	
Cocoyam leaves + Moringa leaves	2 (2.5)	1 (1.3)	0	3 (3.8)	
Cocoyam leaves + Eggplant leaves	3 (3.8)	0	0	3 (3.8)	
Cocoyam leaves + Amaranth	0	1 (1.3)	0	1 (1.3)	
Jute leaves	2 (2.5)	0	0	2 (2.5)	
Cocoyam leaves + Eggplant leaves + Moringa leaves	1 (1.3)	0	0	1 (1.3)	
Cocoyam leaves + Eggplant leaves + Amaranth	1 (1.3)	0	0	1 (1.3)	
Cocoyam leaves + Jute leaves	11 (13.9)	0	0	11 (13.9)	
Cocoyam leaves+ Water leaves + Amaranth	0	1 (1.3)	0	1 (1.3)	
Eggplant leaves +Jute leaves	2 (2.5)	1 (1.3)	0	3 (3.8)	
Cocoyam leaves + Eggplant leaves + Jute	8 (10.1)	0	0	8 (10.1)	

leaves				
Cocoyam leaves + Jute leaves + Water leaves	2 (2.5)	0	0	2 (2.5)
Cocoyam leaves+ Jute leaves + Amaranth	1 (1.3)	0	0	1 (1.3)
Eggplant leaves + Jute leaves + Water leaves	0	0	1 (1.3)	1 (1.3)
Cocoyam leaves + Eggplant leaves+ Jute leaves + Moringa leaves	4 (5.1)	1 (1.3)	0	5 (6.3)
Cocoyam leaves + eggplant leaves + Jute leaves +Water leaves	5 (6.3)	0	0	5 (6.3)
Cocoyam leaves + Eggplant leaves+ Jute leaves + Kenaf	1 (1.3)	0	0	1 (1.3)
Cocoyam leaves + Eggplant leaves + Jute leaves + Amaranth	2 (2.5)	0	0	2 (2.5)
Cocoyam leaves + Jute leaves + Water leaves + Moringa leaves	2 (2.5)	0	0	2 (2.5)
Cocoyam leaves + Jute leaves + Water leaves + Amaranth	1 (1.3)	0	0	1 (1.3)
Eggplant leaves+ Baobab leaves+ Jute leaves + Kenaf	1 (1.3)	0	0	1 (1.3)
Cocoyam leaves + Eggplant leaves + Baobab leaves+ Jute leaves + Water leaves	0	1 (1.3)	0	1 (1.3)
Cocoyam leaves +Eggplant leaves + Jute leaves + Water leaves + Amaranth	1 (1.3)	0	0	1 (1.3)
Cocoyam leaves+ Eggplant leaves + Jute leaves	1 (1.3)	0	0	1 (1.3)
Cocoyam leaves + Eggplant leaves + Baobab leaves + Jute	1 (1.3)	0	0	1 (1.3)

leaves + Water leaves + Kenaf + Amaranth				
Cocoyam leaves + Jute leaves + Water leaves + Moringa leaves	1 (1.3)	0	0	1 (1.3)
Total	**72 (91.1)**	**6 (7.6)**	**1 (1.3)**	**79 (100)**

Benefits Associated with the Consumption of Iglvs

When asked about the health and nutritional benefits derived from the consumption of IGLV, more than half of the respondents indicated that they hardly fall sick (55%) when they consumed IGLV (Figure 9). Others indicated that they have free bowel movements (20%), improved hemoglobin levels (20%), while some indicated nutrients for well-being (3.3%) as some of the perceived benefits. These findings agree with an earlier submission by Kansiime et al. (2018), who explained that the increase in hemoglobin level, increased immunity, and repair of body tissues are the key benefits of consuming IGLV among pastoral communities in northern Tanzania.

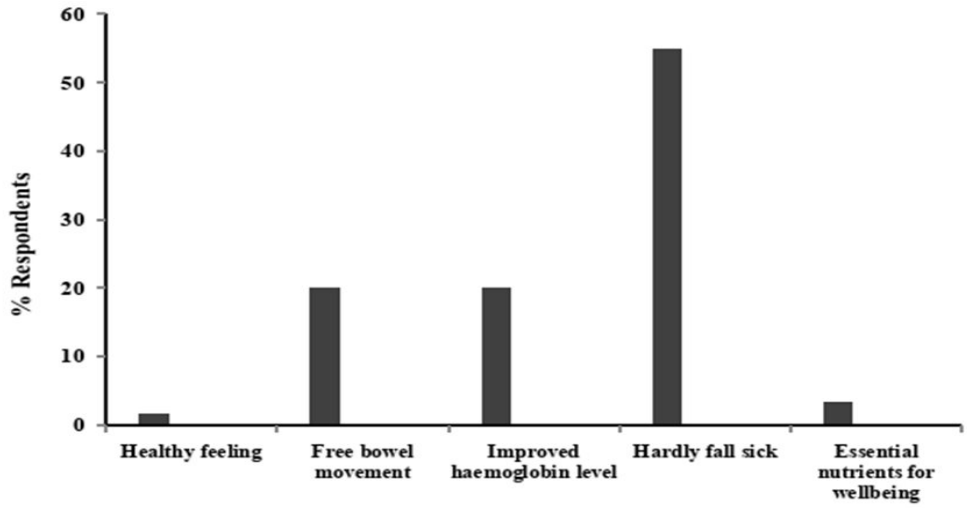


Figure 9: Perceived benefits associated with the consumption of IGLVs.

Truly, the uniformity of the benefits of IGLVs across sub-Saharan African countries cannot be overemphasized. These IGLVs are rich carriers of antioxidants, anti-inflammatory properties, flavonoids, phenolic acids, glucosinolates, and vitamins with the potential to prevent a wide range of diseases (Sivakumar et al., 2018). A computational crosstab to ascertain whether IGLV consumption (based on perceived nutritional and health benefits) was value for money especially when out of season, was significant ($p<0.018$). Indeed, a higher proportion of the respondents (approximately 66%) confirmed that they consumed IGLV due to its perceived health benefits (Table 4).

Table 4: Association between IGLVS consumption and value for money

NUMBER OF PARTICIPANTS (n = 80)				
	No	**Yes**		
	n (%)	**n (%)**	**Total**	***p-value***
Reason				**0.018**
Enormous health benefits	3 (3.8)	**52 (65.8)**	55 (69.6)	
It is cheaper	3 (3.8)	13 (16.5)	16 (20.3)	
It is expensive	1 (1.3)	0	1 (1.3)	
Nutritional benefits	0	5 (6.3)	5 (6.3)	
Reduces medical bills	0	1 (1.3)	1 (1.3)	
Spends less on medicine	0	1 (1.3)	1 (13)	
Total n (%)	7 (8.9)	**72 (91.1)**	79 (100)	

Utilization of IGLVs

Approximately 98.8% of the respondents' preference for the use of their IGLVs is for the preparation of soups and stews. (Figure 7). This is expected because most indigenous staple dishes (*banku*, *kenkey*, *rice*, yam, *fufu*) in Ghana are consumed with soups or stews, making most IGLVs part of the meal. This finding agrees with the work of Nti et al. (2011) and Atuna et al. (2022). Although cooking improves the taste, appearance, aroma, and overall edibility of most IGLVs, prolonged boiling (more than 15 minutes) often leads to alteration of their physical, chemical, biological, and bioavailability characteristics (Moyo, 2024). Less than 2% of the respondents stated that they had consumed their preferred IGLV in the form of salad, which was likely to contain all essential micronutrients (Figure 10). However, anti-nutritive factors such as oxalates, phytates, nitrates, and tannins are likely to affect consumers when IGLVs are eaten raw (Flyman et al., 2006). Thus, there is a need to modify our cooking methods to ensure that these anti-nutritive factors are minimized while enhancing the nutritional attributes of IGLVs.

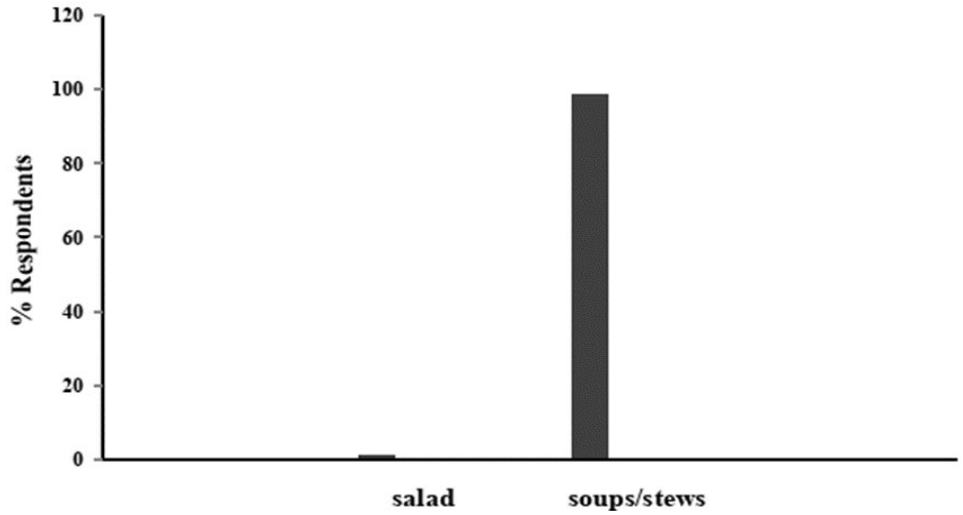


Figure 10: Utilization of IGLVs

Preparation and Processing of Iglvs

Due to anti-nutritive attributes in many IGLVs, knowledge of the right food preparation techniques is needed to improve their taste without compromising their essential nutrients. However, apart from the poor post-harvest practices that serve as a barrier to the ready availability of the IGLVs to many urban dwellers, the lack of knowledge in the preparation of some of these IGLVs, coupled with the processing time (before cooking), has also been cited as a deterrent to their consumption. For example, the unavailability of leafy vegetables such as baobab and cowpea leaves, in some localities along the southern parts of Ghana, has been cited by respondents as a barrier to their consumption of IGLV (Atuna et al., 2022). Also, the inaccessibility of cocoyam leaves in most communities in northern Ghana is a major motive for the non-consumption of this IGLV (Atuna et al., 2022). These, and other factors such as full-time occupations outside the home, have reduced the regular consumption of IGLVs in several urban communities. To overcome these challenges, urban dwellers have been called upon to adopt an already processed IGLV. However, when respondents were asked about their preference for an already processed IGLV, 59.0% of respondents said NO, 16.7% said YES and 24.4 % of respondents indicated that they would only consider an already processed IGLV if they were assured that all food safety mechanisms had been met (Table 5). Respondents who objected to an already processed IGLV cited reasons such as contamination (20.5%), loss of vital nutrients (7.7%), and the addition of unhealthy preservatives (9.0%) as reasons for their objections (Table 5). This agrees with previous work conducted in Kenya, which found that about 70% of consumers are unwilling to purchase an already processed IGLV (Schreinemachers 2022). Respondents (16.7) who agreed to consume an already processed IGLV believe that it will save processing time (20.5).

Although the processing of most IGLVs may include plucking, sorting, washing, cutting, blanching, and packaging, ready-to-eat IGLV producers must assure urban consumers that all these procedures will be carried out under strict hygienic conditions to whet the interest of urban dwellers in their consumption. Furthermore, it is necessary to develop appropriate technologies for the effective preservation of IGLVs to minimize post-harvest losses during bumper seasons, reduce the exorbitantly high cost of the leaves during lean seasons, and ensure that urban dwellers get the full benefits associated with the consumption of IGLVs.

Table 5: Preference for an already processed IGLV and associated reasons

PREFERENCE FOR AN ALREADY PROCESSED IGLV AND ASSOCIATED REASONS								
	NUMBER OF PARTICIPANTS (n = 80)							
Variables	**I prefer to process it myself**	**If processed under hygienic conditions**	**It might be contaminated**	**It will save preparation time**	**Loss of Nutrients**	**Preservatives might be added**		
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**Total**	**p - value**
Would prefer processed IGLV								**< 0.0001**
No	**21(26.9)**	0	14 (17.9)	1 (1.3)	4 (5.1)	6 (7.7)	**46 (59.0)**	
Yes	0	4 (5.1)	0	9 (11.5)	0	0	13 (16.7)	

Maybe	3 (3.8)	5 (6.4)	2 (2.6)	6 (7.7)	2 (2.6)	1 (1.3)	19 (24.4)
Total	**24 (30.8)**	9 (11.5)	16 (20.5)	16 20.5	6 (7.7)	7 (9.0)	78 (100)

Improving the Consumption of IGLVs

The enormous nutritional and health benefits of consuming IGLVs cannot be overstressed. When asked about ways to improve the consumption of IGLVs in urban Accra, 45.0% of the respondents believed that when farmers are encouraged to cultivate more IGLVs, their availability in all markets will increase leading to an improvement in their consumption. On the other hand, 21.7% of the respondents were of the view that harnessing the benefits associated with the consumption of IGLVs in all available media in Ghana will spark individual interest in their consumption (Figure 11). Gido et al. (2017), also concluded that adding value to IGLVs and making the leaves available on the doorstep of urban consumers through a coordinated market supply will improve their consumption.

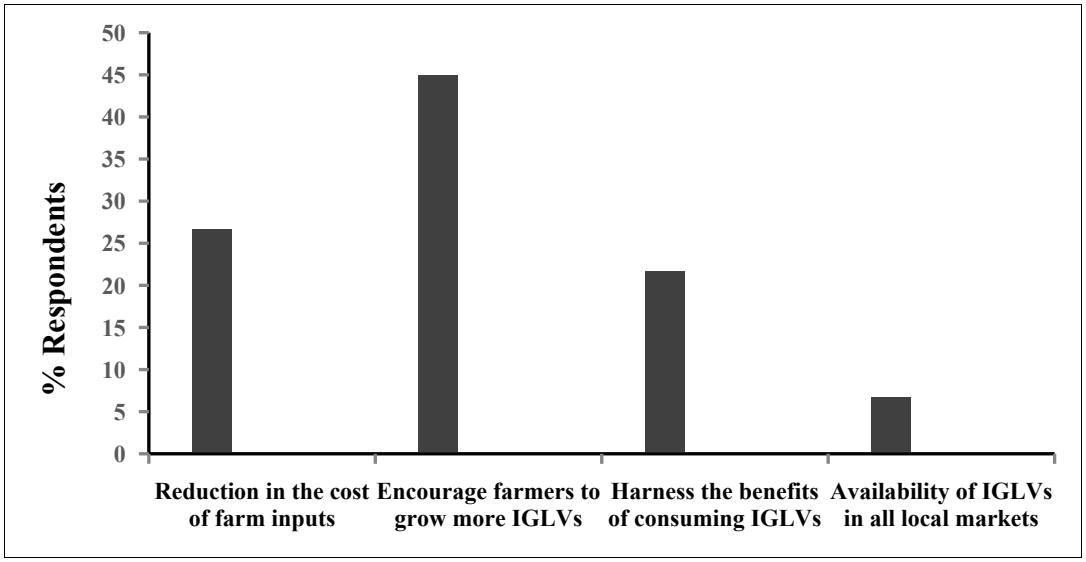


Figure 11: Improving the consumption of IGLVs in Greater Accra

Limitation of the Study

An online Google Form was used to administer the survey to consumers. Thus, people living in urban Accra with smartphones were eligible participants.

CONCLUSION

The availability and marketability of IGLVs are affected by the primary post-harvest management obstacles of inadequate handling, contamination, and storage, particularly during the dry seasons. Even so, IGLVs are thought to offer good value for money. Most people living in urban Accra consume IGLVs used in the preparation of soups and stews, with the most common being cocoyam leaves (*Xanthosoma spp./Colocasia spp.)*, jute mallow (*Corchorus olitorius*), eggplant leaves (*Solanum macrocapon*), amaranth (*Amaranthus spp.L)*, moringa (*Moringa oleifera*), roselle (*Hibiscus sabdariffa* L. *sabdariffa)* and baobab leaves (*Adansonia digitate*). Their nutritional value and health benefits were cited as the main justifications for

their consumption. To ensure the availability and consumption of IGLVs year-round, it is necessary to present individuals with value-added and processed IGLVs. Researchers, academia, and value chain actors must dispel food safety rumours and leverage post-harvest technology advances to increase the commercial value and use of IGLVs.

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Conflicts of Interest

None.

AI use Declaration

No AI tools used

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