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Vegetable Consumption Predictors in Three Markets, Kampala, Uganda

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ABSTRACT

Vegetable consumption remains low among Africans, particularly in sub-Saharan Africa. A study conducted in the greater Kampala metropolitan area of Uganda examined consumer patterns and challenges in adopting vegetables as part of the staple diet. The majority of vegetable consumers (65.3 %) were women, with Nakawa market being crucial. Participants had a mean age of 34.6 years, were primarily Catholic (34.2%), were Ugandans, had a basic education, and earned a monthly income above USD 110. Vegetable consumption frequency every week was similar between Nakawa and Kalerwe markets. The most commonly consumed vegetables were the leafy vegetables, dodo *Amaranthus dubius* (47.5%), and cabbages *Brassica oleracea* (63.9%). 'Biringanya' *Solanum melongena* (82,9%) was the most purchased non-leafy vegetable. Overall, vegetable consumption was low and irregular, with specific vegetables showing daily consumption rates ranging from 41.2% to 57.1%. Challenges associated with vegetable consumption included vegetable handling and transportation, lack of refrigeration facilities, and inadequate equipment for storage. Charcoal was the primary cooking fuel for most people (90.8%). Promotional efforts are needed to increase vegetable sales and consumption in Kampala, aligning with WHO recommendations for improved nutrition, health, and income.

Keywords: Nutrition, Uganda markets, Vegetable consumption

RÉSUMÉ

La consommation de légumes reste faible chez les Africains, en particulier en Afrique subsaharienne. Une étude menée dans la grande zone métropolitaine de Kampala en Ouganda a examiné les habitudes des consommateurs et les défis liés à l'adoption des légumes comme partie intégrante du régime alimentaire de base. La majorité des consommateurs de légumes (65,3 %) étaient des femmes, le marché de Nakawa étant un point d'approvisionnement crucial. Les participants avaient un âge moyen de 34,6 ans, étaient majoritairement catholiques (34,2 %), de nationalité ougandaise, disposaient d'une éducation de base et percevaient un revenu mensuel supérieur à 110 USD. La fréquence hebdomadaire de consommation de légumes était similaire entre les marchés de Nakawa et de Kalerwe. Les légumes les plus couramment consommés étaient les légumes-feuilles : dodo Amaranthus dubius

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(47,5 %) et choux Brassica oleracea (63,9 %). Le « Biringanya » Solanum melongena (82,9 %) était le légume non-feuillu le plus acheté. Globalement, la consommation de légumes était faible et irrégulière, certains légumes présentant des taux de consommation quotidienne allant de 41,2 % à 57,1 %. Les défis liés à la consommation de légumes comprenaient la manutention et le transport des légumes, le manque d'installations de réfrigération, et le matériel de stockage insuffisant. Le charbon de bois était le principal combustible de cuisson pour la majorité des personnes (90,8 %). Des efforts de promotion sont nécessaires pour accroître les ventes et la consommation de légumes à Kampala, en accord avec les recommandations de l'OMS pour améliorer la nutrition, la santé et les revenus.

Mots clés: Nutrition, Marchés d'Ouganda, Consommation de légumes

INTRODUCTION

The World Health Organization (WHO) has promoted vegetable consumption to reduce the risk of noncommunicable diseases. However, the global intake of vegetables remains low and this fails the drive which wants people to benefit from healthy eating (Kalmpourtzidou *et al*., 2020). Vegetables offer essential nutrients such as Potassium (essential for neural and cardiac function), dietary fibre (for digestion), and Vitamins such as A and C essential for collagen formation and immune function (Wallace *et al*., 2020). Regular consumption of fruits and vegetables (FaV) has been associated with improved grip strength, improved health and mental outcomes amongst 22, 635 adults (Gehlich *et al*., 2020). Furthermore, regular FaV consumption reduces the risk of cardiac, metabolic and neurological diseases due to their additive antioxidant properties and bioactive compounds (del Río-Celestino and Font, 2020), demonstrating their importance for the management of non-communicable diseases (Budreviciute *et al*., 2020). Vegetables are rich in micronutrients and a low intake is responsible for the growing malnutrition in most Sub-Saharan countries (Marie *et al*., 2004).

In Africa, boasting human consumption of vegetables requires a technical-organizational approach (Wopereis, 2018) for the attainment of sustainable development goals (SDGs) i.e., Goals 1, 2, 3, 8, 11, 12, and 15 (i.e., No poverty, zero hunger, good health and well-being, decent work and economic growth, sustainable cities and communities, responsible consumption and production and life on land), respectively. Vegetables are not only a source of food but also contribute to household income for many in the informal sector of employment, i.e.,urban and peri-urban markets. Additionally, they are a source of revenue for emerging cities in Africa through the taxes generated from the suppliers and vegetable consumers (Diouf and Ba, 2014)).

Vegetable consumption as a meal or part of a meal is presumed to be a common practice among urban dwellers in developing countries in Africa (Godfrey *et al*., 2017). This vegetable-composed meal is seen as a cheap source of nutrients and should be readily available to anyone who chooses to partake its nutrients. The cost of consuming animal proteins daily is beyond reach for many households. This high cost of animal proteins is a pointer towards the need for a cheap source of nutrients.

Diet selection and food preparation in African households mainly lie with women. Therefore, the women in the households dictate the pattern of vegetable consumption in urban cities. This consumption pattern translates into disparity depending on the source of purchase, i.e., High end and low-end market (Auma *et al*., 2019). Vegetables in addition to nutritional value, add health and medicinal value, i.e., medication to prevent and control diseases (Moyo *et al*., 2021).

Unfortunately, vegetable consumption has also been associated with health burdens resulting from environmental contaminants where these vegetables are produced. This is crucial information for crippled health systems and costs of health (Gido *et al*., 2017; Kansiime *et al*., 2018). Therefore, Drivers of vegetable consumption in urban cities in Africa are complex and have been contextualized as, gender-based, culturally related and, socially centered (Kansiime *et al*., 2018; Modibedi *et al*., 2021). Unfortunetely, data available on the drivers of vegetable consumption amongst urban dwellers is limited, a gap that this study is ready to populate. Attempts towards organic farming as a driver towards vegetable production in areas where land sizes are small is partially seen as an intervention which will guarantee the supply of vegetables to most urban dwellers in cities (Ighoro, 2019; Modibedi *et al*., 2021).

Studies about vegetables consumed from home gardens indicate a greater frequency of vegetable consumption and also show a lessened health burden from environmental contaminants. Health risks associated with the consumption of contaminated vegetables with environmental pollutants are unknown amongst urban dwellers. The lack of food consumption advisories in Africa predisposes vegetable consumers to non-communicable health ailments (Poornima and Suryawanshi, 2020). The current study was undertaken to document the socio-demographic patterns, commonly consumed vegetables and practices associated with vegetable consumption amongst city dwellers in Kampala, Uganda. The health risks resulting from consumption of contaminated vegetables, i.e., pesticides, heavy metals, and plastics at points of sale, can be determined after getting the sociodemographic data, consumption data and practices (Zhang *et al*., 2019).

METHODS

Study design. The study was a cross-sectional survey involving vegetable consumers in Kampala Uganda (Figure1). Three open markets in three divisions (Kawempe, Nakawa and Kampala Central) were utilized for the study. These markets serve clients of different income levels. Based on the location of the market, the study established the common vegetables consumed, the drivers behind this consumption and the common practices to which these vegetables were exposed before being sold off.

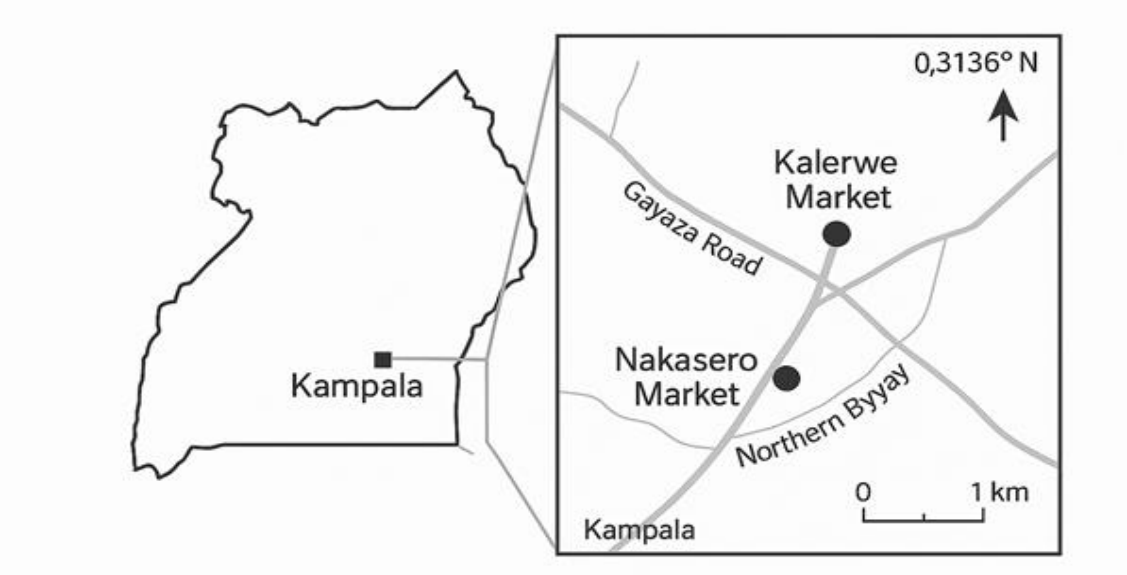

FIGURE. 1 Map of Uganda and Kampala showing Nakasero and Kalerwe Markets
Source (Mugo-Kamiri *et al*., 2024)

Study population. Vegetable consumers from three markets were included in the study. The market stalls are mainly run by women who are mainly single parents, widowed or divorced. Kalerwe is a low-budget market which serves many people in Kampala. Nakasero is a high-end market which is accessed by the middle class and the expatriates. Nakawa is mid-way between Nakasero and Kalerwe markets.

Sample size determination. The sampling unit for the survey was the vegetable consumer who purchases vegetables from one of the markets above. The sample size of vegetable consumers required was obtained from the three markets using G-Power (How to determine sample size from G*Power, n.d.).

1 Level of significance (alpha)=0.05
2 Beta of the test=test 20%
3 Power of the test =80%
4 Confidence interval =95%
5 Margin of error=5error %
6 Assumed population size of Kampala residents who consume vegetables at 1,659,600 ((*Statistical Abstract (2019) - Uganda Bureau of Statistics*, n.d.))

Therefore, a total of 404 participants were studied, above the 384 originally calculated.

Data collection and sampling. The structured questionnaire covered aspects on types of vegetables in the market, purchases made daily, amounts consumed daily, demographic data of the respondent, methods of preparation and sources of the vegetables. The structured questionnaire was administered to vegetable consumers from three markets in Kampala (Kalerwe, Nakasero and Nakawa).

Statistical analysis. Data were entered in Excel Sheets 2016 and checked for normality. This was then exported to SPSS version 20 and descriptive statistics involving summaries, associations and Odds ratios were established for various factors.

RESULTS

Socio-demographic characteristics of study participants. The socio-demographic factors that differed significantly between the markets were sex, age, religion, nationality, education, monthly income, and occupation, based on the chi-square test with a p-value < 0.05, as shown in Table 1. Additionally, the mean age of consumers across the different markets was also significantly different, based on the ANOVA test with a p-value < 0.05, as illustrated in Table 1.

Table 1. Association between socio-demographic characteristics and markets

		Market			
Variable	Overall (N=404)	Kalerwe (n=141)	Nakasero (n=122)	Nakawa (n=141)	P-value[ł]
Sex n (%)					
Female	264(65.3)	104(39.4)	44(16.7)	116(43.9)	<0.001
Male	140(34.7)	37(26.4)	78(55.7)	25(17.9)	
Mean age in years (sd)	34.6(9.4)	33.0(10.3)	36.6(8.2)	34.4(9.4)	0.01[¥]
Religion n (%)					
Anglican	64(15.8)	20(31.2)	22(34.4)	22(34.4)	<0.001
Born again	93(23.0)	37(39.8)	17(18.3)	39(41.9)	
Catholic	138(34.2)	49(35.5)	33(23.9)	56(40.6)	
Hindu	26(6.4)	0(0.0)	26(100.0)	0(0.0)	
Jehovah's witness	4(1.0)	1(25.0)	1(25.0)	2(50.0)	

		Market			
Variable	Overall (N=404)	Kalerwe (n=141)	Nakasero (n=122)	Nakawa (n=141)	P-value[ł]
Muslim	56(13.9)	29(51.8)	15(26.8)	12(21.4)	
Pentecostal	7(1.7)	2(28.6)	1(14.3)	4(57.1)	
other	16(4.0)	3(18.8)	7(43.8)	6(37.5)	
Nationality n (%)					
Congolese	2(0.5)	0(0.0)	0(0.0)	2(100.0)	<0.001
Indian	28(6.9)	0(0.0)	28(10.00)	0(0.0)	
Kenyan	7(1.7)	0(0.0)	6(85.7)	1(14.3)	
South Sudanese	2(0.5)	0(0.0)	1(50.0)	1(50.0)	
Ugandan	360(89.1)	141(39.2)	83(23.1)	136(37.8)	
Other	5(1.2)	0(0.0)	4(80.0)	1(20.0)	
Education level n (%)					
No formal education	27(6.7)	10(37.0)	6(22.2)	11(40.7)	<0.001
Primary	81(20.0)	40(49.4)	8(9.9)	33(40.7)	
Secondary	142(35.1)	57(40.1)	24(16.9)	61(43.0)	
Tertiary	45(11.1)	9(20.0)	19(42.2)	17(37.8)	
university	106(26.2)	23(21.7)	65(61.3)	18(17.0)	
Other	3(0.7)	2(66.7)	0(0.0)	1(33.3)	
Monthly income in Uganda shillings n (%)					
<100,000	65(16.1)	37(56.9)	5(7.7)	23(35.4)	<0.001
100,000-200,000	57(14.1)	21(36.8)	6(10.5)	30(51.9)	
>200,000-300,000	54(13.4)	21(38.9)	5(9.3)	28(51.9)	
>300,000-400,000	80(19.8)	25(31.2)	20(25.0)	35(43.8)	
>400,000	148(36.6)	37(25.0)	86(58.1)	25(16.9)	
Which Job you do n (%)					
Business	175(43.3)	55(31.4)	65(37.1)	55(31.4)	<0.001
Petty trade	79(19.6)	28(35.4)	9(11.4)	42(53.2)	
Salaried	115(28.5)	32(27.8)	47(40.9)	36(31.3)	
Unemployed	21(5.2)	18(85.7)	0(0.0)	3(14.3)	
other	14(3.5)	8(57.1)	1(7.1)	5(35.7)	

ł Chi-square P-value; ¥F-test

Consumption attributes of vegetables sold in three markets. The consumption attributes that were significantly different between the three markets were the frequency of purchase from the market and types of vegetables consumed (leafy and non-leafy vegetables), based on the chi-

square p values < 0.05. The median expenditure on vegetables was significantly different based on the Kruskal-Wallis p value <0.05. The common leafy vegetables consumed were Nakati (81.2%), Doddo (47.5%) and Cabbages (63.9%). The common non-leafy vegetables consumed included the Eggplants (81.2%), garden eggs (76%) and cucumber (45.5%) (Table 2)

Handling practices of vegetables purchased from selected markets in Kampala. The common materials used for transporting vegetables were shopping baskets and in the hands of the consumers. Consumers had different means of transport when returning home after the purchase of the vegetables, some used refrigeration for preservation, some preferred eating raw vegetables and others cleaned vegetables using raw water. The methods of preparation, cooking and storage were different for the consumers in the three markets based on the chi-square p values <0.05. A household where all household members consumed vegetables was also significantly different for the three markets at a p-value <0.05, as shown in Table 3 below

Table 2. Attributes of vegetables sold in selected markets in Kampala

Variable	Overall (N=404)	Market Kalerwe (n=141)	Nakasero (n=122)	Nakawa (n=141)	P-value[ł]
How often do you purchase vegetables in this market n (%)					
Daily	198(49.0)	79(39.9)	52(26.3)	67(33.8)	<0.001
Biweekly	44(10.9)	12(27.3)	10(22.7)	22(50.0)	
Weekly	160(39.6)	49(30.6)	60(37.5)	51(31.9)	
Others	2(0.5)	1(50.0)	0(0.0)	1(50.0)	
Median expenditure on vegetables in Uganda shillings (IQR)	4,500(2,000-10,000)	2,000(1,000-3,000)	15,000(5,000-50,000)	4,000(2,000-10,000)	<0.001[§]
Which leafy vegetable do you consume most n (%)					
nakati	328(81.2)	126(38.4)	80(24.4)	122(37.2)	<0.001
Doddo	192(47.5)	57(29.7)	48(25.0)	87(45.3)	<0.001
bugga	180(44.5)	65(36.1)	45(25.0)	70(38.9)	0.104
okra	124(30.7)	19(15.3)	60(48.4)	45(36.3)	<0.001
jobyo	97(24.0)	35(36.1)	17(17.5)	45(46.4)	0.03
Gobe	96(23.8)	30(31.3)	13(13.5)	53(55.2)	<0.001
Spinach	130(32.2)	23(17.7)	67(51.5)	40(30.8)	<0.001
Sukamawiki	180(44.5)	47(26.1)	53(29.4)	80(40.4)	<0.001
Broccoli	76(18.8)	6(7.9)	49(64.5)	21(27.6)	<0.001

Variable	Overall (N=404)	Market Kalerwe (n=141)	Nakasero (n=122)	Nakawa (n=141)	P-value[l]
cabbages	258(63.9)	80(31.0)	83(32.2)	95(36.8)	<0.001
parsley	66(16.3)	4(6.1)	47(71.2)	15(22.7)	<0.001
Green amaranth	26(6.4)	10(38.5)	14(53.9)	2(7.7)	0.004
kale	14(3.5)	0(0.0)	12(85.7)	2(14.3)	<0.001
Lettuce	52(12.9)	2(3.9)	35(67.3)	15(28.9)	<0.001
Purple cabbage	62(15.3)	6(9.7)	36(58.1)	20(28.9)	<0.001
Chinese cabbage	31(7.7)	1(3.2)	15(48.4)	15(48.4)	0.001
Other species	61(15.1)	8(13.1)	26(42.6)	27(44.3)	<0.001
Which non-leafy vegetable do you consume most n (%)					
Big egg plant(biringanya)	335(82.9)	113(33.7)	96(28.7)	126(37.6)	0.04
Garden egg	307(76.0)	108(35.2)	80(26.1)	119(38.8)	0.002
Sigwa	24(5.9)	1(4.2)	14(58.3)	9(37.5)	0.001
Small brinjal	26(6.4)	4(15.4)	20(76.9)	2(7.7)	<0.001
Bitter gourd	30(7.4)	5(16.7)	22(73.3)	3(10.0)	<0.001
Bottle gourd	20(4.9)	1(5.0)	18(90.0)	1(5.0)	<0.001
cucumber	184(45.5)	48(26.1)	78(42.4)	58(31.5)	<0.001
others	86(21.3)	25(29.1)	26(30.2)	35(40.7)	0.35

Kruskal wallis

Table 3. Handling Practices of Vegetables from Markets in Kampala

Variable	Overall (N=404)	Market Kalerwe (n=141)	Nakasero (n=122)	Nakawa (n=141)	P-value[l]
Container used for shopping n (%)					
polythene	372(92.1)	126(33.9)	116(31.2)	130(34.9)	0.23
Shopping basket	48(18.8)	9(18.8)	12(25.0)	27(56.2)	0.003
Sisal shopping bags	52(12.9)	17(32.7)	13(25.0)	22(42.3)	0.46
Wooden crate	2(0.5)	0(0.0)	0(0.0)	2(100.0)	0.15
hand	67(16.6)	24(35.8)	13(19.4)	30(44.8)	0.07
Personal home-made bag	11(2.7)	4(36.4)	4(36.4)	3(27.3)	0.84
Means of transport n (%)					

Variable	Overall (N=404)	Market			P-value[1]
		Kalerwe (n=141)	Nakasero (n=122)	Nakawa (n=141)	
Boda	**211(52.2)**	65(30.8)	55(26.1)	91(43.1)	<0.001
Private vehicle	70(17.3)	14(20.0)	49(70.0)	7(10.0)	
Public vehicle	53(13.1)	19(35.9)	14(26.4)	20(37.7)	
Others	70(17.3)	43(61.4)	4(5.7)	23(32.9)	
Do you refrigerate your vegetables?					
No	242(59.9)	100(41.3)	32(13.2)	110(45.4)	<0.001
Yes	162(40.1)	41(25.3)	90(55.6)	31(19.1)	
Which surface do you chop your vegetables n (%)					
Others	20(4.9)	16(80.0)	1(5.0)	3(15.0)	<0.001
Plastic board	75(18.6)	29(38.7)	19(25.3)	27(36.0)	
Saucepan	167(41.3)	68(40.7)	27(16.2)	72(43.1)	
Wooden chopping board	142(35.2)	28(19.7)	75(52.8)	39(27.5)	
What form do you consume vegetables? n (%)					
Cooked	334(82.7)	92(27.5)	113(33.8)	129(38.6)	<0.001
Raw salad	143(35.4)	31(21.7)	67(46.9)	45(31.5)	<0.001
Source of fuel n (%)					
Charcoal	367(90.8)	136(37.1)	94(25.6)	137(37.3)	<0.001
Gas	124(30.7)	29(23.4)	76(61.3)	19(15.3)	<0.001
Electricity	51(12.6)	11(21.6)	31(60.8)	9(17.6)	<0.001
Kerosene	12(3.0)	2(16.7)	3(25.0)	7(58.3)	0.20
Have vegetable garden close to your homestead n (%)					
No	322(79.7)	102(31.7)	96(29.8)	124(38.5)	0.005
yes	82(20.3)	39(47.6)	26(31.7)	17(20.7)	
Do you have special place for storage/preserving vegetables at home n (%)					
No	319(79.0)	97(30.4)	102(32.0)	120(37.6)	0.001
Yes	85(21.0)	44(51.8)	20(23.5)	21(24.7)	
Type of water used to wash vegetables n(%)					

		Market			
Variable	Overall (N=404)	Kalerwe (n=141)	Nakasero (n=122)	Nakawa (n=141)	P-value[1]
Running tap water	143(35.4)	42(29.4)	43(30.1)	58(40.6)	0.14
Rain water	96(23.8)	27(28.1)	18(18.8)	51(53.1)	<0.001
What kind of persons do consume vegetables at home n (%)					
adults	140(36.7)	58(41.4)	41(29.3)	41(29.3)	0.10
Infants	72(17.8)	31(43.1)	18(25.0)	23(31.9)	0.26
Elderly	15(3.7)	2(13.3)	7(46.7)	6(40.0)	0.17
Sick	18(4.5)	5(27.8)	8(44.4)	5(27.8)	0.40
All persons	253(62.6)	76(30.0)	79(31.2)	98(38.7)	0.02

DISCUSSION

Consumers at Nakasero market had significantly lower vegetable purchases compared to Kalerwe (42.6%), and Nakawa (47.9%). The differences observed in the market purchases could be attributed to the populations that access these markets (Kubwimana, 2020). Other studies looked at rural and urban areas and these are at different levels of development as per sub-Saharan African countries (Marie *et al*., 2004). For improved public health, WHO recommends increased consumption of FaV since these play a crucial role in the management of both infectious and neglected diseases (Budreviciute *et al*., 2020; Gehlich *et al*., 2020; Kalmpourtzidou *et al*., 2020; Wallace *et al*., 2020). The most commonly consumed leafy vegetables were Nakati, Doddo and Cabbages, and this was in agreement with a previous epidemiological survey in southwestern Uganda, which implies that leafy vegetables continue to be among the major vegetables preferred by a majority of Ugandans (Kasozi *et al*., 2021). These vegetables are generally grown by people of low socio-economic status (Dijkxhoorn *et al*., 2019), demonstrating their important role in helping vulnerable communities attain SDGs (goals 1,2,3,8, 11, 12, and 15) essential for national development. (Diouf and Ba, 2014). We also identified a preference for much cheaper vegetables (egg plants, garden egg, and cucumber) due to their affordability on the market. This demonstrated a need to prioritize production of native vegetables as compared to exotic vegetables which might prove to be expensive for a majority of the local population. For example, a rapid participatory appraisal showed that urban farmers can produce vegetables demanded within the Kampala metropolitan area (Nyapendi *et al*., 2003).

Amongst the consumers who reported a high intake of vegetables, we also observed differential consumption rates within individual households (not everyone in the home takes the vegetables). There are no known medical/ allergic reactions associated with vegetable consumption; thus, findings in the study demonstrate a need for education of the masses to change the paradigm. This mass education is important since some individuals think vegetables are to be eaten by the poor and not the rich (field observation). Similar misconceptions have been reported in South Africa, where consumption of soft drinks and chicken were considered superior diets compared to vegetables (Kroll, 2016). Clearing the misconceptions is important for Uganda as a developing country to ensure people still have an interest in vegetable

diets, i.e., for healthy benefits. As comparison chicken and vegetables will cost (USD 7 and USD 2, respectively for the same weight. Therefore, it is evident that vegetables are easier to access and a better food choice which remains to be promoted massively in Kampala for increased human consumption and health benefits in agreement with recommendations from the Food and Agriculture Organisation (Guiro *et al.*, 2010)

CONCLUSION

Residents in the Kampala metropolitan area showed an increased interest in consuming vegetables that were affordable, accessible, and in high demand. The consumption rates reported by most participants in our survey indicated that Nakati had the highest daily intake, followed by Cabbages and Dodo, while among the non-leafy vegetables, large eggplants were significantly preferred by the local population. The predictors were sociodemographic and handling practices. These were exhibited at the individual, family, and societal levels.

The findings in our study demonstrate the importance of vegetables in emerging cities as part of the diet, and the levels of consumption should be increased to reach the levels recommended by the WHO.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest in this paper

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