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Impact of COVID-19 on Diets of Poor Consumers in Africa: Evidence from the Slums of Nairobi, Kenya

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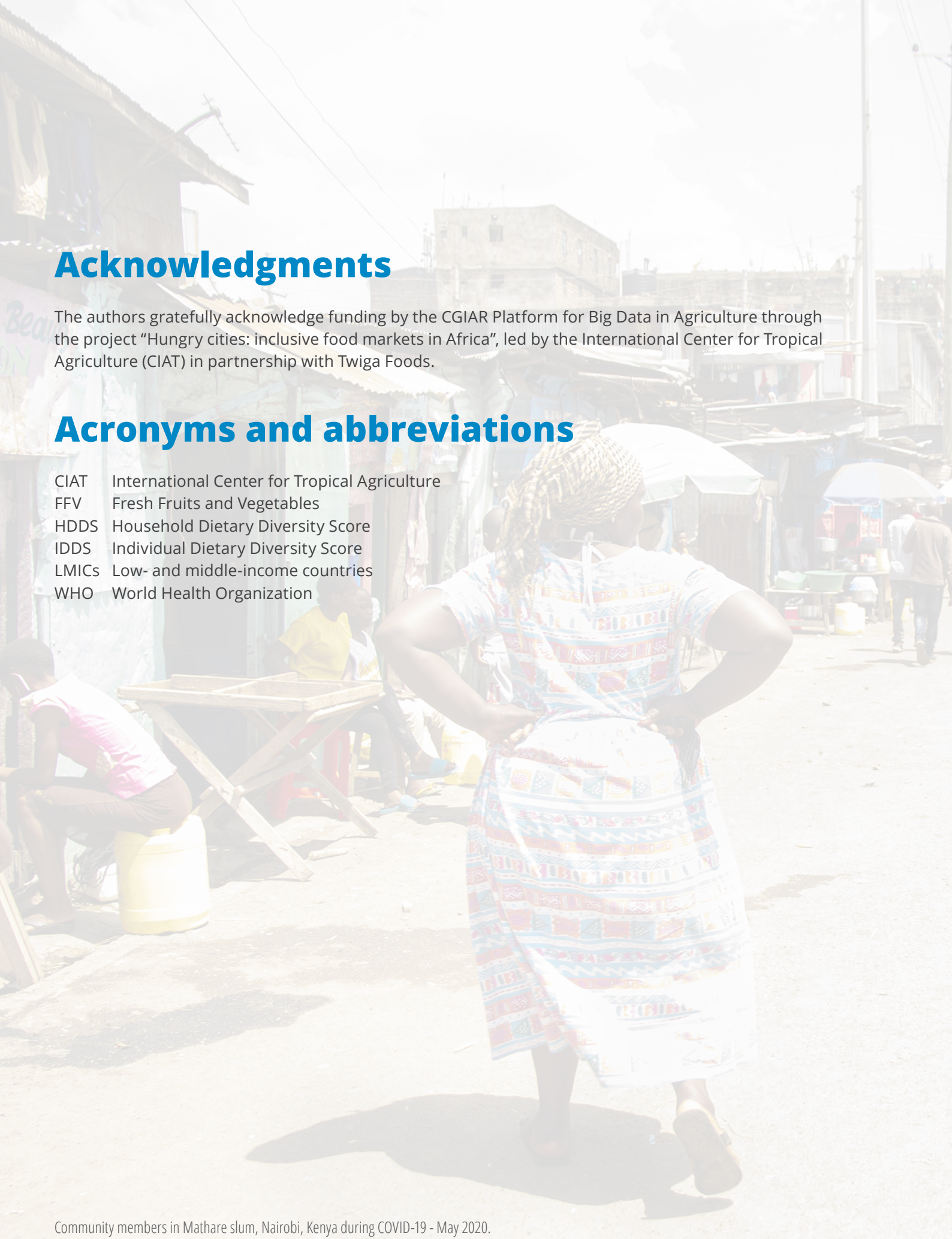
Acronyms and abbreviations

CIAT	International Center for Tropical Agriculture
FFV	Fresh Fruits and Vegetables
HDDS	Household Dietary Diversity Score
IDDS	Individual Dietary Diversity Score
LMICs	Low- and middle-income countries
WHO	World Health Organization



Community members in Mathare slum, Nairobi, Kenya during COVID-19 - May 2020.
Photo: @UN-Habitat/Kirsten Milhahn.

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Abstract

The COVID-19 pandemic has disrupted food systems worldwide, and this is likely to have negative implications for food and nutrition security. The vulnerable poor, especially those in the urban areas, are likely to feel a bigger impact. More than half of Africa's urban population lives in slums. Little is known about the impact of the current pandemic on their consumption behavior and diets. This study analyzes effects of the COVID-19 pandemic on consumption of nutritious foods (including fresh fruits and vegetables and animal source foods) and diets of poor slum-dwellers and middle-income non-slum dwellers in Nairobi, Kenya, using primary data collected from 2,465 households between April and May 2020. Food (in)security assessment and consumption behavior questions are asked to capture before and during pandemic using recall. In addition, household dietary diversity scores are calculated based on 7-day food consumption recalls. Both descriptive and econometric regression analyses are conducted. Households in the slums are affected more than the non-slum middle-income households. More than 40% of slum households do not have jobs, their average monthly household income is very low, at USD78. About 90% of households in the slums reported dire food insecurity situations. They were not able to eat the kind of foods they preferred, they ate a limited variety of foods, a smaller meal than they felt they needed and fewer number of meals in a day. Slum households have a lower dietary diversity score (4 out of 9) compared to the non-slum (5 out of 9). In addition, slum dwellers show larger negative effects on consumption of nutritious foods especially fresh fruit and vegetables and animal source foods. Several factors associated with quality food consumption during the pandemic period are highlighted. Mitigation measures should pay close attention to slums as they are deeply impacted by the pandemic. In addition, policy design and implementation should be inclusive of the vulnerable poor consumers in the slums.

Keywords:
COVID-19; Urban poor consumers; Consumption; Nutrition; Africa; Kenya.

Photo: @UN-Habitat/Isaac Muasa

Introduction

COVID-19 is a highly infectious disease, in severe cases fatal, caused by the novel coronavirus (Chen *et al.*, 2020). The disease, first identified in December 2019 in Wuhan, Hubei Province in China, affected patients who had an unidentified form of viral pneumonia (Chen *et al.*, 2020; Peeri *et al.*, 2020; Zhu *et al.*, 2020). The majority of initial cases were linked to a seafood and wet animal wholesale market, Huanan (Zhu *et al.*, 2020). The disease quickly spread to other provinces in China and around the world. In March 2020, the World Health Organization (WHO) declared it a global pandemic (WHO, 2020). As of 14 June 2020, over 7.8 million cases had been reported globally with at least 431,000 deaths and about 3.7 million recoveries (JHU, 2020). As the number of infections and fatalities continue to grow exponentially, global efforts are being made to develop a vaccine for this disease.

In Kenya, the first case of COVID-19 was confirmed on 13 March 2020 (MoH, 2020a). Background information indicated that the patient had travelled from the United States of America through London and arrived in Kenya on 5 March 2020. Given the contagious nature of the disease, confirmation of the first case implied that all persons who had been in contact with the patient had to be traced and isolated to prevent further infections. Continuous mass testing, quarantine of suspected cases and isolation of infected individuals have been ongoing since then. By 14 June 2020, a total of 3,594 cases had been confirmed positive for COVID-19, with 103 fatalities (a case fatality rate of 2.9%) and 1,253 recoveries (MoH, 2020b). Like in many other countries, the Kenyan government has adopted various measures to minimize the spread of the disease. These include social distancing, nationwide dusk-to-dawn curfew, border closures, closure of traditional markets, learning institutions and places of worship, and mandatory quarantine for travelers from foreign countries, among others. In addition, the government identified 'hotspots' – places with higher number of infections reported – and imposed restriction of movement into or outside those regions. The capital city Nairobi, Mombasa, Kilifi and Kwale were identified as hotspots. Similar measures have been implemented in many low- and middle-income countries (LMICs) depending on rate of infection and government response.

While these measures are critical in containing the disease, they pose a significant threat to food and nutrition security, especially in LMICs. The *State of Food Security and Nutrition in the World* 2019 report showed that an estimated 821 million people were undernourished between 2016 and 2018, with majority living in low-income countries (FAO *et al.*, 2019). These numbers are expected to rise significantly as a result of the COVID-19 pandemic, with the vulnerable – notably urban poor and other vulnerable groups likely to face the worst consequences (HLPE, 2020). The urban poor often rely on low-wage casual employment and depend (almost entirely) on market purchases for food (Bundervoet and Finn, 2020; Hirvonen *et al.*, 2020; Wanyama *et al.*, 2019a). Yet, measures to minimize exposure to the disease, like social distancing and stay-at-home orders, are likely to affect the informal sector employment to a significant extent, thus affecting income flows.

Closures and restrictions on informal/traditional markets, because of high perceived risk of infection, are also worrying as such markets remain principal sources of food for majority of the urban poor (GAIN, 2020; IPES, 2020; Wanyama *et al.*, 2019b; Wertheim-Heck *et al.*, 2019; Wertheim-Heck, 2020).

> *For urban poor consumers, sudden disruption of income flow means that such households cannot meet their basic needs, let alone access adequate and nutritious foods.*

In order to cope with this shock, households may change their consumption behavior, for instance, by going for cheaper but nutritionally poor diets to cater for immediate hunger needs. It is also possible that these households consume less diversified diets, thus curtailing ongoing initiatives to promote consumption of adequate nutritious foods. According to Headey and Ruel (2020), the COVID-19 crisis will affect diets primarily through declining demand of high-value nutritious foods, such as fruits and vegetables, and animal source foods while increasing demand for nutrient-poor diets. This could be exacerbated by the likelihood of increased food prices, triggered by increased transaction costs due to restrictions on food

supply chain logistics, and speculative hoarding (Reardon *et al.*, 2020).

Existing evidence shows that, while food remains generally available in most LMICs, access is becoming limited due to restrictions (GAIN, 2020). The effect is especially notable in cities, and for lower-income populations and migrant workers due to affordability and access barriers (GAIN, 2020). In Ethiopia and India, preliminary findings show a declining trend in consumption of high-value nutritionally richer foods such as fruits, vegetables and animal products (Harvard, 2020; Hirvonen *et al.*, 2020; Tamru *et al.*, 2020). Loss of income, which has a direct consequence to consumption patterns, has also been reported in some countries. Results from a nationwide telephone survey conducted in Kenya showed that about 30% of the respondents were absent from work because of temporary layoff or temporary slack for technical or economic reasons (KNBS, 2020). In Ethiopia, income loss was more likely to be reported by less-wealthy households than wealthier households (Hirvonen *et al.*, 2020).

While these findings provide important insights for intervention, there is still limited evidence of how COVID-19 is influencing consumption, purchasing patterns and overall food security and nutrition of vulnerable households, especially those in urban slums. In this paper, we provide early evidence using primary data collected from 2,465 slum and non-slum dwellers in Nairobi, Kenya, in April/May 2020. We used these data to analyze consumption and purchasing behavior for nutritious foods, especially fresh fruits and vegetables, and to assess the overall effect on food security and nutrition. The findings are critical to identify potential entry points for food and nutrition interventions for vulnerable households as well as for policy makers in designing policies that are inclusive of poor urban consumers.

Food and nutrition security for poor urban consumers in Africa

Malnutrition and food insecurity continue to be major public health challenges in Africa. Undernourishment, micronutrient malnutrition, obesity and overweight are rapidly increasing, especially in the urban areas due to high dependence on markets for food needs as well as increases in food prices (Ruel *et al.*, 2010). Kenya is not exceptional to these trends. Even though the malnutrition situation in Kenya has shown a positive change in the last decade, the rate of undernourished population remains high. Nationally, 26% of the under 5-year olds are stunted, 11% underweight and 4% wasted (KDHS, 2014). Further, 27% of women of reproductive age (15–49 years) are anemic. In urban informal settlements, prevalence of stunting among children below 5 years and women can even be higher than the national situation, and has been reported to exceed 40% (Kimani, 2014; Kimani *et al.*, 2015; Olack *et al.*, 2011).

> *A recent study in the informal settlements of Nairobi indicated that 87% of the study households are food insecure, among which, 46% are severely food insecure (Wanyama et al, 2019a).*

In terms of diets for specific vulnerable consumers, studies show that **more than 20% of children in the slums of Nairobi and Kampala do not meet the daily minimum required diets for balanced diets and micronutrient adequacy, and 40–50% of women in reproductive age do not meet the recommended minimum dietary quality** (Wanyama *et al.*, 2019a). This highlights potential development challenges for the growing children and women who may be pregnant or lactating. Consumption of nutritious foods such as fresh fruits and vegetables would contribute in providing the required micronutrients such as vitamin A, iron and zinc in the diets of poor consumers.

Materials and methods

Sample selection and data collection

This study uses primary data collected between 26 April and 13 May 2020 from resource-poor consumers in urban informal settlements and

middle-income consumers from urban Nairobi, Kenya. Nairobi is one of the most urbanized cities in East Africa, yet slum dwellers represent more than 50% of the urban population (Syagga *et al*., 2001; World Bank, 2017). A multi-stage sampling strategy was used to select respondents for this study. First, two slums, Kibera and Mathare were selected since they have the highest poverty levels in Nairobi, based on the national statistics (KNBS, 2015). Further, six middle-income sites within Nairobi were randomly selected: Nairobi West, Embakasi, Kaloleni, Waiyaki Way, Langata and Dagoretti Corner. Households to be interviewed in both slum and non-slum locations were selected using a systematic random sampling procedure.

> *In total, 2,465 households were interviewed, 1,298 in slums and 1,167 in non-slum sites.*

The target respondent at the household level was the main decision maker on household food consumption, who in most cases but not always, was the main female in the household.

The study tool captured household demographics and questions on food security, consumption behavior of diverse foods including fresh fruits and vegetables and the impact of the COVID-19 pandemic on their consumption behavior.

Dietary Diversity Score

Food consumption data was collected using a 7-day recall period, and it was used to generate dietary diversity scores, a simple count of the number of food groups consumed by a household or an individual within a specified recall period (Kennedy *et al.,* 2010). The Household Dietary Diversity Score (HDDS) indicates the economic ability of a household to access a variety of foods (FAO, 2011), while the Individual Dietary Diversity Score (IDDS) indicates the quality of the individual diets. Previous analyses have shown that HDDS and IDDS are significantly correlated (Koppmair *et al.*, 2017; Wanyama *et al.*, 2019a). Since households, especially the resource poor, typically first try to satisfy their food energy needs before diversifying their diets, HDDS is also used as a food security proxy (Headey and Ecker, 2013; Elliot, 2014).

HDDS was originally developed by the FANTA II Project (Swindale and Bilinsky, 2006) as a measure of household food access and has been widely used since then (Chege *et al.,* 2015: Fongar *et al.,* 2019; Headey and Ecker, 2013). HDDS can be generated using 9, 12 or 16 food groups (FAO, 2011). The more categorized indicators are, the more difficult to operate due to high requirements for data collection process (Arimond *et al*., 2010). Studies have calculated HDDS using 9 food groups, excluding three groups: oils and fats; sweets; spices, condiments and beverages, which have very little micronutrient density, and the results have been robust (Sibhatu *et al*., 2015). In our case, we use HDDS classification based on the 9 food groups consisting of cereals; white roots and tubers; vegetables; fruits; meat; eggs; fish and other seafood; legumes, nuts and seeds; milk and other milk products. A higher HDDS indicates more dietary diversity, but there is no consensus in terms of a minimum HDDS threshold to classify food secure households (Kennedy *et al*., 2010).

Statistical analyses

The data was analyzed using descriptive and econometric models. Descriptive analyses were conducted to present the diet characteristics of the sampled households and their consumption behavior. Mean values, percentages, and t-tests were computed to describe the level of consumption of different food groups and the effect of COVID-19 on diversity, frequency and quantity of foods consumed, and consumption of preferred foods. Further analyses were conducted to assess the effect of COVID-19 on consumption of nutritious foods, especially fresh fruits and vegetables, and the reasons for changes if any.

To show the influence of various factors on household diets, we estimated a simple regression model of the following form:

$$HDDS=\alpha+\beta X+\varepsilon$$

where ***HDDS*** is the household dietary diversity indicator based on nine food groups, α and β are parameters to be estimated while ε is the random error term. X is a vector of control variables including gender, education and occupation of the household head, household size, consumption of fresh fruits and vegetables, and location of the household i.e. slum or non-slum. Analyses

were conducted to understand socio-economic, demographic, and food and nutrition situation in slums and non-slum based households.

Results

Descriptive results

Table 1 presents the general demographic and social economic characteristics for the full sample, but also differentiated by slum and non-slum locations. Overall, 62% of the study households are male headed. The household heads have an average of 12.7 years of formal education, and those in slums have a significantly lower level of education (10.7 years) compared to those in non-slum locations (14.9 years). Overall, most of the household heads at the time of the survey were working as casual laborers, or under self or salaried employment. However, a significantly higher number of household heads in the slums (16%) was not working at the time of the interview compared to only 5.6% from the non-slum areas. The highest proportion of household heads in the non-slum locations were either in salaried (34%) or self-employment (34%) jobs, while in the slums a significantly higher percent was working as casual laborers (47.9%).

Households in the slum areas are larger than those in the non-slum locations. The households' average monthly income in the slums is significantly lower (USD 78) than in the non-slum households (USD 382). The mean household dietary diversity for the slum households is also significantly lower (4 groups out of 9) compared to the non-slum households (5 groups out of 9). Overall, the slum households constituted 52% of the sample size and the non-slum households 48%.

Table 1: Demographic characteristics of the study sample in slum and non-slum locations

VARIABLES	OVERALL (n=2,465)	SLUM (n=1,298)	NON SLUM (n=1,167)
Male household head (Dummy)	62.23 (48.49)	61.48 (48.68)	63.07 (48.28)
Household head education (years)	12.77 (8.07)	10.79 (9.38)	14.97 (5.52)***
Occupation of the head			
None	11.52 (31.93)	16.8 (37.40)***	5.66 (23.11)
Salaried employment	23.29 (42.27)	13.41 (34.08)	34.28 (47.48)***
Casual laborer	37.24 (48.36)	47.92 (49.98)***	25.36 (43.53)
Self-employment	27.95 (44.89)	21.88 (41.36)	34.7 (47.62)***
Household size	3.8 (2.00)	4.3 (1.93)***	3.3 (1.94)
Average Monthly income (USD)	222.42 (2267.1)	78.75 (145.4)	382.21 (3284.7)***
Mean HDDS (During COVID-19)	5.31 (1.72)	4.88 (1.76)	5.78 (1.56)***
Study sites			
Kibera	32.29 (46.77)	61.33 (48.72)	0 (0.00)
Mathare	20.37 (40.28)	38.67 (48.72)	0 (0.00)
Nairobi West	0.08 (2.85)	0 (0.00)	0.17 (4.14)
Embakasi	11.32 (31.69)	0 (0.00)	23.91 (42.67)
Kaloleni	12.58 (33.16)	0 (0.00)	26.56 (44.19)
Wayiaki Way	11.24 (31.59)	0 (0.00)	23.74 (42.57)
Langata	2.15 (14.51)	0 (0.00)	4.54 (20.83)
Dagoretti Corner	9.98 (29.98)	0 (0.00)	21.08 (40.81)

Notes: Means are presented with standard deviation in parentheses; The USD - KES exchange rate used was the rate at the time of the survey of KES 107.11=USD 1; HDDS, Household dietary diversity score; Mean differences between slum and non-slum locations were tested for statistical significance; * P < 0.1, ** P < 0.5, *** P < 0.01.

To understand how the food security situation of households has been affected by the current pandemic, we asked several questions related to their perception about their food (in)security over a four-week recall period using a range of questions adopted from the Household Food Insecurity Access Scale (HFIAS) (Coates *et al.*, 2007).

Table 2 presents the results. Overall, more than 65% of all respondents are negative affected in terms of their food security situation as shown in the four perception questions asked. In addition, households living in the slums are significantly more affected compared to those in non-slum locations.

> *In total, 90% of the study households in the slums were not able to eat the kind of foods they preferred over the past four weeks, compared to 56% for the non-slum households. In addition, 92% of the slum households had to eat a limited variety of foods due to lack of resources occasioned by the COVID-19 pandemic, compared to just 53% for households in the non-slum locations. Further, 89% of slum and 42% of non-slum households had to eat smaller quantities of meals than they felt they needed because there was not enough food.*

At times, households also had to eat fewer meals in a day because they did not have enough food, which was the case for 88% of slum dwellers and 46% of non-slum households.

Table 2: Percentage of households facing various food insecurity challenges by location

VARIABLES	OVERALL	SLUM	NON-SLUM
In the past four weeks, household members were **not able to eat the kinds of foods they preferred** because of the Corona virus pandemic	74.28 (43.72)	90.60*** (29.19)	56.13 (46.64)
In the past four weeks, household members had **to eat a limited variety of foods** due to a lack of resources occasioned by the Corona virus pandemic	74.00 (43.88)	92.37*** (26.55)	53.56 (49.89)
In the past four weeks, household members had **to eat a smaller meal than they felt they needed** because there was not enough food due to the Corona virus pandemic	67.42 (46.88)	89.83*** (30.24)	42.5 (49.46)
In the past four weeks, household members had **to eat fewer meals in a day** because there was not enough food occasioned by the Corona virus pandemic	68.72 (43.37)	88.98*** (31.32)	46.19 (49.86)
NUMBER OF OBSERVATIONS	2,465	1,298	1,167

Notes: Means are presented with standard deviation in parentheses; Mean differences between slum and non-slum locations were tested for statistical significance; * P < 0.1, ** P < 0.5, *** P < 0.01.

Consumption behavior of slum and non-slum households also differ in terms of types of foods consumed, as shown in Table 3. Almost all the study households in both slum and non-slum locations consume cereals (98%) as well as fresh vegetables (99%). A significantly higher percent of non-slum households (89%) consume fresh fruits compared to the slum households (52%). Looking at the animal source foods that usually have higher quality nutrients compared to plant source foods, **a significantly higher percent of non-slum households (46%) consume meat compared to the slum households (23%). In addition, consumption of eggs and milk and dairy products is significantly higher in the non-slum households (57% and 82%) compared to the slum households (37% and 51%), respectively.** Fish consumption is higher in the slum households (57%) than in non-slum (43%), and the most consumed fish was identified as silver fish locally known as *Omena*. Omena is relatively cheap fish highly consumed in low-income settings.

Table 3: Consumption of various food groups in the past seven days

FOOD GROUPS	OVERALL	SLUM	NON-SLUM
Cereals (grains and flour)	97.69 (14.90)	97.61 (15.27)	97.77 (14.49)
Roots and tubers	32.01 (46.66)	32.67 (46.92)	31.28 (46.38)
Nuts and pulses	33.06 (47.05)	35.21 (47.78)*	30.68 (46.14)
Fresh vegetables	99.43 (7.24)	99.69 (5.54)	99.14 (8.75)
Fresh fruits	69.61 (45.98)	52.16 (49.97)	89.03 (31.16)***
Meats	34.44 (47.54)	23.88 (42.65)	46.19 (49.88)***
Eggs	46.73 (49.90)	37.44 (48.42)	57.07 (49.52)***
Milk and dairy products	66.33 (47.27)	51.39 (50.00)	82.95 (37.63)***
Fish (including *omena*)	50.99 (50.00)	57.86 (49.40)***	43.36 (49.59)
SAMPLE SIZE	2,465	1,298	1,167

Notes: Means are presented with standard deviation in parentheses; Mean differences between slum and non-slum locations were tested for statistical significance; * P < 0.1, ** P < 0.5, *** P < 0.01.

To further understand consumption of fresh fruits and vegetables in the study areas, we asked households how their consumption behavior had changed over the past four weeks prior to the study. The results are presented in Table 4. Almost all of the slum dwellers (92%) reported having reduced consumption of fruits and vegetables, compared to 55% of the non-slum households. Additionally, while almost half of the non-slum households (43%) did not change their frequency and quantity of fruits and vegetable consumption, it is only 7% in the slum areas who reported this.

The 74% of total respondents who reported reduced consumption of FFV were queried about the reduction.

> *The largest percentage of the non-slum households (89%) indicated that FFV had become more expensive while the main reason for the slum households was reduced incomes (95%).*

Only a few non-slum households indicated non-availability and low supply of FFV as a reason for reduced consumption.

Photo: Twiga Foods

Table 4: Percentage of households' consumption of fresh fruits and vegetables, by location

VARIABLES	CATEGORY	OVERALL	SLUM	NON-SLUM
Over the past four weeks, how has your frequency/quantity of fresh fruits and vegetables (FFV) consumption changed?	No change	24.87 (43.23)	7.70 (26.68)	43.96*** (49.65)
	Increased	0.49 (6.96)	0.00 (0.00)	1.03*** (10.09)
	Reduced	74.65 (43.51)	92.30*** (26.68)	55.01 (49.77)
Reasons for REDUCED consumption of fresh fruits and vegetables-frequency/quantity?	FFV not available	0.38 (6.16)	0.00 (0.00)	1.09*** (10.39)
	FFV became expensive	34.08 (47.41)	4.26 (20.20)	89.72*** (30.39)
	Reduced incomes	64.78 (47.78)	95.74*** (20.20)	7.01 (25.55)
	Low supply	0.76 (8.69)	0.00 (0.00)	2.18*** (14.62)
Reasons for INCREASED consumption of fresh fruits and vegetables-frequency/quantity?	More household members	91.7 (28.86)	0.00 (0.00)	91.7 (28.86)
	Own supply from rural home	8.33 (28.87)	0.00 (0.00)	8.33 (28.87)
NUMBER OF OBSERVATIONS		2,465	1,298	1,167

Notes: Means are presented with standard deviation in parentheses; Mean differences between slum and non-slum locations were tested for statistical significance; * P < 0.1, ** P < 0.5, *** P < 0.01.

To further understand the changes in consumption of FFV by slum and non-slum households, consumers were asked to indicate the three main fresh fruits and vegetables they consumed before and during the pandemic period. Results are presented in Figures 1 to 4.

Before the pandemic, almost all households (99%) in non-slum locations consumed at least one fruit, but during the pandemic, this number has decreased to 93%, as shown in Figure 1. In addition, more than 50% of the non-slum households consumed mangoes, ripe bananas and citrus fruits (oranges, tangerine and lemons) before the pandemic. During the pandemic period, there was a significant drop in the number of households consuming mangoes (from 51% to 31%), also a reduction of households consuming ripe bananas (from 64% to 53%) and the citrus fruits (from 59% to 51%). Watermelon was also highly consumed before the pandemic by 43% of the households but during the pandemic period their consumption has dropped to only 25% of the households. Consumption of apples has dropped from 10% of the households before the pandemic to only 3% after the pandemic. Avocado consumption has not changed much in both periods. They are still being consumed by between 22% and 23% of the households in both periods. Consumption of plums, coconut, wild berries and passion fruits has remained low both before and during the pandemic.

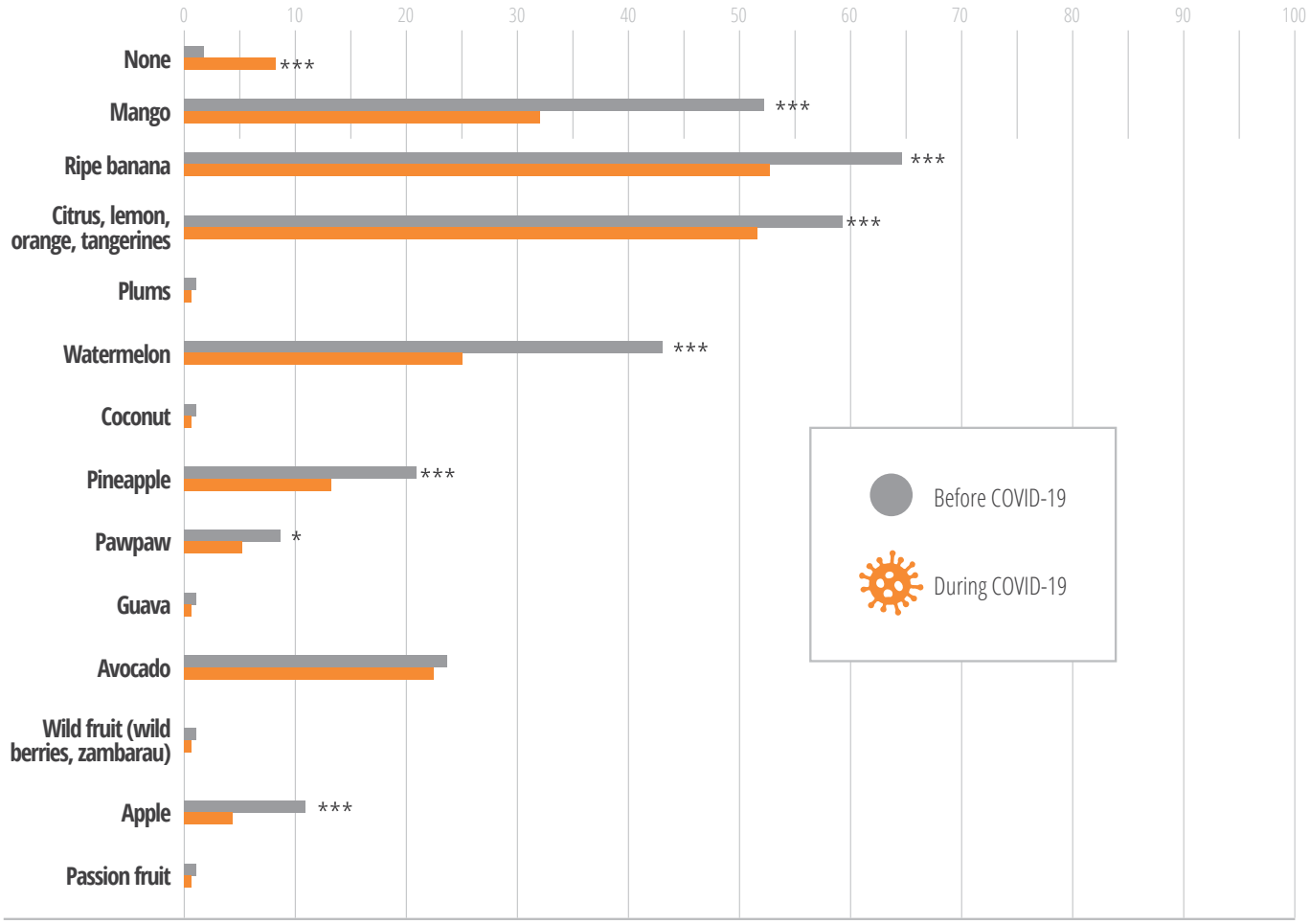

Figure 1: Consumption of fresh fruits before and during CV19 by non-slum households (Note: * P < 0.1, *** P < 0.01).

Consumption of fresh fruits by the slum households has significantly decreased between the two periods, as shown in Figure 2.

> *Before the pandemic, only 6% of the slum households were not eating fresh fruits, but during the pandemic this number has significantly increased to 37%.*

Before the pandemic, over 70% of the slum households consumed ripe bananas (75%) and citrus fruits such as oranges, lemon and tangerine (71%). During the COVID-19 period, only 37% of the households were consuming ripe bananas and the identified citrus fruits. Mangoes were initially consumed by 37% of the slum households, but during the pandemic the percentage dropped to 8% of the households. Consumption of watermelon and avocados also dropped significantly, from 25% of the households to 6% and from 23% to 11%, respectively. There is also a significant drop in the number of households consuming plums, coconut, pineapple, pawpaw, guava, wild berries and apples.


Photo: Twiga Foods

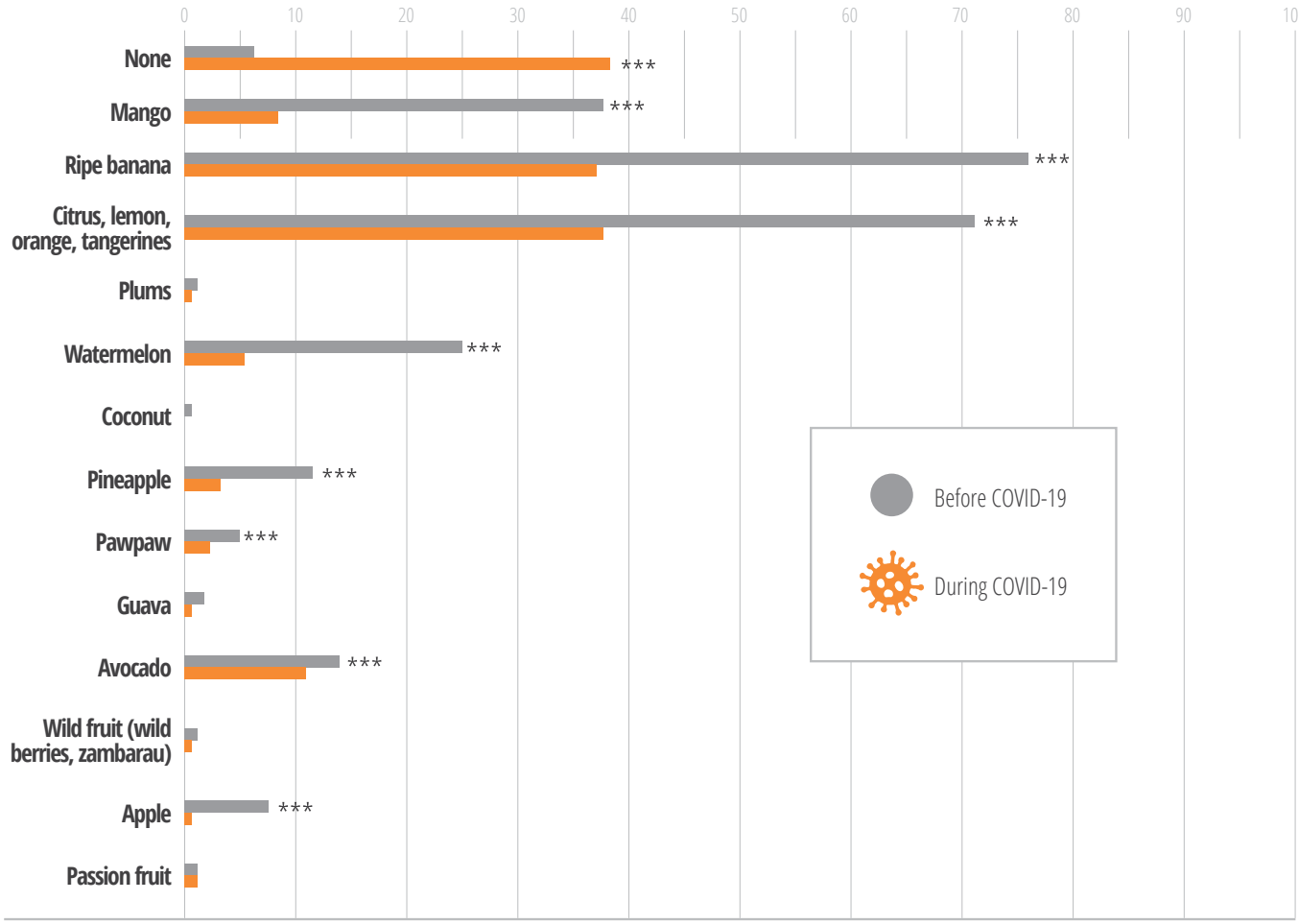

Figure 2: Consumption of fresh fruits before and during CV19 by slum households (Note: *** P < 0.01).

Consumption of fresh vegetables by slum and non-slum households has also changed over the two periods. The main vegetables consumed by the non-slum households before the pandemic were kales, onions, tomatoes and black night shade, as shown in Figure 3. Consumption of kales and onions by households has significantly increased during the pandemic period, from 48% to 53% and from 48% to 53%, respectively. Number of households consuming tomatoes has decreased. On the other hand, a higher percent of households were consuming indigenous leafy vegetables (amaranth vegetables, cowpea leaves, black night shade, and spider plant) before the pandemic, but the percent of households consuming these vegetables during the pandemic period has reduced significantly. Other vegetables such as eggplant, cucumber, butternut, pumpkin leaves and carrots were consumed by a few households before the pandemic, and the number of households consuming them during the pandemic has further dropped significantly.

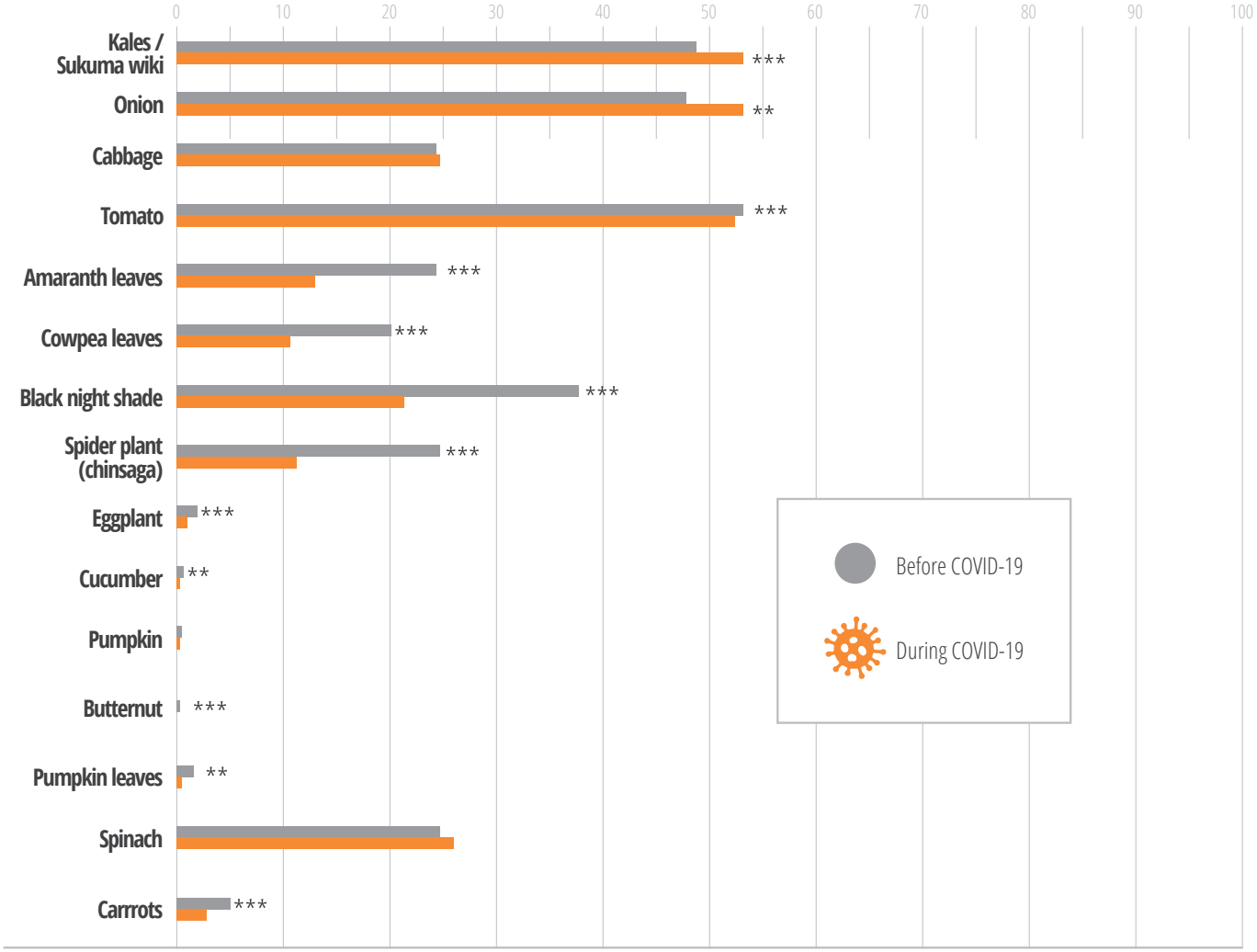

Figure 3: Consumption of fresh vegetables before and after CV19 by non-slum consumers (Note: ** P < 0.5, *** P < 0.01).

A similar trend of vegetable consumption is observed amongst the slum households. There is high consumption of kales, onions, tomatoes, black night shade and spider plant before the pandemic. During the pandemic, consumption of kales and onions has significantly increased from 61% to 74% and from 45% to 56% for the two commodities respectively.

> *There is a big and significant drop in the number of households consuming indigenous vegetables (amaranth, cowpea, black night shade, spider plant and pumpkin leaves) between the two periods.*

Number of households consuming tomatoes, spinach, carrots, eggplant, cucumber and pumpkin has also significantly dropped between the two periods.


Photo: @UN-Habitat/Kirsten Milhahn.

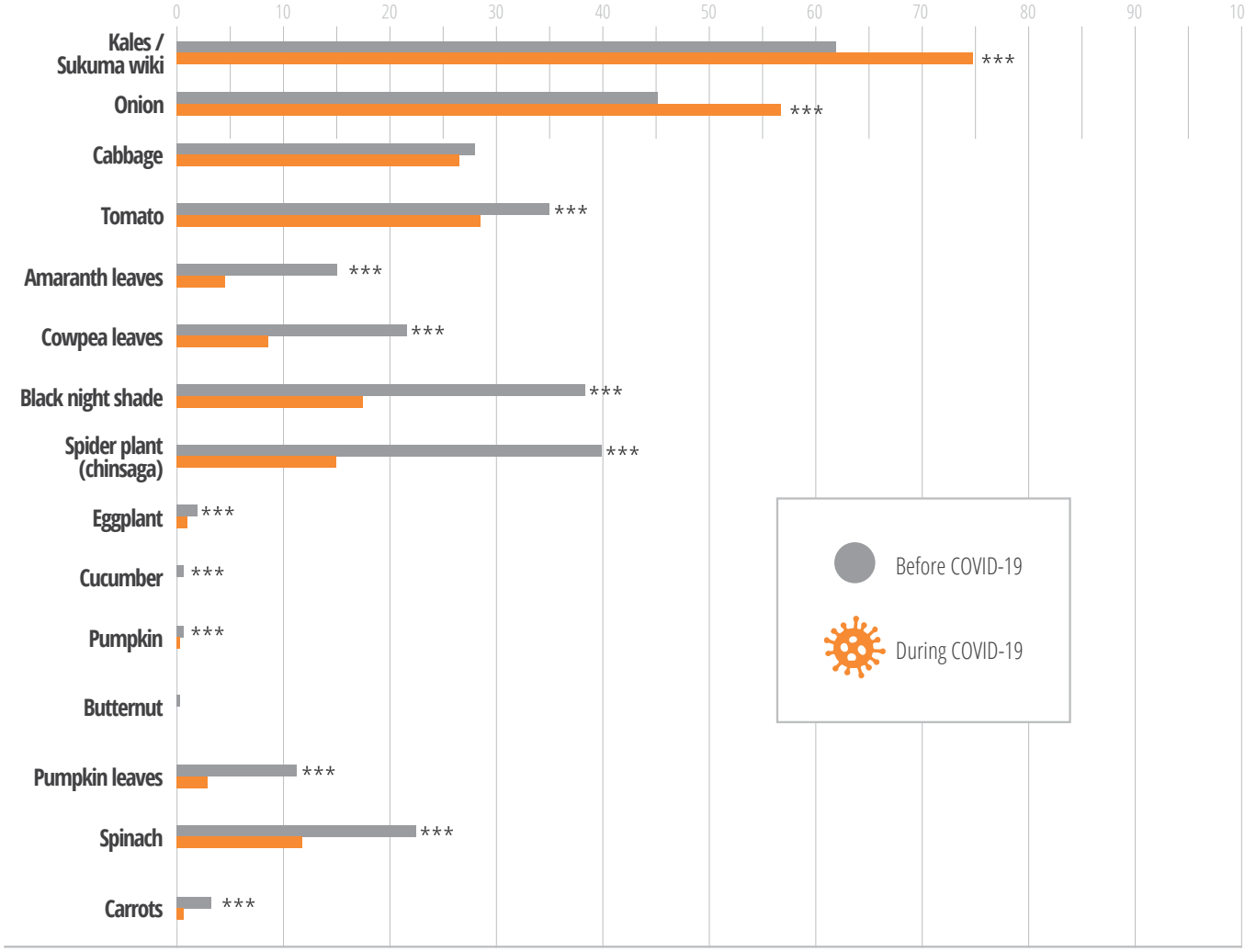

Figure 4: Consumption of fresh vegetables before and after CV19 by non-slum consumers (Note: *** P < 0.01).

Econometric model results

In this subsection, we conduct simple econometric regressions to understand factors that may be associated with a higher or lower household dietary diversity during the COVID-19 pandemic period. Table 5 presents the overall regression results and also separate for slum and non-slum households. Overall, households headed by males have a higher probability of having a higher dietary diversity score than those headed by females. This is also true for households in the slums. Education of household head is only important for the non-slum households. Households with heads who have a higher education level are also likely to have a higher diversity in their diets. In all the models where household head is either in salaried or self-employed, the household is likely to have higher dietary diversity score, implying higher diversity in their diets compared to households where the heads do not have stable employment.

Table 5: Poisson regression on determinants of household dietary diversity by location

	MODEL 1 (OVERALL)		MODEL 2 (SLUM)		MODEL 2 (NON-SLUM)	
VARIABLES	COEFFICIENT	STD. ERROR	COEFFICIENT	STD. ERROR	COEFFICIENT	STD. ERROR
Male household head (Dummy)	0.058***	0.019	0.127***	0.027	0.000	0.026
Household head education (years)	0.002	0.001	0.001	0.001	0.005**	0.002
Occupation of the head (Base=None)						
Salaried employment	0.166***	0.034	0.092*	0.047	0.150**	0.058
Casual laborer	0.032	0.032	0.024	0.038	0.000	0.060
Self-employment	0.138***	0.033	0.120***	0.042	0.097*	0.058
Household size	0.001	0.005	-0.006	0.007	0.009	0.007
Decrease in consumption of fruits (Dummy)	-0.055**	0.024	-0.120***	0.034	-0.021	0.033
Decrease in consumption of vegetables (Dummy)	-0.042*	0.022	-0.077**	0.030	-0.012	0.033
Increase in food prices (Dummy)	-0.015	0.023	-0.083**	0.039	0.008	0.028
Slum dweller (Dummy)	-0.089***	0.020				
Constant	1.632***	0.042	1.687***	0.062	1.575***	0.071
LR chi2(9)	184.970		93.220		38.300	
Prob > chi2	0.000		0.000		0.000	
Log likelihood	-4922.062		-2574.092		-2327.8804	
NUMBER OF OBSERVATIONS	2,465		1,298		1,167	

Notes: * P < 0.1, ** P < 0.5, *** P < 0.01.

Decreased consumption of fruits and vegetables is positively associated with lower diet diversity, but only in the overall model and in the case of households in the slums. In addition, increased food prices are associated with a reduced dietary diversity for the households in the slums. The slum variable in the overall model indicates that households in the slums have a lower dietary diversity compared to those in the non-slum locations.

Discussion and conclusions

In this paper, we have analyzed the impact of COVID-19 on diets of slum and non-slum households in Africa using representative data from 2,465 slums and middle-income residents in Nairobi, Kenya. We have used descriptive analysis to show how households have been affected in terms of socio-economics as well as food security and nutrition. Further, we use dietary diversity scores, in particular household dietary diversity score (HDDS), to assess factors affecting diversification of slum and non-slum households' diets during the pandemic period. HDDS is a simple count of number of foods consumed in the household within a given reference period. The score does not take account quantities of foods consumed, but it is easy to collect data required to generate it and it is also easy to measure.

The initial descriptive results show a significant difference between proportions of slum households (16%) who do not have any job at the moment compared to non-slum households (5%). In addition, the highest percent of household heads in the slums work as casual laborers (47%) compared to 25% in the non-slum households. The non-slum household heads are mostly in salaried (34%) or self-employment (34%) jobs. This could be an explanation for the low mean household monthly incomes reported in the slum households (USD 78) as well as the non-slum households (USD 382). The current low incomes are not surprising given the pandemic and the high levels

of unemployment among the slum dwellers. Further, the current government movement restrictions, coupled with the curfew, could be affecting the economic situation of the households working as casual laborers. We also found that households in the slum have an average dietary diversity score of 4 out of the possible 9, compared to 5 scores by the non-slum households. The low dietary diversity scores could be attributed to reduced incomes of consumers as well as increased food prices as reported by study households.

Using the self-reported food (in)security situation during the pandemic period, we found that about 90% of households in the slums were not able to eat the kinds of foods they preferred, they ate a limited variety of foods due to lack of resources attributed to the pandemic, they ate a smaller meal than they felt they needed and also ate fewer number of meals in a day. The percentage of households in the non-slum locations reporting these food insecurity situations was much lower, ranging between 42%–56%. All these are indications of food insecurity in the study sites but mostly amongst households in the slums. Previous studies conducted in the slums of Nairobi showed that only 13% of the sampled households were food secure, 46% were severely food insecure and 41% were moderately/mildly food insecure (Wanyama *et al*., 2019a).

Analyzing consumption of various food groups by slum and non-slum households, we found that almost every household in both slum and non-slum locations (98%) consumed cereals in the past seven days. However, fresh fruits were consumed more by non-slum households (89%) compared to those in the slums (52%) and the difference is significant. Further, we found that animal foods that usually have higher quality nutrition, but are also more expensive than plant-based foods, are consumed more by non-slum households compared to slum households. This was the case for meats (46% vs. 23%), eggs (57% vs. 37%) and milk and dairy products (82% vs. 51%) for non-slum and slum households, respectively. The low consumption of animal foods could be attributed to their higher prices and given that slum households currently have very low incomes, it means that their disposable incomes that could be used for quality and nutritious food purchase is even lower. Fish is consumed more by slum household compared to non-slum households. This is not surprising given that silver fish (omena) is widely sold in the slums in small quantities and at low prices (Cornelsen *et al*., 2016). Our findings also show that almost every household in both slum and non-slum locations (average 99%) consumed fresh vegetables. Further analysis on the type of vegetables consumed in the study households showed that kales are widely consumed by both slum and non-slum households, and their consumption has significantly increased during the pandemic period. However, consumption of indigenous vegetables that are more nutritious than the exotic ones has significantly reduced during the pandemic period across all study locations. Consumption of other vegetables such as tomatoes, spinach, eggplants, cucumber and carrots has also decreased significantly during the COVID-19 period for both slum and non-slum households. An increase in consumption of kales and reduced consumption of indigenous and other exotic vegetables could be attributed to their costs as well as availability.

Analysis on how consumption of fresh fruits and vegetables (FFV) has changed compared to before the pandemic shows that majority of the households both in the slum (92%) and non-slum locations (55%) have reduced the frequency and/or quantity of FFV consumption. Reasons for reduced consumption differ between slum and non-slum households. The slum households cite reduced incomes (96% of households) as the main reason for reduced consumption of FFV. Government measures to control COVID-19 including market closures, stay-at-home orders and social distancing have wider implications for the mostly casual income generating opportunities for these households. This lack of day labor opportunities contribute to lower incomes and, therefore, less purchasing power. On the other hand, the non-slum households cite increased prices for FFV as the reason for reduced consumption (90% of households).

Looking at the exact fruits consumed in the household, we found that there is a significant drop in consumption of all types of fruits during the pandemic period, except for avocados in the non-slum locations whose drop is not significant. The decrease is larger in the slum households compared to the non-slums. In addition, there is a drop to almost zero for consumption of the nutritious fruits such as the vitamin A-rich fruits such as mangoes and pawpaw. The low consumption of mangoes may be partly attributed to the fruit being out of season, hence making it

less available and potentially more expensive. The number of household not consuming any fruits during the pandemic period is much higher in the slums (41%) compared to non-slums (6%). These decreases in fruit consumption could be attributed to their costs, low supply, as well as decreased household incomes during the COVID-19 pandemic period.

The econometric regression analysis assessing determinants of household dietary diversity confirms the descriptive results. We found that in the slum model, the male-headed households have a higher diet diversity compared to the female-headed households. This could be because the male heads are able to look for casual jobs as a source of income compared to the female heads who may be forced to stay at home and take care of children therefore having less time to work in casual jobs to earn an income. Due to the current government restriction on school closure, all children are at home and households with small school going children are likely to have more child-care responsibilities. Our analysis also shows that the education of household head is associated with an improved diet diversity but only for the non-slum households. This could be because in the non-slum households people have opportunities for salaried or self-employment jobs which may require higher levels of education compared to casual jobs prevalent in the slum areas. Further, we found that decreased consumption of fruits and vegetables is associated with a lower diet diversity score for the households in the slums. This could be because while the non-slum households may replace FFV with other foods, the slum households may not replace the foods but reduce the diversity of their diets. Increased food prices were associated with reduced dietary diversity for the slum households. Again, this could be attributed to low incomes by the slum compared to the non-slum households. Overall, our analysis showed that slum dwellers have a lower HDDS compared to non-slum households. With income shocks from COVID-19 control measures, it is likely that dietary quality will suffer for slum dwellers with negative potential implications for health and well-being especially for children and women.

Several conclusions can be drawn from our findings.

> *First, the pandemic has largely affected the resource-poor consumers in the urban slums more than the middle-income consumers in the non-slum locations.*

The effect is on food security and nutrition, as well as economic aspects. Given that the slum dwellers mostly rely on casual employment, the COVID-19 pandemic has disrupted the possibility of working in those casual jobs, and this has led to reduction in incomes for the households in the slums. Second, slum dwellers have significantly reduced consumption of nutritious foods, especially the more nutritious FFV and animal source foods, and this is likely to have short-term and long-term negative implications on their nutrition situation. Third, increased prices of FFV are largely affecting consumption of these nutritious foods among the non-slum and slum households. Reduced incomes for the slum households is an additional constraint.

Several policy implications can be drawn from these findings. **First, the voices of the poor need to be considered during formulation of policies**. We find that slum and non-slum households are affected differently by the COVID-19 pandemic, and therefore differentiated policies and solutions are needed to address food security and nutrition of the two consumer groups. For example, we find that for the non-slum households, increased food prices are significantly affecting consumption of FFV. Therefore, for this consumer segment, interventions aimed at reducing food prices will help to improve their food security and nutrition situation. However, for the slum households, interventions to reduce food prices during such a pandemic like COVID-19 will not necessarily guarantee improved food security and nutrition. For this consumer group, strategies and interventions to improve their incomes would be a first solution to give them economic empowerment to access nutritious foods. Once they are empowered economically, a second intervention would be towards lowering food prices.

A second implication of our study is the gender angle. We find that male- and female-headed households are affected differently by COVID-19. Women have more productive and reproductive roles in the household compared to men, and therefore, when women are the household heads and bestowed with all the household responsibilities, it may be a challenge to attain food and nutrition security for the household. This is especially true under the pandemic with movement restrictions and reduction in casual labor employment that reduce income opportunities. Market and school closures further exacerbate the situation by limiting physical access to food while increasing household workload with all children being at home. More analysis is required on the gender impacts of COVID-19 to have a clear understanding of how different genders are affected by the pandemic.

Photo: Twiga Foods

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