



## Article

# Influence of COVID-19 Pandemic on Food Market Prices and Food Supply in Urban Markets in Nairobi, Kenya

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**Abstract:** The COVID-19 pandemic caused an unprecedented disruption of food systems worldwide, with most governments taking severe containment measures to curb the spread. This resulted in unpredicted negative impacts of the agri-food supply chains coupled with food price inflations. Ultimately, this affected the food security and urban livelihoods for most households, who are dependent on urban markets for food supply. This study examined the implications of the pandemic on food prices and commodities supplies to urban markets conducted through structured interviews. A review of the secondary data was also conducted to show the trends of commodity prices over the last 5 years. The high inflation of commodity prices with a decline in sales volumes was reported by most traders (97%) with decreases in supply quantities. Changes in the consumption behaviour in households was reported by consumers (75%), with 65% experiencing reduced food diversity at home. Households adopted varied coping mechanisms, including reduced food portions (52%), reduced food varieties (44%) and skipping meals (32%). Market prices increased by an average margin of 13.8% for grains and pulses with price decline observed for cabbages (−30.8%) and Irish potatoes (−19.4%). The findings may inform policymakers of additional future shock and pandemic control protocols, whose actions would assure food protection of urban livelihoods.

**Keywords:** food prices; urban markets; COVID-19 impact; food protection; livelihoods; food security



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## 1. Introduction

By the end of 2019, approximately 690 million people were enduring chronic hunger, and 135 million were facing acute food insecurity at crisis levels or higher [1]. Prior to the impacts of the COVID-19 pandemic, most countries in Africa were experiencing serious hunger and poverty. It has been predicted that, due to the effects of the COVID-19 pandemic, approximately 657 million people (representing 8% of the global population) will be undernourished in 2030, which is approximately 30 million more than if the pandemic had not occurred in 2020 [2,3]. The key driver is economic shocks affecting over 30 million people in 21 countries, down from over 40 million people in 17 countries in 2020, mainly due to the fallout from the COVID-19 pandemic. Further, in 2020, nearly 12 percent of the global population was severely food insecure, representing 928 million people with 148 million more than in 2019 [2]. Therefore, the stability of food systems continues to undergo pressure tests as the aftershocks of COVID-19 continues to reverberate through different sectors across Sub-Saharan Africa, following its arrival in the region in early 2020. The pandemic has transitioned from a mere health issue into a socio-economic threat following the imposition of strict control measures on commercial and social activities is proving to be more devastating than the actual virus in many countries [4], manifested through economic deadline, food trade restrictions and rising food inflation [1,5].

In Sub-Saharan Africa, the pandemic has coincided with a partial or a combination of other stresses, including extreme weather events, locust infestations, conflict and insecurity, therefore exacerbating some of the observed effects resulting from efforts to control the spread of the virus [6]. As a consequence, the domestic food prices in most markets have increased in many countries since the beginning of the pandemic and might still come under further pressure.

In Kenya, food insecurity ravages approximately 10 million individuals who still suffer inadequate access to affordable quality food. In the 2021 Global Hunger Index, Kenya's level of hunger is serious, with a score of 23.0 for the years between 2014 and 2019, and was ranked 87th out of the 116 countries with sufficient data to calculate 2021 GHI scores [3,6]. Kenya experienced severe droughts and high levels of hunger and undernutrition, which more than doubled the number of food insecure people from 1.3 million to 2.7 million [1,7]. To exacerbate this, conflict, climate change, COVID-19 and surging food and fuel costs have created a perfect storm affecting food and nutrition security in Kenya. In the 2018 main season, the losses in maize, the maize cereal in the low- and medium-potential areas were approximately 20%, but the high-potential areas were more affected, with an estimated loss of 33% [8]. In coastal areas, the production of maize has decreased by 99%, while agricultural output in Kenya has been decimated by the infestation of the African army worm, resulting in food shortages and an increase in food prices [8]. According to [9], households with low income are disproportionately ravaged by food insecurity, and this situation has further been worsened by the pandemic, especially if household members get infected with the virus. Consequently, COVID-19 continues to increase the problem of food insecurity tremendously through loss of income for most households caused by the infections; previous quarantine, restrictions in movement, government-imposed lockdowns and food system disruptions and food supplies; and increased food prices [10].

Markets are critical in food security pillars, especially regarding food availability and accessibility. Although the global agricultural markets are projected to continue being stable into 2021 [11], food security impacts are being felt unevenly at the local level [12,13]. The critical role played by agri-food markets is underscored in Sustainable Development Goal (SDG) 2 'Zero Hunger' through recommendations to adopt measures that ensure proper functioning of food commodity markets and their derivatives as a cautionary measure against extreme food price volatility [14]. Unfortunately, the pandemic has disrupted food supply chains, resulting in detrimental consequences for farmers and consumers. Restrictions on international travels and export restrictions saw farmers contend with unprecedented glut levels and large-scale wastage of food at the farm level further worsened by closure of institutional off-takers, such as schools and hotels [15]. It is recognised that there can be no end to the adversity of COVID-19 pandemic without food access [16].

The COVID-19 pandemic is set to radically increase food insecurity in Kenya, especially in the urban areas, exacerbating an issue that has only worsened in recent years. This has transitioned from a health crisis into a food crisis. The decisive lockdowns imposed by the government to prevent the spread of the virus disrupted the food supply to the markets. This led to decline in food commodities available in the urban markets and thus interfered with consumption patterns among urban dwellers. Some of the factors triggered by COVID-19 pandemic, and likely to push households to severe hunger, are reduced purchasing power, food supply disruptions affecting the movement of food and the movement of inputs to production areas and that there are few safety nets to cushion the vulnerable populations. There are questions that remain about the effect of COVID-19 on market prices, the supply of food commodities and consumption. This study aims to explore how COVID-19 influences food prices, food supplies and consumption in the urban context. The findings will contribute to the body of knowledge and inform policymakers on the actions to be taken in the post-COVID-19 era. Against this backdrop, this paper examines the implications of COVID-19 on food market prices for selected food commodities in selected markets since the COVID-19 pandemic; assesses changes in quantities supplied for the selected food commodities; and determines the effects of the price fluctuations on

the market and household's access to food commodities in Nairobi, Kenya. This is because for food security analysis, it is important to monitor prices in the market in order to obtain useful insights that may inform decision making for families or the community at large in understanding food security situation or to increase competition along the food chain.

Further, market information plays an essential role in policy decisions and food allocation. Generally, food prices strongly influence the livelihoods and dietary choices of farmers, traders, processors and consumers. If markets are constricted, the prices for food commodities become sensitive to shocks, such as a bad harvest or, in today's context, supply disruptions caused by COVID-19.

In Africa, the first case of coronavirus was reported in Cairo, Egypt, in February 2020. Just like China, most of the African governments restricted the movement of people thus affecting the daily lives of the people and reducing the economic activities impacting negatively on the food security [17]. Across Africa, evidence shows that most of the food systems are not resilient to withstand any type of shocks. During the pandemic period, most of the countries in Sub-Saharan Africa experienced food price increases associated with restrictions on movement [18]. Consequently, this worsened the food security situation given that most people in the African region are still grappling with the problem of food insecurity even before the onset of coronavirus [19]. The urban poor have been affected the most by the imposed COVID-19 policy measures [20]. The food market demand and supply sides are affected by the infection due to COVID-19 and the resulting restrictions adopted to curb the spread of the virus. However, the demand side is not greatly affected compared to the supply side. A reduction of food supply occurs due to a reduction of the labour supply as a result of COVID-19 as well as increased input prices [21]. Food prices can be affected by the supply of food in the market and the effect of macroeconomic variables on the cost of production and distribution. Studies conducted in Rwanda and Kinshasa showed a high increase in food prices among the staples [22]. Indeed, the negative impacts of the food crisis that occurred between 2007–2008 on the price of some commodities [23] show that it is imperative to analyse the effects of COVID-19 on food prices, particularly among the vulnerable population, to inform evidence-based policy recommendations. Additionally, in response to the effects of the pandemic on the food markets, social protection strategies to ensure nutrient-rich foods are available and affordable during the pandemic period are paramount.

In Kenya, the first case of COVID-19 was reported on 12 March 2020 while the first death was reported on 26 March 2020. The confirmed positive cases peaked in August 2020 following a relaxation of the Nairobi Metropolitan Area and coastal counties lockdown. A second and third wave were thereafter recorded in mid-November 2020 and March 2021, respectively, and were strongly correlated with the relaxation of previous restrictions and the spread of the virus into new geographical areas [24]. A fourth wave was recorded in August 2021 after the emergence of more virulent variants [25]. Combined with the effects of change in climate, poor soil quality and a decline in biodiversity putting pressure on regional food systems, COVID-19 has taken a toll on the Kenyan economy.

This has placed the country into a prolonged food and poverty crisis the impact of which is still bound to be felt in the years to come. There is no dependable forecast on how long the pandemic will last, hence making it imperative to assess its impacts on food supplies and prices to inform the tailoring of appropriate interventions that assure protection of urban livelihoods and the supply of adequate and affordable quality food to the population. According to Arndt and others [26], the resultant shocks from the control measures, coupled with the associated macroeconomic shocks to household incomes would very likely spread through the entire global economy and surpass the 2008 global financial crisis.

## 2. Materials and Methods

We employed a cross-sectional survey using mixed methods approach, which was employed with combined qualitative and quantitative data sources, in order to analyse the

impact of COVID-19 on food market prices towards food security in selected major urban markets in Nairobi, Kenya. The study location was Nairobi County in Kenya, among major markets selling key agricultural commodities, especially cereal grains and pulses.

The data was collected from primary sources through in-depth face to face interviews while adhering to Ministry of Health (MoH) and World Health Organization (WHO) COVID-19 control protocols. Relevant data collection tools for the survey (structured questionnaires, key informant interview guides and check lists) were developed and pretested for data collection among market vendors/traders and consumers. The market assessment helped in understanding the effects of COVID-19 at the trader and consumer level to inform actions to assure protection of urban livelihoods and the supply of adequate, affordable quality food to the urban population. The quantitative market data complemented the secondary data and triangulation of findings was conducted to ensure solid evidence is drawn on the effect of COVID-19 on market prices and household consumption.

### *2.1. Theoretical Background*

The COVID-19 pandemic is a one-of-a-kind, extraordinary pandemic. Consequently, to the best of the authors' knowledge, no similar phenomena, both in nature and magnitude, can be found in existing literature on consumer behaviour. Globally, there is a growing number of research studies examining the early impacts of COVID-19-related policy limitations on food markets. Food price increases caused by COVID-19-related supply chain disruptions might have serious effects on both food availability and diet quality [27,28]. Higher food costs disproportionately affect the weakest members of society, particularly at a time when many have lost their jobs owing to the closure of non-essential economic activities. Furthermore, poorer consumers' diminished buying power leads to the substitution of less attractive but less costly items, possibly decreasing prices in these value chains [29]. In theory, the equilibrium market price of a product is determined by the market supply and demand. As a result, any variables that may impact either the supply or demand for that commodity would alter the commodity price. Previous research indicates that the COVID-19 policy limits had an impact on both the supply and demand sides of global agricultural markets [30,31]. Besides the lockdown, numerous variables may affect commodity supply and demand, based on a country's weather unpredictability, the cyclical nature of the product, macroeconomic circumstances, economic structure and culture. Lockdown measures used to halt the spread of the pandemic may have an impact on the short-term market results due to supply and demand challenges. On the supply side, food prices in wholesale and retail markets may rise owing to a significant lack of goods, particularly in deficit markets. It may also rise as a result of artificial shortages caused by merchants' hoarding, particularly for storable food commodities with adequate post-harvest infrastructure. Furthermore, prices may rise as a result of production and harvest constraints caused by labour shortages and the unavailability of inputs throughout the value chain. Because of these disruptions, it is projected that the quantity of goods arriving in urban wholesale markets—which also supply downstream retail outlets—will drop or slow, putting upward pressure on wholesale prices [30,31]. The degree to which wholesale price rises are passed on to retail depends on the power dynamics between wholesale and retail businesses. Ultimately the price increase lowers the consumer's purchasing power and influences their consumption habits. While we anticipate a supply shock like COVID-19 to raise overall costs, prices for specific perishable commodities such vegetables and potatoes that were produced around the time of COVID-19's commencement and have limited cold storage facilities may decline [32].

The empirical evidence about the effects of the COVID-19 pandemic on the food and agriculture markets is still in its infancy. For example, [30] discovered a 10% decline in the online availability of certain goods (with no effect on retail pricing) immediately after the initial lockout. Between March and April, market arrivals of vegetables and fruits fell by approximately 20% in a few places. They attribute them mostly to disturbances in the supply chain. Analysing retail and wholesale pricing until the end of April, Narayanan

and Saha [33] discovered that numerous commodities, including pulses and grains, experienced a substantial increase in prices shortly after the lockdown. They discovered that transportation limitations functioned to limit food supply to the major marketplaces, resulting in an increase in the wholesale price spread.

## 2.2. Sampling Technique and Sample Size

A list of traders and consumers from three main food wholesale urban markets in Nairobi County, including Kangemi, Kawangware and Wakulima markets, were generated from the city county information. The traders' list was also obtained from the market supervisor while the consumers' list was obtained from the traders. Key informants who are knowledgeable in the subject matter from higher institutions, NGOs and the government were purposively sampled. Study participants consisted of 120 vendors, 60 consumers, and 20 key informants for the three markets, 80 respondents per market and 20 KIIs. The sample size (200) adequately covered the three major markets in Nairobi, the biggest urban centre in Kenya, for this study. The markets are located in the peri-urban areas and serves a sizeable population of low-middle income populations in Kenya. All the major cereals and pulses traded in the market were covered in this study design. The volume of transactions in the three markets assisted in assessment of impact of COVID-19 on food access and, ultimately, the food security of households. The inclusion criteria used ensured that the study participants were recruited through the random sampling technique. All market traders and vendors selling non-perishable food commodities of interest, with regards to commonly consumed in urban households in the selected markets, were interviewed and participants were required to be over the age of consent (over 18 years old). The exclusion criteria ensured that the market traders, vendors and key informants that declined to participate and that sell perishables food commodities, such as vegetables, were excluded.

## 2.3. Methodology

### Comprehensive Review of Literature and Secondary Data

A comprehensive desktop review of literature and secondary data was undertaken, including reports and other publications. Secondary data was gathered on food market prices and sales volumes from secondary sources, particularly the Ministry of Agriculture, Livestock and Fisheries and the Ministry's new KAMIS online platform initiative (<http://amis.co.ke/site/market>, accessed on 10 June 2021). KAMIS is a quick way for farmers, traders and processors to obtain regional market information anywhere, anytime, easily using mobile phones or computers. KAMIS was developed to enable members access early warning marketing and trade information, resulting to competitive and efficient transactions in food trade between surplus and deficit regions.

It provides real-time, relevant and accurate information, with national coverage of five markets in each of the 47 counties in Kenya. The system captures more than 150 products with the capture of output market data (quantities) and wholesale, retail and farm-gate prices for agricultural sector commodities (agriculture, livestock and fisheries). In addition, the secondary data on quantities and price fluctuation of cereals/pulses and the wholesale monthly prices and quantities sold in Kangemi, Kawangware and Wakulima wholesale markets for the last 3 years (2017–2021) was gathered from the National Cereals and Produce Board and county market offices, respectively.

### 2.4. Food Market Survey Data

A structured questionnaire was used to collect data from the traders and consumers. The trader's questionnaires captured data on the source markets, changes in quantities purchased and prices since the onset of COVID-19, as well as volumes sold, while the consumer questionnaire focused on the main food commodities purchased, frequency of purchase and changes in prices since the onset of COVID-19, as well as the coping strategies to a reduction in food availability at the household level and their perceptions on market hy-

giene. Additionally, market data on sale and the purchase of selected food commodities were collected from wholesale traders and consumers in selected urban wholesale markets in Nairobi. Personal information, such as the name of the trader or consumer, were not collected but a unique number was assigned for identification during analysis. Data were entered in ODK software in a tablet. The market workers employed by the city council were used to mobilise the respondents to ensure they were available for the interviews. Informed consent was obtained from the traders and consumers to proceed with the interviews. The market assessment helped in understanding the effects of COVID-19 at the trader and consumer level to inform actions to assure protection of urban livelihoods and the supply of adequate and affordable quality food to the population. This study defined traders as persons whose business is buying and selling or bartering, such as merchant in this case food commodities, or a person who buys and sells (something, such as stocks or commodities futures) in search of short-term profits in the market. Wholesalers are companies or individuals that purchase great quantities of products from manufacturers, farmers, other producers and vendors. They buy and sell food commodities in bulk.

During the structured interviews, traders described how the pandemic had impacted their businesses in regards to commodities traded, traded volumes, changes in produce sources and supply, changes in commodity prices and their general outlook in the foreseeable future. Conversely, consumers responded to questions on commodities they often bought in the markets, the purchase frequency, price changes, barriers experienced and the coping strategies they were using in response to the pandemic. The trader participants were equally distributed in three markets, namely Kawangware (33.8%), Kangemi (33.8%) and Wakulima (32.4%). The study considered different food cereals/pulses and commodities types commonly consumed by households/families and mostly locally sold out in the urban food markets/stores. The food commodities sampled were rice (*Oryza sativa*), dry maize (*Zea mays*), millet (*Eleusine coracana*), sorghum (*Sorghum bicolor*), peas (*Pisum sativum*), Canadian wonder French Bean (*Phaseolus vulgaris* L.), rose coco beans (*Phaseolus vulgaris* L.), mweetmania beans (*Phaseolus vulgaris* L.), green grams (*Vigna radiata*), cabbages (*Brassica oleracea*) and potatoes (*Solanum tuberosum*).

### 2.5. Key Informant Interviews (KIIs)

Regarding the key informants, phone interviews were conducted as well as email correspondence using a checklist of questions. The key informants included government officials, city council officials, market supervisors and managers, group opinion leaders in the urban markets, major suppliers to markets, major retailers, transporters and distributors and academia among others. In addition, the interviews gathered secondary reports from the informant's organisations on the selected food markets on prices and quantities sold over a given period of years. All the FGDs and key informant interviews were recorded and transcribed in English. The transcriptions were analysed using the NVIVO software. A codebook was developed based on the thematic areas, including changes in prices, commodities supplied in the markets and consumption patterns. Content analysis conducted for all transcripts was generated. The analysis involved the identification of patterns and trends that triangulated the quantitative data.

### 2.6. Ethical Consideration

An informed consent was obtained from all the subjects before participation. The study was carried out in line with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the University of Nairobi, Kenya (KNH-UON ERC application reference P447/06/2021) and Warwick University in the UK (application reference HSSREC 154/20-21).

### 2.7. Statistical Analysis

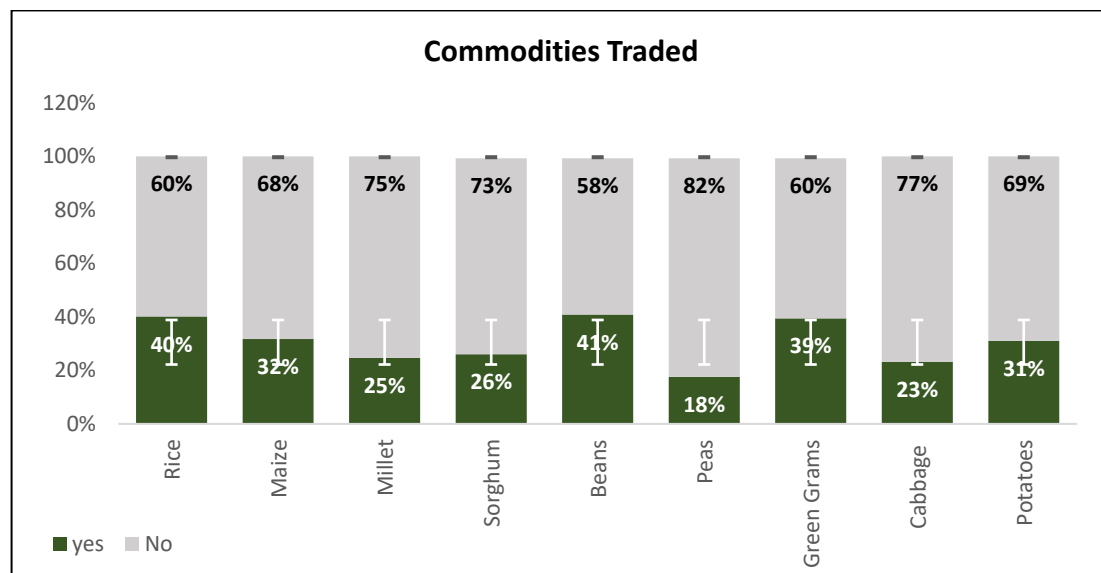
Data were analysed using ATLAS.ti ((version 5.5) and NVIVO (version 12). Secondary data analysis after mining was performed using STATA (version 14.0). Data analysis in-

cluded descriptive, bivariate and multivariate analysis. The qualitative data from key informants was translated and the transcripts analysed thematically using NVivo software (version 12). Other relevant statistical software was used depending on the data parameters. Trends in market prices were analysed using R, after cleaning the market data in Excel. One-way ANOVA (R-4.2.2 for Windows) was used for each crop price per Kg (KSh) per year to estimate the means of the different food commodity groups from 2017 to 2020. This was followed by Tukey post hoc test to check which year (2017 to 2019) had significantly different means in each specific commodity group.

### 3. Results

#### 3.1. Food Quantities in the Urban Markets

Traders were interviewed on the food commodities focusing on maize, millet, sorghum, beans, peas, green grams, cabbages and Irish potatoes. Traders in the selected markets sold all types of cereals (Figure 1). Rice, beans and green grams were frequently purchased in the urban markets. Notably, there were more traders selling Irish potatoes in Kangemi compared to the other markets.



**Figure 1.** Food commodities sold by traders since March 2020.

Table 1 shows that 41% of the traders had the common beans among their stock, with rice (40%) ranking second and green grams (39%) third. The participants, however, reported an overall decline on their sales volumes. Besides the reduced sales, 97% of the traders indicated that the supply quantities from their sources had declined, despite 78% of them retaining the same supply sources. A total of 22% of the consumer participants decried lack of commodities as a key barrier they faced while accessing food in the market.

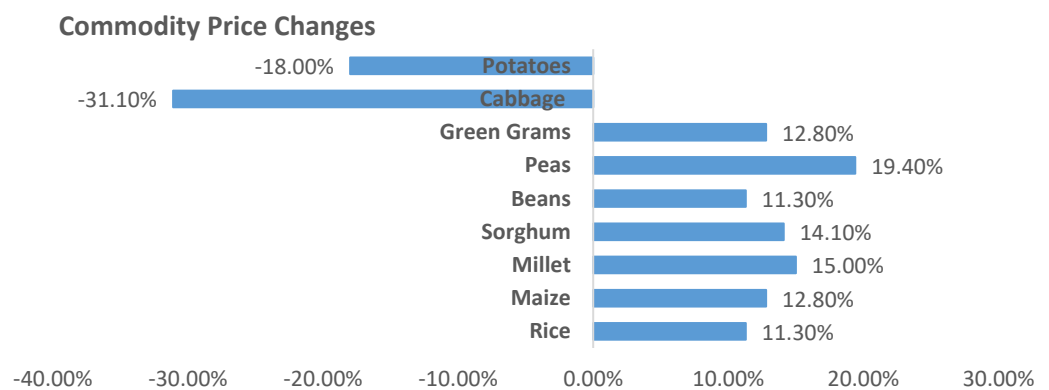
**Table 1.** Changes in sales quantities (percent) since COVID-19 onset.

		Rice	Maize	Millet	Sorghum	Beans	Peas	Green Grams	Cabbage	Potatoes	Average
Commodities stocked (%)	Yes	40	32	25	26	41	18	39	23	31	
Consumer purchased (%)	Yes	65	65	41	41	85	65	78	84	81	
Sales comparison to before March 2020	Less	89	84	91	86	88	88	79	100	86	88
	More	2	2	6	5	3	0	0	0	2	2
	No Change	9	13	3	8	9	12	21	0	11	10

A change in consumption behaviour in households was also reported by 75% of the consumers reducing the quantity, and 65% experienced reduced food diversity at home compared to pre-pandemic period. A further 78% of the consumers indicated reduced food availability. To cope with the reduced food quantities and diversity, households adopted varied coping mechanisms, including reduced food portions (52%), reduced food varieties (44%) and skipping meals (32%). Other coping mechanisms cited included sourcing food supplies from their rural homes, buying foods on credit, shifting to cheaper and less preferred foods and, in severe cases, borrowing food from neighbours.

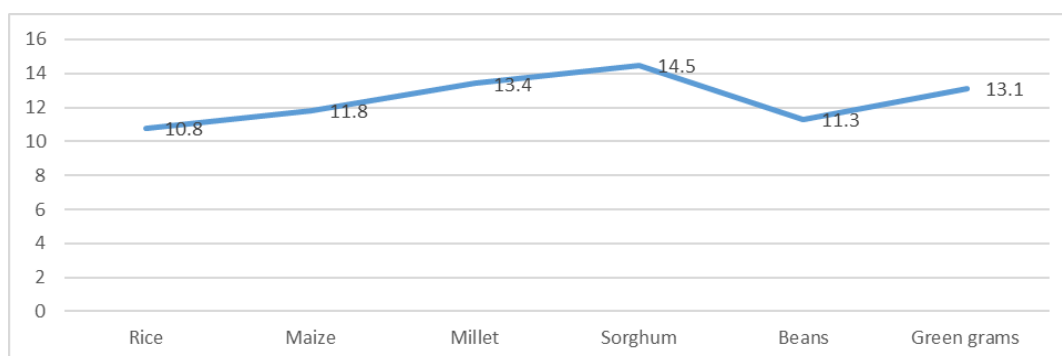
### 3.2. Food Commodity Prices

Generally, the price of cereals (rice, maize, beans and millet) have increased while prices for cabbages and Irish potatoes have decreased since the onset of COVID-19 pandemic. Cabbages and Irish potatoes prices declined by  $-30.8\%$  and  $-19.4\%$ , respectively. Despite this reported price decline by traders, 43% and 74% of the interviewed consumers reported buying cabbages and Irish potatoes at a higher price, respectively, than before the pandemic onset. For grains and pulses, however, prices increased by an average margin of 13.8% during the pandemic with green peas recording the highest price increase (+19.1%) and the lowest price increase being for common beans at +11.1%. Figure 2 indicates the percentage change in price for each food commodity.



**Figure 2.** Price changes by commodity in the urban markets.

On average, the price of cereals (rice, maize, millet, sorghum, beans and green grams) increased by between 10 to 15% during the COVID-19 period (Figure 3). The traders have been selling fewer food commodities since the onset of COVID-19. The traders interviewed reported that the main reasons for declining sales included increased prices of commodities, reduced incomes from customers leading decreased consumption, reduced demand for food commodities, depressed supplies in most food commodities and the closure of hotels and schools which led to reduced demand for food commodities.



**Figure 3.** Price margin increase (in percentage) for cereals.



Commodities, such as common beans, green grams and rice, had different varieties with differing prices based on quality, consumer preferences, source and taste. The price was reported to have increased with almost equal margins and the wholesale prices were recorded, as tabulated in Table 2.

**Table 2.** Price variances by food commodity and variety.

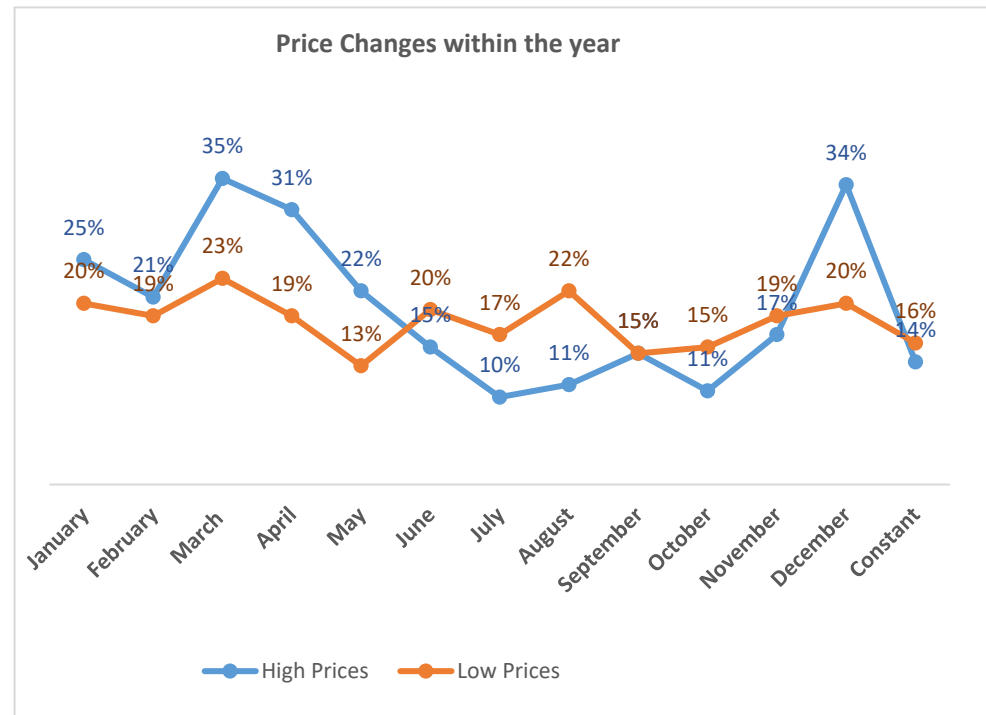
Commodity	Variety/Unit	Obs	Mean Standard Error	SD	Min	Max
Potato	Kg	44	33.45 ± 1.56	10.34	13	54
Cabbage	Per Piece	28	24.11 ± 1.39	7.34	10	40
Green Grams	Makueni (Kg)	50	127.97 ± 3.75	26.55	78	180
	Nylon (Kg)	8	109.79 ± 12.4	35.08	67	150
Peas	Kg	25	135.61 ± 9.41	47.04	82	300
Common Bean	Gikara (Kg)	3	130.00 ± 10	17.32	120	150
	Mwitmania	9	116.67 ± 8.16	24.49	60	140
	Nyayo (Kg)	28	106.04 ± 4.73	25.01	50	143
	Rose coco (Kg)	11	135.66 ± 8.8	29.19	80	180
	Royal (Kg)	8	145.00 ± 2.67	7.56	130	150
	Wairimu (Kg)	31	95.16 ± 5.07	28.23	62	150
	Yellow bean (Kg)	41	127.32 ± 4.42	28.32	64	173
Sorghum	Kg	37	73.94 ± 4.12	25.09	28	140
Millet	Kg	34	101.17 ± 4.76	27.75	50	200
Maize	Kg	41	40.72 ± 1.9	12.18	3	75
Rice	Basmati (Kg)	15	125.47 ± 3.39	13.13	88	150
	Biriani (Kg)	32	99.38 ± 3.44	19.49	84	180
	Five Star (Kg)	3	86.00 ± 7.02	12.17	78	100
	Indian (Kg)	3	113.33 ± 28.39	49.17	82	170
	Pakistan (Kg)	3	120.00 ± 15.28 ± 4.55	26.46	100	150
	Pishori (Kg)	35	148.86 ± 3.97	26.93	80	200
	Sindano (Kg)	28	99.75 ± 0.17	21.02	25	130

Table 3 shows the food commodity price change per market which differed significantly between markets with Kawangware registering the highest price volatility (7.3%), followed by Wakulima (3.6%) and lastly Kangemi (4.8%). Given the price changes, most traders (93%) reported serving a reduced number of customers since the beginning of COVID-19 pandemic. The issue of high prices was cited by 82% of the consumers as a key barrier they faced while accessing food in the markets.

**Table 3.** Commodity price changes (in percentage) by commodity and market.

Commodity	Kangemi	Kawangware	Wakulima	Commodity Average
Rice	10.2	11.4	13.2	11.6
Maize	7.3	23.4	9.0	13.2
Millet	10.8	17.6	19.5	16.0
Sorghum	7.5	17.6	14.9	13.3
Beans	9.8	8.1	15.5	11.1
Peas	17.2	33.2	7.0	19.1
Green Grams	14.1	10.3	13.9	12.8
Cabbage	−22.6	−34.2	−35.5	−30.8
Potatoes	−11.5	−21.5	−25.2	−19.4
Market average	4.8	7.3	3.6	5.2

In regard to the average price trends, traders rated months that they deemed prices to have been high. The onset of the pandemic in March 2020 seemed to have highly inflated commodity prices and then stabilised, before increasing again in December 2020 as illustrated in the Figure 4 below. Prices for the studied commodities were established to have been mainly determined by supply (64%), then wholesalers (25%) and only 3% by demand.



**Figure 4.** Price changes by month during the year 2020.

### 3.3. Frequency of Purchase of Food Commodities by Consumers

The consumers in the market reported that the most frequently purchased food commodities since March 2020 were rice, maize, millet, sorghum, beans, peas, green grams, cabbage and potatoes, ranging between 37 to 77% of the consumers (Figure 5).

Figure 6 shows the frequency daily, weekly and monthly among other times. Most traders reported that they purchased rice (44%), maize (46%), millet (38%), sorghum (56%), green grams (52%), beans (53%), peas (44%), cabbage (37%) and potatoes (35%) every week.

In general, 92% of the traders in all markets reported a decline in customers since COVID-19. The decline in the number of customers was due to low purchasing power as a result of reduced incomes, fear of contracting COVID-19 and the closure of schools and hotels.

Further, the consumers reported the increases in the prices for rice (76%), maize (80%), millet (81%), sorghum (76%), beans (77%), peas (78%), green grams (75%), cabbage (43%) and potatoes (74%). This indicated that the prices for the food commodities had changed in these markets since the onset of COVID-19 as indicated in Figure 7 below. Further, 84% of the consumers indicated that they face many barriers in accessing food in the market.

#### 3.3.1. Barriers Faced by Traders

Some of the barriers faced while accessing food in the market were mainly the high prices of the food commodities (82%), congestion in the markets (28%), transport (25%) and a lack of commodity supply (22%). Figure 8 shows the other barriers to food access in urban markets. Disaggregating the barriers by the markets shows that high prices were the main barrier in all the markets, especially in the Kangemi and Kawangware markets. It can

be observed that due to low prices in Wakulima, there was more congestion, insecurity and hygiene problems in that market, compared to the Kangemi and Kawangware markets.

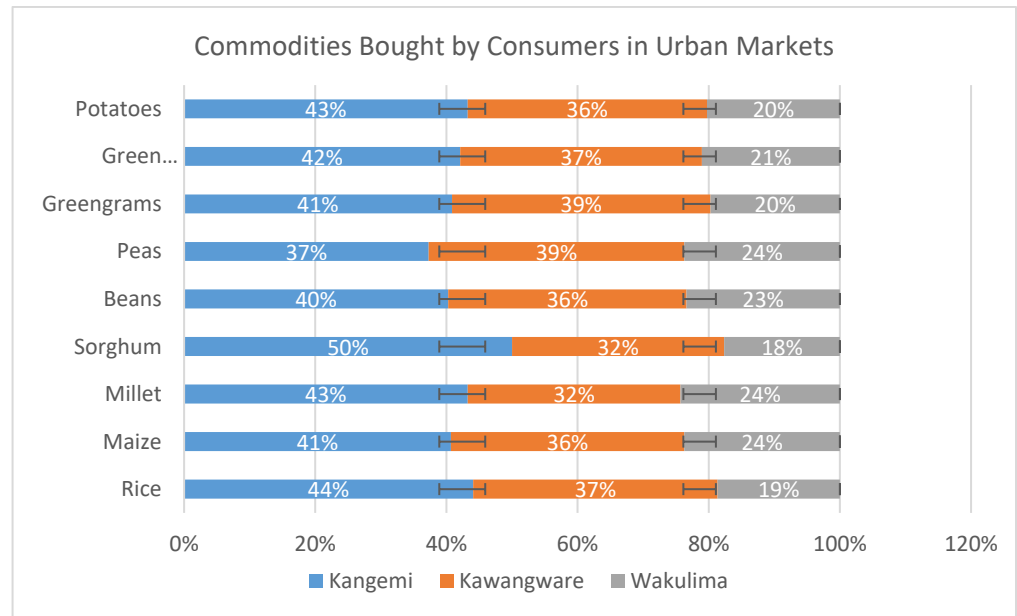


Figure 5. Food commodities purchased by consumers in major urban markets.

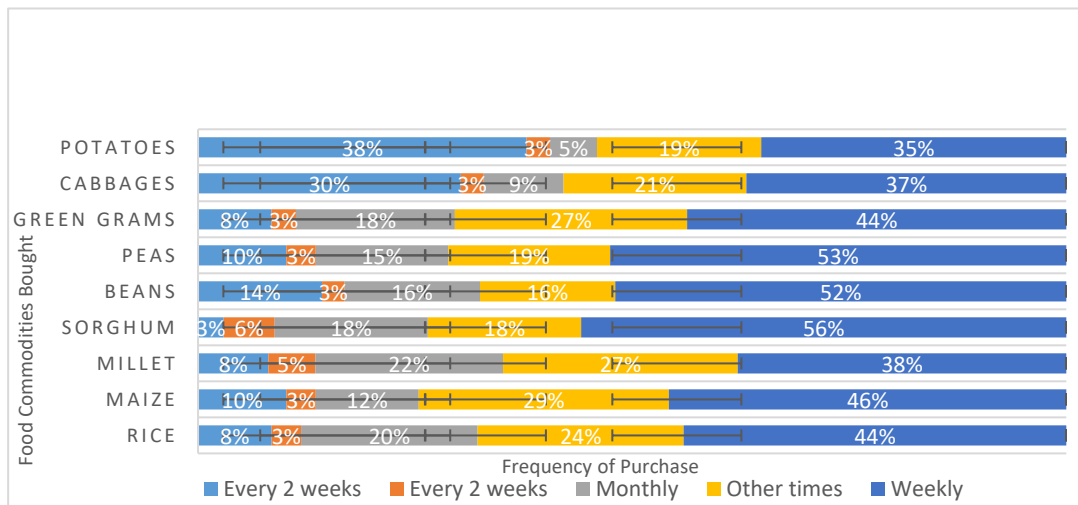


Figure 6. Frequency of purchase of key food commodities in urban markets.

### 3.3.2. Monthly Price Fluctuations

The food commodity prices were shown to fluctuate mostly in the months of January, March, May and December 2020, during the COVID-19 pandemic, with high prices in the markets being reported (Figure 9).

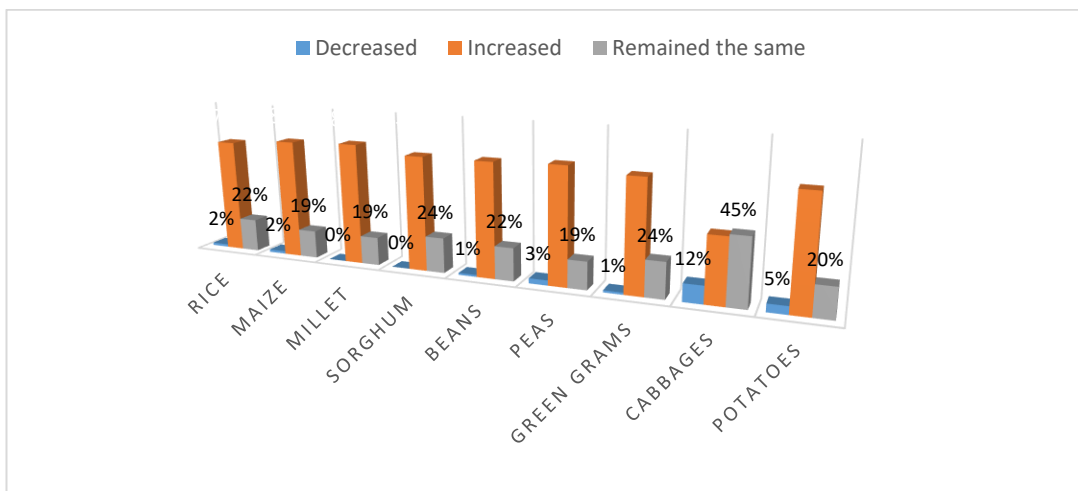


Figure 7. Price changes during COVID-19 pandemic in urban markets.

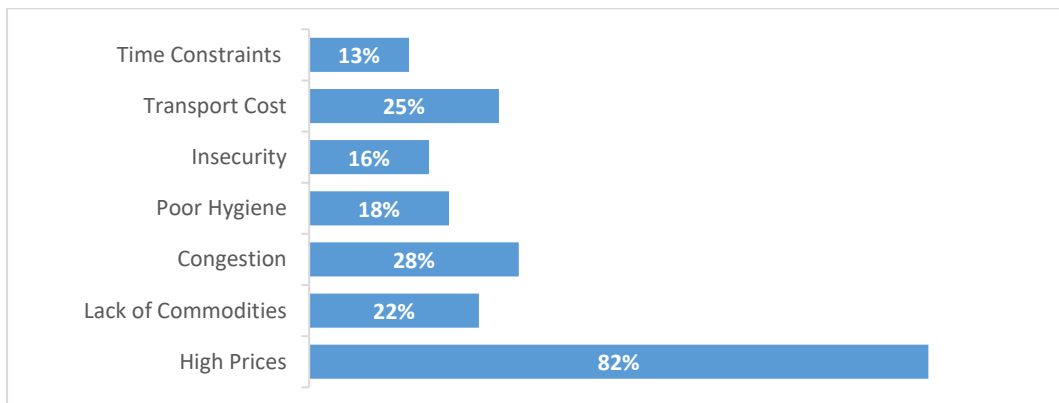


Figure 8. Barriers faced while accessing food commodities in the urban markets.

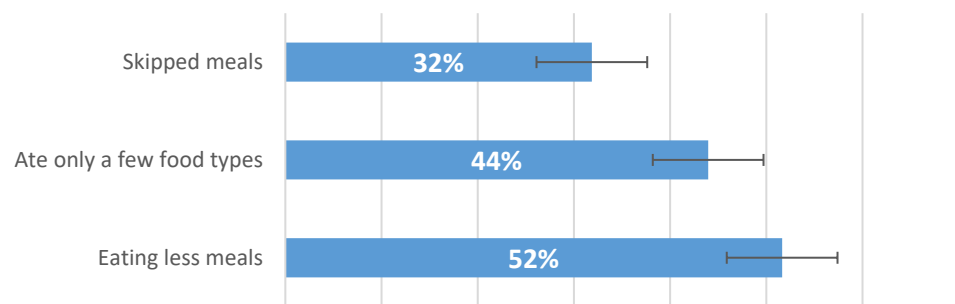


Figure 9. Price fluctuations over the months in year 2020 in the markets.

### 3.4. Effects of COVID-19 to the Consumers Food Availability and Access

Consumers reported to have purchased rice (65% of respondents), maize (65%), millet (41%), sorghum (41%), beans (85%), peas (65%), green grams (78%), cabbage (84%) and

potatoes (81%) since March 2020 (Figure 10). A total of 78% of the consumers indicated that they had experienced a reduction in the food available for consumption at their homes since March 2020. Further, 75% observed that there has been a decrease in the quantity of food commodities consumed at their homes due to COVID-19. A total of 65% showed that there has been a decrease in the diversity of food commodities consumed at home. On the foods purchased from markets, 75% of the consumers indicated that the market hygiene was good, while only 25% indicated that it was bad. About the cleanliness of food commodities, 95% of the consumers reported that the food sold in the markets was clean. Consumers reported that they ate less meals (52%), ate only fewer food types (44%) and skipped meals (32%) as coping mechanisms during the pandemic. Other coping strategies mentioned were borrowing from neighbours, shifts to less preferred foods, buying food on credit, sourcing food supplies from relatives in rural homes and consuming what was in season due to lower prices.



**Figure 10.** Coping mechanisms for food shortages.

#### Market Prices and Changes during COVID-19 Pandemic

The study considered different food cereals and commodity types commonly consumed by households/families and mostly locally sold out in the urban food markets/stores. The food commodities sampled were rice, dry maize, millet, sorghum, peas, Canadian beans, rose coco beans, mwitemania beans, green grams, cabbages and potatoes. Out of the list, there were no market prices available for peas and sorghum, hence they were not included in our analysis. During the COVID-19 pandemic season, the prices of all the commodities sampled were not recorded at some point for a period of 6 months in the year 2020, hence the gap in the trend. The main reason was the COVID-19 restriction in the markets but also the unavailability of the commodity at the market. There was no statistically significant difference in price per kilogram at  $p \leq 0.05$  among and between months for the three years (2017, 2018 and 2019) for all the crops that had all the data (Table 4). There was statistically significant difference in quantities in kilograms between 2017 and 2018 (adjusted  $p = 0.0000379$ ) and between 2018 and 2019 (Adjusted  $p = 0.0075766$ ) for dry maize. There was no difference between 2017 and 2019. Additionally, for sorghum, there was a statistically significant difference in prices per kilogram between 2018 and 2019 (adjusted  $p$  value = 0.0148019). Further, for grams, the difference in price per kilogram was statistically significant between 2017 and 2019 (adjusted  $p$  value = 0.047904) and between 2018 and 2019 (adjusted  $p$  value = 0.0115987). There was no difference between 2017 and 2018.

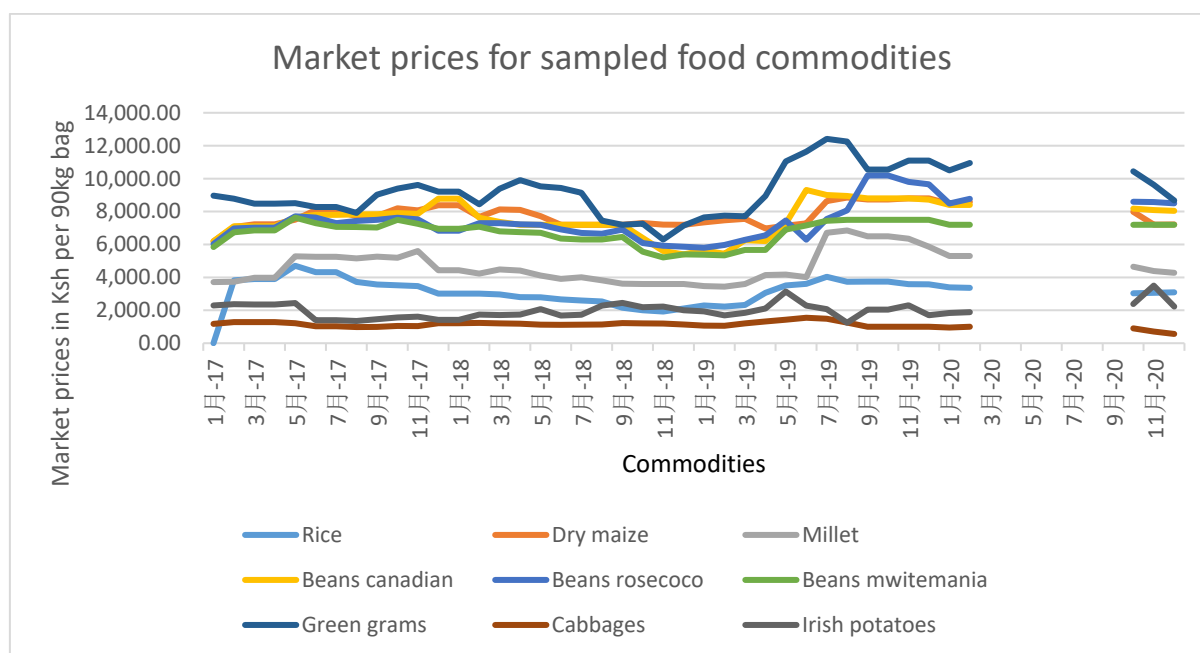
According to the data recorded, the price of cabbages was almost constant throughout the seasons of the year, with little change in the price curve (Figure 11). The lowest market price for cabbages was USD 4.81 (Ksh 564) per 90 kg bag in the month of December 2020, hence making it the overall lowest in price for the sampled commodities. The other commodity prices were not constant and kept changing throughout the year at different seasonality where in December 2018, there was a notable observation of the commodity market prices rising to approximately December 2019. In July 2019, a bag of 90 kg bag green grams was selling at USD 105.98 (Ksh 12,416), and this was the highest price hike ever recorded throughout the sampled period. At around the same season in June 2019, millet prices also rose from USD 38.41 (Ksh 4500) to USD 57.29 (Ksh 6712) per 90 kg bag in

July 2019, and rose again higher to USD 58.47 (Ksh 6850) in August 2019 before gradually dropping its price down to USD 36.53 (Ksh 4280) by December 2020. The above-mentioned price hike could have been a result of the demand and supply curve during the season.

**Table 4.** Descriptive statistics of prices of various crops per kilogram in Kenya Shillings for a period of 3 years (2017–2019).

Year *	2017				2018				2019				2020			
Crop	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Grams	97.2 <sup>a</sup>	5.6	88.0	106.8	93.0 <sup>ab</sup>	13.6	70.0	110.1	113.6 <sup>c</sup>	19.6	84.9	138.0	111.4	10.0	96.3	121.7
Millet	84.7	6.9	68.8	93.2	83.8	4.9	80.0	93.2	89.2	8.7	77.4	98.3	87.0	6.8	80.0	95.4
Beans Canadian	84.2	7.1	68.8	97.6	78.1	9.9	60.0	97.6	86.3	16.5	60.4	103.5	90.9	1.5	89.3	93.3
Beans Rose Coco	80.2	5.3	67.0	85.6	74.9	5.8	65.2	81.0	86.9	19.1	64.4	113.2	95.7	1.1	94.4	97.4
Beans Mwiternia	77.8	5.0	64.9	84.8	70.3	6.9	57.9	78.7	75.0	10.4	59.3	83.3	80.0	0.0	80.0	80.0
Sorghum	52.6 <sup>a</sup>	7.9	41.3	62.2	44.3 <sup>ab</sup>	3.8	40.0	49.8	57.0 <sup>ac</sup>	15.8	38.2	76.1	53.0	5.3	47.6	58.9
Dry Maize	41.9 <sup>a</sup>	5.6	33.5	52.3	28.3 <sup>b</sup>	4.5	21.4	33.5	36.5 <sup>a</sup>	7.2	24.7	44.8	34.5	1.7	33.0	37.4
Potatoes	20.4	5.2	15.0	27.1	21.5	3.5	15.7	27.3	22.6	5.0	13.8	34.9	28.6	9.2	20.9	44.5
Cabbages	12.6	1.3	10.9	14.3	13.1	0.5	12.4	13.7	13.3	2.3	11.1	17.2	9.3	2.1	6.3	11.1

Means on the same row with different superscript letters are statistically significantly different at  $p \leq 0.05$ .  
 \* During the COVID-19 pandemic season, the prices of all the commodities sampled were not recorded at some point for a period of 6 months (March to September) in the year 2020, hence the gap in the trend.



**Figure 11.** Changes in market prices for food commodities sold in Nairobi (2017–2020). 月 means month.

Finally, when the COVID-19 pandemic was registered in the country in March 2020, the food commodity prices seemed still to be high, although the commodities market prices data was not captured at some months. Although there seemed to be several clearly known factors which could have contributed to the food prices hike, including the movement restriction resulting in inaccessibility, the injunction of curfew hours, closed institutions leading to children and adults being at home and weather-based seasonality among others. Looking at the past months of the price trend, there was a high possibility of prices variation changes pattern, although it was not clear to what extent, but as from October 2020, most of the commodity prices started going down, apart from the price of Irish potatoes, which hiked in November 2020 to USD 29.88 (Ksh 3500) per 90 kg bag and later that month started going down, recording a selling price of USD 19.03 (Ksh 2229) in December 2020 per 90 kg bag.

From the findings, COVID-19 control measures were skewed towards limiting social interaction as well as limiting the number of hours that the population is working. While the measures have largely been helpful at controlling the spread of the virus, the measures may have affected food supplies and prices, especially in market-dependent urban areas.

## 4. Discussion

### 4.1. COVID-19 Influence on Market Food Access and Food Security

Food access has been jeopardised by the COVID-19 pandemic, mostly through the loss of assets and income that discriminates the capacity to purchase food in the market [34]. Further, low-income households spend approximately 70% of their earnings on food, and their access to financial markets is limited, making their food security particularly vulnerable to income shocks. Approximately 78% of households in Kenya were reported to be food secure and four out of five (79%) of households indicated that there was an increase in food prices due to the COVID-19 pandemic [35]. However, 78% of households reported having no challenges in accessing the market/grocery store to purchase food items. A report by the 2019 Kenya Food Security Steering group and Short Rains Assessment shows that nearly 1.3 million people in Kenya are currently experiencing Crisis (IPC3) or worse levels of food insecurity, accounting for a reduction from approximated 2.6 million people that require assistance in late 2019, which again drastically increased in 2020 [36]. The Integrated Food Security Phase Classification (IPC) is a standard tool that classifies the severity and magnitude of acute food insecurity.

In the first few months of COVID-19, there were reports of main direct effects of the pandemic, which had immense impact on employment, income and a reduction in the purchasing power of the affected populations due to the loss of jobs and livelihoods influenced by the preventive measures that were issued by national governments [37]. Indeed, the pandemic containment measures severely constrained the movement of goods, people and services within and without borders, thereby curtailing sufficient supplies agricultural commodities to markets and increased food prices. The hardest hit were the marginalised urban and rural communities that lost incomes with the direct impact on the availability of their food. A study conducted in the USA revealed that the COVID-19 pandemic increased food insecurity in a number of college students [38].

Generally, food prices strongly impact on the livelihoods and dietary choices of farmers, traders, processors and consumers. If markets are constricted, prices for food commodities become sensitive to shocks, including bad harvest or, in today's context, supply disruptions caused by COVID-19 [39].

Fluctuations with increases in food commodity prices can expose populations and households at risk of being food insecure especially for low-income earners. The results demonstrate a reduction in volumes of sales for the traders in the selected markets and a confirmation of reduced consumption in households. The adoption of severe food shortage coping mechanisms such as skipping meals, reduced food portions, borrowing from neighbours are indicative of reduced household incomes through the shocks instigated by the pandemic. The severe coping mechanisms may have been more common among low-income households, especially daily wage earners unable to work from home and without any savings [40].

The restrictive control measures that were enforced in response to the pandemic have had severe negative unintended consequences for food and nutritional security for urban households by inhibiting the proper functioning of food supply chains. As evidenced by the results, food prices have skyrocketed with a reduced number of households able to sustain uninterrupted food consumption trends. The study findings provide a glimpse on the extent that COVID-19 has impacted market trader and consumer households in regard to skyrocketing food prices for households that have been impoverished through the loss of incomes and health care costs directly related to the pandemic.

#### 4.2. COVID-19 Impact on Food Market Prices

The increased prices of maize and millet is because they are important commodities for Kenyan consumers. Most consumers eat ugali (made from either maize or millet) or make porridge. Therefore, the demand of these commodities is unlikely to decrease as a result of the change in price. In addition, the price changes could have been attributed by food supply shortages due to disruptions to transportations or hoarding and the panic buying of consumers to reduce shopping trips to the market given the uncertainty of the pandemic at the time [41]. Similarly, a study conducted in India also showed an increase in the prices of essential commodities due to the COVID-19 pandemic [32]. According to the literature review, the increase in commodity prices could be influenced by either a demand or shortage in supply as well as the structure and institutions of a country's economy. Moreover, it also depends on the nature of the food commodity; whether it is locally produced or imported, a luxury or important commodity or perishable or non-perishable [16]. The decrease in the prices of cabbages and potatoes is related to their perishable and semi-perishable natures, respectively, and production. Notably, the supply in markets for both the cabbages and potatoes was high due to high production arising from sufficient rains during the COVID-19 pandemic. However, the COVID-19 lockdown measures, restricted movement of consumers resulting in an oversupply in the market. Thus, to avoid losses, most of the sellers resorted to selling at lower retail prices. Our findings corroborate with previous research [42], which reported a decrease in retail prices of semi-perishables as influenced by COVID-19 pandemic.

#### 4.3. COVID-19 Impacts on Food Supply Chains

At the onset of the pandemic, there was minimal understanding of the novel coronavirus, its potential severity and the duration it would take to be controlled [43]. To contain the virus, the World Health Organization (WHO) recommended drastic containment measures, such as hand washing, social distancing and the wearing of face masks. This often led to the adoption of measures, such as the temporary closure of crowded institutions, business closures, remote working, suspension of international and domestic flights and home confinement in extreme cases. These measures had significant spill-over effects on food supply chains with the potential of causing a global food crisis [44]. According to Hassen and others [45], the effects of COVID-19 will differ from country to country based on levels of socioeconomic development and local epidemiological situation with logistics interruptions and disruptions in food supply chains and limited access to markets and significant increases in food loss and waste. The April–June lockdown in Kenya could have determined a significant decrease in GDP and household income, which have then translated into a lower demand for food commodities [46]. On supply, the resultant restrictive control measures that were enforced in response to the pandemic greatly reduced the mobility of people, goods and services, and severely reduced labour availability in the agricultural sector, thereby inhibiting the proper functioning of food supply chains, disrupting cross border trade and limiting market access for both farmers and traders [47].

Markets contribute to the three pillars of food security, namely food availability, accessibility and utilisation. The COVID-19 pandemic affected a number of food system drivers from production to marketing and food commodity prices, which greatly influenced the affordability by consumers [28,48]. Food availability depends on producers who must be able to buy inputs for the production of food, and regions in the country normally buy and sell from each other to ensure that enough food is available, especially in urban markets. Food prices in the market determine whether a household's income is enough to buy an adequate quantity and quality of food [49]. Similarly, the movement of food through markets from one location to another, from surplus to deficit areas and across borders, usually helps to ensure stable food supplies over time and space. Adequate market information is required to ensure the availability, access and utilisation of food leading to acceptable food security. Market information plays an essential role in policy decisions and food allocation, as well as food security analysis. Market inaccessibility, especially for highly perishable



horticultural foods, led to unwarranted and unprecedented food waste, food shortages in market-dependent regions and a significant increase in food prices. However, Dev-ereux and others [27] opine that despite the interruptions in the food supply chains, food availability was minimally compromised, especially considering that food retail outlets remained open and consumers were able to restock their food supplies. Our findings on the coping strategies included the change in dietary patterns, reliance on savings, eating less diverse diets, meal skipping and eating reduced food portions in response to the COVID-19 pandemic [50,51]. COVID-19 has influenced food purchase patterns with consumers being more selective on where and how they buy their food [52,53]. At the height of the pandemic in Kenya, roadside open-air markets mushroomed as people tried to cope with job losses or earn extra income through food sales. The markets were mainly operated by the middle class, often selling food products from their vehicles, and would often do home deliveries driven by shifts in consumers behaviour and preferences to reduce social exposure. The substitution of food shopping trends greatly affected open air market traders as they grappled with reduced consumer buyers visiting the markets and increased competition from new entrant roadside traders [51]. Online shopping has flourished as the pandemic accelerated a digital revolution, with more consumers placing online orders and more traders continue to setup online shopping channels with an option of home deliveries.

## 5. Conclusions and Policy Implications

The study findings show that the outbreak of COVID-19 pandemic affected food supply and consumption of food commodities among the urban households. On the market supply side, there was notable increase in food prices for major food staples in the markets surveyed. The increase in prices was associated with declining food supplies from the source markets due to travel restrictions. Notably, the price changes before and after the COVID-19 was quite substantial affecting consumer purchasing power. The reduction in demand for food commodities by consumers was attributed to reduced incomes and customers shying away from visiting the market out of fear of contracting the virus. The reduction in the quantity and diversity of the food consumed at home has adverse effects on household nutritional status, especially for children in the informal urban settlements. The results have critical relevance to policymakers for consideration in the enforcement of additional pandemic control protocols. The results should, therefore, inform actions to assure protection of urban livelihoods and the supply of adequate and affordable quality food to the population. A strong policy framework that prevents food price increases should be established by the government. During a crisis, the government should take necessary policy actions to stabilise food prices through the supply of staple foods to the markets from the public distribution system. These findings have a great impact on the welfare of farmers and consumers in the country. From a policy perspective, the price drop in cabbages and potatoes in the beginning of the pandemic shows the urgent need for investment in warehouses, cold storage and processing facilities in the country to minimise the loss of income by small holder farmers as a result of unexpected health and market shocks.

## 6. Limitations and Recommendations for Future Research

Despite insightful findings, two limitations were noted, including few essential commodities and a smaller sample, particularly for perishables. In addition, the study did not consider the whole supply chain. Identifying the factors of erratic price behaviour in a value chain during a crisis would provide more insights to inform policymakers in designing an effective price stabilisation policy.

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**Institutional Review Board Statement:** This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the University of Nairobi, Kenya (KNH-UON ERC application reference P447/06/2021) and Warwick University in the UK (application reference HSSREC 154/20-).

**Informed Consent Statement:** All human subjects gave their informed consent for inclusion before they participated in the study.

**Data Availability Statement:** Not applicable.

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## References

1. Global Hunger Index (GHI). One Decade to Zero Hunger. Linking Health and Sustainable Food Systems. GHI. 2020. Available online: <https://www.globalhungerindex.org/pdf/en/2020.pdf> (accessed on 15 June 2022).
2. FAO; IFAD; UNICEF; WFP; WHO. *The State of Food Security and Nutrition in the World 2021: Transforming Food Systems for Food Security, Improved Nutrition and Affordable Healthy Diets for All*; FAO: Rome, Italy, 2021. Available online: <https://www.fao.org/publications/sofi/2021/en/> (accessed on 3 June 2022). [CrossRef]
3. Global Hunger Index (GHI). Hunger and Food Systems in Conflict Settings. GHI. 2021. Available online: <https://www.globalhungerindex.org/pdf/en/2021.pdf> (accessed on 10 June 2022).
4. Erokhin, V.; Gao, T. Impacts of COVID-19 on Trade and Economic Aspects of Food Security: Evidence from 45 Developing Countries. *Int. J. Environ. Res. Public Health* **2020**, *17*, 5775. [CrossRef] [PubMed]
5. World Food Programme (WFP). Annual Performance Report for 2020. Annual Session in Rome. 21–25 June 2021. Available online: [https://docs.wfp.org/api/documents/WFP-0000127445/download/?\\_ga=2.44182499.614536672.1654867885-408679399.1654867885](https://docs.wfp.org/api/documents/WFP-0000127445/download/?_ga=2.44182499.614536672.1654867885-408679399.1654867885) (accessed on 12 June 2022).
6. World Food Programme (WFP); Food and Agriculture Organization (FAO). Hunger Hotspots. FAO-WFP Early Warnings on Acute Food Insecurity: February to May 2022 Outlook. Rome. Available online: <https://www.fao.org/documents/card/en/c/b8376en> (accessed on 2 June 2022).
7. Dometita, M.L.M. Beneath the Dryland: Kenya Drought Gender Analysis. Oxfam International. 2017. Available online: <https://oxfamlibrary.openrepository.com/handle/10546/620403> (accessed on 7 June 2022).
8. De Groote, H.; Kimenju, S.C.; Munyua, B.; Palmas, S.; Kassie, M.; Bruce, A. Spread and impact of fall armyworm (*Spodoptera frugiperda* JE Smith) in maize production areas of Kenya. *Agric. Ecosyst. Environ.* **2020**, *292*, 106804. [CrossRef]
9. Korir, L.; Rizov, M.; Ruto, E.; Walsh, P.P. Household Vulnerability to Food Insecurity and the Regional Food Insecurity Gap in Kenya. *Sustainability* **2021**, *13*, 9022. [CrossRef]
10. Amare, M.; Abay, K.A.; Tiberti, L.; Chamberlin, J. COVID-19 and Food Security: Panel Data Evidence from Nigeria. *Food Policy* **2021**, *101*, 102099. [CrossRef] [PubMed]
11. Schmidhuber, J. COVID-19: From a Global Health Crisis to a Global Food Crisis? Food and Agriculture Organization of the United Nations. 2020. Available online: <https://www.fao.org/3/ca9509en/covid.pdf> (accessed on 5 June 2022).
12. Carreras, M.; Saha, A.; Thompson, J. *Rapid Assessment of the Impact of COVID-19 on Food Systems and Rural Livelihoods in Sub-Saharan Africa. APRA COVID-19 Synthesis Report 2*; Future Agricultures Consortium: Brighton, UK, 2020. [CrossRef]
13. Reardon, T.; Bellemare, M.F.; Zilberman, D. How COVID-19 may disrupt food supply chains in developing countries. In *COVID-19 and Global Food Security*; Swinnen, J., McDermott, J., Eds.; Part Five: Supply chains; International Food Policy Research Institute (IFPRI): Washington, DC, USA, 2020; Chapter 17; pp. 78–80. Available online: <https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/133821/filename/134034.pdf> (accessed on 20 June 2022).

14. Borsellino, V.; Kaliji, S.A.; Schimmenti, E. COVID-19 Drives Consumer Behaviour and Agro-Food Markets towards Healthier and More Sustainable Patterns. *Sustainability* **2020**, *12*, 8366. [CrossRef]
15. Mogues, T. *Food Markets during COVID-19*; International Monetary Fund (IMF): Washington, DC, USA, 2020. Available online: <https://www.special-series-on-covid-19-food-markets-during-covid-19.pdf> (accessed on 10 June 2022).
16. Torero, M. Without food, there can be no exit from the pandemic. *Nature* **2020**, *580*, 588–589. Available online: <https://www.nature.com/articles/d41586-020-01181-3> (accessed on 5 January 2022). [CrossRef]
17. Mehtar, S.; Preiser, W.; Lakhe, N.A.; Bousso, A.; TamFum, J.J.M.; Kallay, O.; Seydi, M.; Zumla, A.; Nachega, J.B. Limiting the spread of COVID-19 in Africa: One size mitigation strategies do not fit all countries. *Lancet Glob. Health* **2020**, *8*, e881–e883. [CrossRef]
18. Agyei, S.K.; Isshaq, Z.; Frimpong, S.; Adam, A.M.; Bossman, A.; Asiamah, O. COVID-19 and food prices in sub-Saharan Africa. *Afr. Dev. Rev.* **2021**, *33*, S102–S113. [CrossRef]
19. FAO Coronavirus Disease 2019 (COVID-19)—Addressing the Impacts of COVID-19 in Food Crises. 2020. Available online: <http://www.fao.org/emergencies/appeals/detail/en/c/1270012/> (accessed on 13 March 2022).
20. Dzimbiri, M.N.; Mwanjawala, P.; Chilanga, E.; Munthali, G.N.C. Perceived implications of COVID-19 policy measures on food insecurity among urban residents in Blantyre Malawi. *BMC Public Health* **2022**, *22*, 522. [CrossRef]
21. Eichenbaum, S.M.; Rebelo, S.; Trabandt, M. *The Macroeconomics of Epidemics*; NBER Working Paper, No. 26882 Massachusetts, Cambridge, USA, 2020. Available online: [https://www.nber.org/system/files/working\\_papers/w26882/revisions/w26882.rev1.pdf](https://www.nber.org/system/files/working_papers/w26882/revisions/w26882.rev1.pdf) (accessed on 11 June 2022).
22. Resnick, D. COVID-19 lockdowns threaten Africa’s vital informal urban food trade. In *COVID-19 and Global Food Security*; Swinnen, J., McDermott, J., Eds.; Part Four: Food trade; International Food Policy Research Institute (IFPRI): Washington, DC, USA, 2020; Chapter 16; pp. 73–74. [CrossRef]
23. FAO. *Good Food Security Governance: The Crucial Premise to the Twin-Track Approach*; Background Paper for FAO, Workshop; FAO: Rome, Italy, 2011. Available online: [http://www.fao.org/righttofood/project\\_files/goodFSgovernance/FoodSecurityGovernanceWorkshop\\_backgroundpaper.pdf](http://www.fao.org/righttofood/project_files/goodFSgovernance/FoodSecurityGovernanceWorkshop_backgroundpaper.pdf) (accessed on 2 May 2022).
24. Government of Kenya (GoK). Presidential Address on the State Interventions to Cushion Kenyans against Economic Effects of COVID-19 Pandemic on 25 March 2020. Available online: <https://www.president.go.ke/2020/03/25/presidential-address-on-the-state-interventions-to-cushion-kenyans-against-economic-effects-of-covid-19-pandemic-on-25th-march-2020/> (accessed on 12 June 2022).
25. Brand, S.P.C.; Ojal, J.; Aziza, R.; Were, V.; Okiro, E.A.; Kombe, I.K.; Mburu, C.; Ogero, M.; Agweyu, A.; Warimwe, G.M.; et al. COVID-19 Transmission Dynamics Underlying Epidemic Waves in Kenya. *Science* **2021**, *374*, 989–994. [CrossRef]
26. Arndt, C.; Davies, R.; Sherwin, G.; Harris, L.; Makrelov, K.; Robinson, S.; Levy, S.; Simbanegavi, W.; Seventer, D.; Anderson, L. COVID-19 lockdowns, income distribution, and food security: An analysis for South Africa. *Glob. Food Secur.* **2020**, *26*, 100410. [CrossRef] [PubMed]
27. Devereux, S.; Béné, C.; Hoddinott, J. Conceptualising COVID-19’s impacts on household food security. *Food Secur.* **2020**, *12*, 769–772. [CrossRef] [PubMed]
28. Harris, J.; Depenbusch, L.; Arshad, A.; Nair, R.M.; Ramasamy, S. Food system disruption: Initial livelihood and dietary effects of COVID-19 on vegetable producers in India. *Food Secur.* **2020**, *12*, 841–851. [CrossRef] [PubMed]
29. Hirvonen, K.; Minten, B.; Mohammed, B.; Tamru, S. Food prices and marketing margins during the COVID-19 pandemic: Evidence from vegetable value chains in Ethiopia. *Agric. Econ.* **2021**, *52*, 407–421. [CrossRef] [PubMed]
30. Mahajan, K.; Tomar, S. COVID-19 and supply chain disruption: Evidence from food markets in India. *Am. J. Agric. Econ.* **2020**, *103*, 35–52. [CrossRef]
31. Varshney, D.; Roy, D.; Meenakshi, J. Impact of COVID-19 on agricultural markets: Assessing the roles of commodity characteristics, disease caseload and market reforms. *Indian Econ. Rev.* **2020**, *55*, 83–103. [CrossRef]
32. Bairagi, S.; Mishra, A.K.; Mottaleb, K.A. Impacts of the COVID-19 pandemic on food prices: Evidence from storable and perishable commodities in India. *PLoS ONE* **2022**, *17*, e0264355. [CrossRef]
33. Narayanan, S.; Saha, S. Urban Food Markets and the COVID-19 lockdown in India. *Glob. Food Secur.* **2021**, *29*, 100515. [CrossRef]
34. Laborde, D.; Martin, W.; Swinnen, J.; Vos, R. COVID-19 risks to global food security. *Science* **2020**, *369*, 500–502. [CrossRef]
35. Kenya National Bureau of Statistics (KNBS). *Survey on Socio Economic Impact of COVID-19 on Households Report, Wave Two*; Kenya National Bureau of Statistics: Nairobi, Kenya, 2020. Available online: <https://www.knbs.or.ke/download/survey-on-socio-economic-impact-of-covid-19-on-households-report-wave-two/#> (accessed on 4 July 2022).
36. USAID. Food Assistance Fact Sheet Kenya. 2020. Available online: [https://www.usaid.gov/sites/default/files/documents/1866/FP\\_Fact\\_Sheet\\_Kenya.pdf](https://www.usaid.gov/sites/default/files/documents/1866/FP_Fact_Sheet_Kenya.pdf) (accessed on 20 June 2022).
37. Béné, C.; Bakker, D.; Chavarro, M.J.; Even, B.; Melo, J.; Sonneveld, A. Global assessment of the impacts of COVID-19 on food security. *Glob. Food Secur.* **2021**, *31*, 100575. [CrossRef]
38. Ahmed, T.; Ilieva, R.T.; Shane, J.; Reader, S.; Aleong, C.; Wong, H.Y.; Chu, C.; Brusche, D.; Jiang, K.; Lopez, D.; et al. Developing Crisis in Hunger: Food Insecurity within 3 Public Colleges before and during the COVID-19 Pandemic. *J. Hunger. Environ. Nutr.* **2022**, *17*, 1–20. [CrossRef]
39. Ceballos, F.; Kannan, S.; Kramer, B. Impacts of a national lockdown on smallholder farmers’ income and food security: Empirical evidence from two states in India. *World Dev.* **2020**, *136*, 105069. [CrossRef]

40. Gupta, A.; Zhu, H.; Doan, M.K.; Michuda, A.; Majumder, B. Economic Impacts of the COVID–19 Lockdown in a Remittance-Dependent Region. *Am. J. Agric. Econ.* **2021**, *103*, 466–485. [[CrossRef](#)]
41. Thakur, V.; Kiran, P. Impact of the Covid-19 Pandemic Outbreak on Panic Buying Behavior in the FMCG Sector. *Ushus J. Bus. Manag.* **2021**, *20*, 71–90. [[CrossRef](#)]
42. Ali, J.; Khan, W. Impact of COVID-19 pandemic on agricultural wholesale prices in India: A comparative analysis across the phases of the lockdown. *J. Public Aff.* **2020**, *20*, e2402. [[CrossRef](#)]
43. David, O.O.; Ireteyayo, A.R.; Abiodun, O.O.; Aborode, A.T.; Ayodele, T.I. Effects of Pandemic on Economy in Sub-Saharan Africa: A Case of Coronavirus (COVID-19). *J. Econ. Manag. Trade* **2020**, *26*, 647–659. [[CrossRef](#)]
44. Leone, L.A.; Fleischhacker, S.; Anderson-Steeves, B.; Harper, K.; Winkler, M.; Racine, E.; Baquero, B.; Gittelsohn, J. Healthy Food Retail during the COVID-19 Pandemic: Challenges and Future Directions. *Int. J. Environ. Res. Public Health* **2020**, *17*, 7397. [[CrossRef](#)]
45. Ben Hassen, T.; El Bilali, H.; Allahyari, M.S. Impact of COVID-19 on Food Behavior and Consumption in Qatar. *Sustainability* **2020**, *12*, 6973. [[CrossRef](#)]
46. Nechifor, V.; Ramos, M.P.; Ferrari, E.; Laichena, J.; Kihui, E.; Omanyo, D.; Musamali, R.; Kiriga, B. Food security and welfare changes under COVID-19 in Sub-Saharan Africa: Impacts and responses in Kenya. *Glob. Food Secur.* **2021**, *28*, 100514. [[CrossRef](#)]
47. Ribeiro-Silva, R.C.; Pereira, M.; Campello, T.; Aragão, É.; Guimarães, J.M.M.; Ferreira, A.J.; Barreto, M.L.; Santos, S.M.C.D. COVID-19 pandemic implications for food and nutrition security in Brazil. *Cienc. Saude Coletiva* **2020**, *25*, 3421–3430. [[CrossRef](#)]
48. GAIN (Global Alliance for Improved Nutrition). Impact of COVID-19 on Food Systems: A Situation Report (edition 1–3). 2020. Available online: <https://www.gainhealth.org/sites/default/files/publications/documents/impact-of-covid-19-on-food-system-a-situation-report-edition-3.pdf> (accessed on 14 June 2021).
49. Niles, M.T.; Bertmann, F.; Belarmino, E.H.; Wentworth, T.; Biehl, E.; Neff, R. The Early Food Insecurity Impacts of COVID-19. *Nutrients* **2020**, *12*, 2096. [[CrossRef](#)] [[PubMed](#)]
50. Amendah, D.D.; Buigut, S.; Mohamed, S. Coping Strategies among Urban Poor: Evidence from Nairobi, Kenya. *PLoS ONE* **2014**, *9*, e83428. [[CrossRef](#)] [[PubMed](#)]
51. Kansime, M.K.; Tambo, J.A.; Mugambi, I.; Bundi, M.; Kara, A.; Owuor, C. COVID-19 implications on household income and food security in Kenya and Uganda: Findings from a rapid assessment. *World Dev.* **2021**, *137*, 105199. [[CrossRef](#)]
52. Kumar, P.; Singh, S.S.; Pandey, A.K.; Singh, R.K.; Srivastava, P.K.; Kumar, M.; Dubey, S.; Sah, U.; Nandan, R.; Singh, S.K.; et al. Multi-level impacts of the COVID-19 lockdown on agricultural systems in India: The case of Uttar Pradesh. *Agric. Syst.* **2021**, *187*, 103027. [[CrossRef](#)]
53. Owens, C.; Weaver, L.J.; Kaiser, B.N.; Kalk, T.; Tesema, F.; Tessema, F.; Hadley, C. Context Matters for Food Security: Multi-Sited Evidence of Shared Cultural Models of Food Consumption. *Ecol. Food Nutr.* **2022**, *61*, 162–181. [[CrossRef](#)] [[PubMed](#)]

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