

**COVID-19 MEASURES EFFECT ON FOOD CONSUMPTION PATTERNS FOR
URBAN LOW-INCOME HOUSEHOLDS IN NAKURU COUNTY, KENYA**

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Master of Science Degree in Agricultural and Applied Economics of Egerton University**

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DECLARATION AND RECOMMENDATION

Declaration

I declare this research thesis is my original work and has not been presented to this University or any other for the award of a degree.

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Recommendation

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DEDICATION

This thesis is dedicated to my loving parents, Samuel Mworio and Jane Mworio, who have always encouraged me to follow my dreams and passions. Their unwavering support and belief in me through this long academic journey have been invaluable. I also dedicate this work to my advisor and mentor, Dr. Dickson Okello, whose wisdom, guidance, and commitment to academic excellence have shaped me into the scholar I am today. His insights and feedback challenged me to dig deeper and produce my best work. Finally, I dedicate this thesis to my dear friends Karwitha, Inyanji, and Talaam, who provided the moral support, comic relief, and caring ears I needed during stressful times. Their friendship has meant the world to me. Completing this project would not have been possible without these special people's faith, love, and support. This accomplishment is as much theirs as it is mine. From the bottom of my heart, I dedicate my thesis to all of you.

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ABSTRACT

The COVID-19 pandemic has disrupted food chains worldwide. The Kenyan government initiated measures to curb the spread of the novel disease. Some measures include lockdown, a ban on social gatherings, and the closure of institutions like school restaurants and eateries, potentially changing households' food consumption patterns. This study contributes towards improving the livelihood of low-income households in Nakuru County by assessing the effects of COVID-19 measures on food consumption patterns in Nakuru County. Specifically, the study aimed to determine the changes in consumption patterns due to COVID-19 measures, assess the factors influencing changes in consumption patterns, and determine COVID-19 measures' effect on food consumption patterns. Data was collected through structured questionnaire interviews. Multi-stage sampling was used to select a sample of 246 Household respondents in Kaptembwa, Rhonda, and Kapkures wards residents in Nakuru West Sub-county. Paired-sample t-tests were undertaken to determine significant differences in the mean level of shopping frequencies and food consumption of different food categories during the pandemic and before. The study used the ordered logistic regression model to assess the factors influencing change in food consumption patterns. The effect of COVID-19 measures on FCP was determined through the multinomial endogenous switching regression model. Study results indicated a significant decrease in household consumption of meat, dairy, fruits, snacks and wheat products (p-values <0.001). Findings also revealed that there was a significant decrease in shopping frequencies of readymade food, snacks and meat products (p-values <0.001) and a significant increase in shopping frequencies of vegetables and wheat products (p-values <0.001 and fruits (p-values <0.05). The factors including HFDM age, Change in food prices, income changes and change in the person in charge of food before COVID-19, fruits and vegetables shopping frequency, and the ban on social gatherings significantly affected the decrease in food consumption patterns while money spent on food and movement restrictions significantly affected an increase in FCPs. Out of the sampled 246 households. 63.01% were affected negatively, 7.32% had no effect. 6.10% experienced positive effects, while all other partial combinations had a negative effect on FCP. Recommendations drawn from the study include subsidies of staple foods during a crisis, educational programs and effective communication of proposed measures to spur the local economy by enabling local production and sourcing of materials required during a crisis.

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LIST OF ABBREVIATIONS AND ACRONYMS

ATT	Average Treatment Effect on the Treated
COVID-19	Corona Virus Disease of 2019
FAO	Food and Agriculture Organization of the United Nations
FCP	Food Consumption Patterns
FFV	Fresh Fruits and Vegetables
HDDS	Household Dietary Diversity Score
HFDM	Household Food Decision Maker
HOH	Head of Household
ILO	International Labour Organization
KNBS	Kenya National Bureau of Statistics
MESRM	Multinomial Endogenous Switching Regression Model
MOH	Ministry of Health
SSA	Sub-Saharan Africa
STATA	Statistical Software Package
UNCTAD	United Nations Conference for Trade and Development
VIF	Variance Inflation Factor
WB	World Bank
WFP	World Food Program
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Food consumption is key to the well-being of the planet. Since the outbreak of the COVID-19 pandemic, measures implemented triggered an economic crisis, resulting in a dramatic loss of livelihoods and income globally (World Bank, 2020). The reduction in purchasing ability due to lost income significantly affected food security and nutrition as food consumption patterns and shopping frequencies changed. This is because income sources are vital to determining household access to food, especially in urban households employed in the informal sector (Demeke *et al.*, 2020).

Developing countries like Kenya were deeply affected by COVID-19 as they were already entering a recession by late 2019 (UNCTAD, 2020). The World Bank estimated that most urban residents would be pushed into extreme poverty by the end of 2020 due to COVID-19 shocks (Al-Samarrai *et al.*, 2020). The pandemic vulnerabilities affected urban dwellers, especially low-income households, more than their rural counterparts. It was estimated that only 26% of urban populations in major towns in Kenya are in salaried employment, with only one individual in every five households maintaining a stable income amid the COVID-19 pandemic, while others are in casual jobs and informal trades (Orkin, 2020). Notably, a sizeable segment of the salary earning population lost their livelihoods due to job layoffs and reduced wages (Council, 2020). In addition, non-essential businesses were closed, disrupting business hours and thereby influencing access to essential food services (Kansiime *et al.*, 2021).

Border restrictions within Kenya and the neighbouring countries limited the flow of goods and escalated the likelihood of food shortages due to impaired supply chains, including labour shortages. Furthermore, the partial and comprehensive lockdown measures introduced at regional and national levels, including the closure of schools, institutions, workplaces, non-essential shops and restaurants, banned events, and mobility restrictions, changed the way people accessed their food, the different types of food they consume, and how the food is prepared (Janssen *et al.*, 2021). Most of the tough restrictive measures were implemented by the national police service to ensure strict adherence. However, the restrictive measures were strictly followed without any push due to fear of getting the virus.

Furthermore, some COVID-19 measures served as obstacles to food distribution to vulnerable populations. For example, programs that provide main meals for school children were not operational during confinement. Additionally, quarantine due to illness or coming into contact with infected people may have further restricted people's access to food (WHO, 2020).

COVID-19 pandemic measures adversely affected urban residents' socioeconomic status, contributing to variations in food choices and eating patterns. Socioeconomic status affects lifestyle patterns such as eating habits, directly affecting individual health (Béné, 2020). The affordability of nutritious and healthy foods, including fruits and vegetables, became a significant challenge amid the pandemic. Consequently, most urban residents shifted to consuming cheaper, more convenient, and possibly unhealthy foods. This shift could lead to detrimental nutrition and health status, thus weakening the immune system and exposing one to opportunistic diseases (Shupler *et al.*, 2021).

The pandemic further caused anxiety and stress among many households, affecting eating behaviour and food choices (Mbijiwe *et al.*, 2021). Anxiety and stress are associated with unhealthy eating habits. In stressful circumstances, individuals develop food cravings for the consumption of energy-dense foods, including carbohydrates, sugar, fats, and oils, since the body triggers hyperphagia (Chopera *et al.*, 2020). Consumption of energy-dense foods gives a temporary antidepressant effect through the production of serotonin (Di Renzo *et al.*, 2020). Unhealthy eating habits could also result in morbidity and mortality, and there is a need to understand dietary practices. However, limited research studies have examined changes in eating habits among urban residents in Kenya amid the implementation of COVID-19 pandemic containment measures. This study will compare food consumption patterns before and upon the onset of the COVID-19 measures and assess the factors that lead to any change in consumption patterns.

1.2 Statement of the Problem

Since the outbreak of the COVID-19 pandemic, the government of Kenya set measures to curb the spread of the virus. These measures included a ban on social gatherings, closure of institutions like restaurants and open-air markets, closure of international borders, and restricted movements, among others. These measures significantly contributed to a substantial population of Kenyans remaining at home during the pandemic, further leading to subsequent changes in

purchase patterns. Shopping frequencies became irregular due to the closure of open-air markets and restaurants and spontaneous shopping due to the stay-home directive. Food supply chains were significantly affected, especially at the border regions, leading to a spike in demand for essential foods in urban areas, hence price volatility. In addition, household incomes were reduced because the day-to-day business was not usual. Consequently, there was a change in household food consumption patterns among households in Kenya. Considering these changes in household consumption patterns, there is little empirical evidence on consumption patterns among low-income households in Nakuru. This study provides knowledge and evidence on how the COVID-19 measures of closure of open-air markets, ban on social gatherings, and border restrictions influenced food consumption patterns.

1.3 Objectives of the Study

1.3.1 General Objective

To contribute towards improving the food resilience of urban low-income households by assessing the effects of COVID-19 measures on food consumption patterns in Nakuru County.

1.3.2 Specific Objectives

- i. To determine the changes in consumption patterns of households in Nakuru County due to COVID-19 measures.
- ii. To assess factors influencing changes in consumption patterns of households in Nakuru County.
- iii. To determine the effects of COVID-19 measures on the consumption patterns of households in Nakuru County.

1.4 Research Questions

- i. How have COVID-19 measures changed households' consumption patterns in Nakuru County?
- ii. What factors influence changes in consumption patterns of households in Nakuru County?
- iii. What effects do COVID-19 measures have on the consumption patterns of households in Nakuru County?

1.5 Justification of the Study

The changes in consumption patterns need to be studied to inform and contribute to existing knowledge on the vast and ever-changing status of food consumption patterns of low-income urban dwellers in Nakuru county. Nakuru West sub-county provides diverse low-income households, and being within the newest and fourth city perfectly serves this study. This will further contribute to the Kenyan government's vision 2030, mainly the agenda on food security, where the government targets 100% national food security, in line with the Nakuru county integrated development plan, which has provided spatial development strategies aimed at enhancing modernizing agriculture, increase food production and accelerated food availability for households.

The study aligns with the National and County Governments' principle of "food for health, nutrition and national security" and the policy statement of developing annual implementation plans towards realizing household and national food and nutrition security. In addition, the study aligns with the Maputo Declaration on agriculture and food security in Africa by informing policy on the state of food security. Findings will enlighten current food policies and provide a potential theoretical guide for research institutions/development partners to improve consumption patterns during a pandemic and contribute to food-secure households in ever-changing environments.

1.6 Scope and Limitations of the Study

The study focused on changes in household food consumption patterns caused by the COVID-19 measures. The research considered the period between March 2020 and March 2021 as the period during COVID-19 measures and 2019 as the period before the pandemic measures. Structured interviews with 246 low-income food decision-makers or household heads respondents were conducted in Nakuru West Sub-county's Kaptembwa, Rhonda, and Kapkures wards. Respondents were drawn from the population due to limited resources. As a result, the data gathered is assumed to represent Nakuru County households. Because part of the response is based on recall, some respondents may not recall as clearly as the study requires; thus, probing was used.

1.7 Definition of Terms

After COVID-19 - This is after the COVID-19 measures were implemented in Kenya after March 2020 and 2021.

Before COVID-19 - This is before the COVID-19 measures were implemented in Kenya, before March 2020 and 2019.

Coping strategies - Methods households use to deal with food access issues and meet dietary needs during periods of hardship or crisis. This can include rationing, reducing meal sizes, and substituting for cheaper foods.

Consumption patterns - Refers to the repeated arrangements of food intake characterized by types and quantities of food items and their combination in dishes and meals.

COVID-19 Measures - Policies implemented to curb the spread of novel coronavirus.

COVID-19 Pandemic - The worldwide outbreak of acute respiratory illness in humans caused by a coronavirus that produces severe symptoms and, in most cases, death. It was initially identified in China in 2019 and became a pandemic in 2020.

Food assistance - Public and private programs that provide resources (food, vouchers, funds) to help households meet their nutritional needs. This includes food stamps, school meal programs, and food banks.

Low-Income Households - These households live below an average of Kenya Shillings 200(1.90 dollars) per day.

Food supply chains – Refers to the connected network of individuals and entities involved in food production, processing, distribution, and sales. It includes farms, manufacturers, distributors, grocery stores, and restaurants.

CHAPTER TWO

LITERATURE REVIEW

2.1 Food Consumption Patterns

Food is a basic necessity for every culture and world heritage for sustained human existence. It brings about different perceptions of individuals and communities (Zlatanova *et al.*, 2015). According to Boniface and Loannides (2017), food manifestations and symbolisms are diverse, even in how it is consumed. The value of food lies in its social function, which includes but is not limited to networking, sharing, and business purposes. Furthermore, different foods are prepared for different occasions. Several scholars have pointed out that culture significantly influences food choices and consumption patterns. Culture defines how food should be prepared, cooked, and presented. However, according to Guerrero (2009), in the same cultural orientations, consumption patterns may differ due to race, sex, age, and physical activity differences.

In Kenya, due to the different cultures therein, food consumption patterns have no special dish representing all of Kenya's vast cuisine. Diverse communities have their native foods (Were, 2016). Kenyan studies show families consume at least three meals daily, with breakfast contributing the lowest caloric value to the daily diet. Sweet tea made of water, milk, tea leaves, and sugar is commonly drunk by adults. Lunch and supper serve as the main meals of the day. Maize meals are the staple food (*ugali* when cooked and *unga* when raw), and other cereals such as rice and wheat are consumed across the Kenyan regions (Holdsworth *et al.*, 2020). These carbohydrates are commonly served alongside beef, chicken stews, and vegetables. Even in cities, where people of different cultures live together, consumption patterns by working families vary according to preference and ethnicity (Bernstein *et al.*, 2003).

In low-income households, it is typical to transform rice into a beautiful mound of different colours infused with spices like saffron, turmeric, and others at gatherings like weddings, burials, and feasts. According to Simiyu (2015), 95% of this category of households serve *ugali*, with kales mostly referred to as *sukumawiki*, which means to stretch the week, eaten at least thrice a week. It is served like any other vegetable grown all over Kenya in most gardens. Because of their availability and lower prices, fruits and vegetables are consumed more during their season (Stewart *et al.*, 2015).

In Nakuru city, most food products such as potatoes, carrots, cabbage, maize, spinach, kale, and fruits are sold cheaply on market days. These products are produced within the surrounding areas of Nakuru city, while others are transported by road. Different ethnic communities occupy the town, the main ones being the Kikuyus and Kalenjins. The city dwellers and those from the suburbs access food through daily or weekly market shopping (Berggrund, 2017).

In Kenya, most households have a culture of welcoming visitors with food, especially around lunch or dinner time. It is a custom that families cook a little extra food to cater for visitors who pop in during meal time. Sometimes, visitors are offered a drink during the primary meal time, the most common one being tea, popularly known as chai, or if not yet ready, it's prepared within five to ten minutes, depending on the quantity. Visitors are expected to accept the food offered to them. Otherwise, rejecting the offer is a sign of contempt (Julier, 2013). Food also unifies a family since eating time is typically considered family time. During mealtime, household members are usually present, including the house head. At this time, family members often share their day's experiences, including family matters like children's academic progress (Cappellini & Parsons, 2012).

2.2 Food Consumption Patterns and COVID-19 Measures

COVID-19 emerged in late 2019 in the city of Wuhan, China. The novel coronavirus rapidly spread worldwide, and the World Health Organization declared it a global pandemic in March 2020 (WHO, 2020). The disease rapidly spread from country to country and across continents, leading to dramatic loss of human life (WHO, 2020) and occasioned one of the worst crises in the world's economy since the end of World War II (OECD, 2020). To mitigate the spread of the COVID-19 virus, governments implemented containment measures such as lockdowns, bans on social gatherings, cessation of movement, dusk to dawn curfew, quarantine, closure of borders and closure of institutions.

These measures led to socio-economic repercussions through disruption of economic activities, ultimately diminishing household livelihoods globally (World Bank, 2020). The pandemic resulted in job loss for both employed and self-employed individuals in the service industry, hospitality, tourism, transport, and SMEs (ILO, 2020). Epidemics negatively impact the economy at different levels of society, from country to households to individuals (Kodish *et al.*,

2019; WBG, 2016). In China, both SARS and COVID-19 comparatively affected the food consumption behaviour of the Chinese population. According to Xie *et al.* (2021), throughout the SARS pandemic, people were concerned that the virus would be spread through the air, and they generally reduced their frequency of going out and meeting each other. These crises compromised people's income activities while consumer spending dropped significantly, and access to food was severely affected. Changes in food consumption were reflected in the quantity, quality, and type of food consumed (Xie *et al.*, 2021).

The COVID-19 pandemic disrupted food supply chains worldwide. Dammeyer (2020) found that the pandemic measures completely changed people's hygiene behaviour, food choice motives and appetitive traits. The pandemic influenced consumers' eating and shopping habits, such as avoiding a meal out or a drink in a pub coupled with limited access to daily grocery shopping. These findings are in line with the discoveries of Fanelli (2021) that household expenditures, shopping frequencies and consumption patterns were affected by the pandemic measures. Consumer behaviour shifts during the pandemic were also observed in Spain, where adults consumed more fruits, vegetables, and legumes.

In contrast, red meat, alcohol, fried foods, and pastries declined compared to regular days (Rodríguez-Pérez *et al.*, 2020). According to Di Renzo *et al.* (2020), the consumption of fresh vegetables and fruits did not decline among the Italian population, regardless of the barriers to accessibility. This was similar to Buckland *et al.* (2021) findings of increased vegetable and fruit consumption in the UK. On the contrary, lower fruit and vegetable intake was recorded among the Danish population (Kartari *et al.*, 2020) and in Poland (Sidor & Rzymiski, 2020).

Lockdowns forced people to stay at home, leading to lifestyle changes. Many people had more time to cook and plan meals. Studies indicated that individuals' time devoted to food preparation and cooking had increased (Ben Hassen *et al.*, 2020; Di Renzo *et al.*, 2020; Zhang *et al.*, 2020). Home cooking is also generally associated with a lower intake of total calories, carbohydrates, fat, and sugar (Wolfson & Bleich, 2015). Consumers adopted more health-conscious trends by reducing the intake of processed foods (Zhao *et al.*, 2020). Notably, there were temporary out-of-stock situations in the food retail sector (Liu *et al.* 2020) for selected products such as flour, pasta, and disinfectants, among others. As a result, people opted for stockpiling due to the fear of the uncertain future (Poelman *et al.*, 2021). On the other hand, the mitigation measures and disease-related fear increased stress levels, causing people to increase

their food consumption (Chopera *et al.*, 2020). Research revealed higher snack consumption during lockdowns (Buckland *et al.*, 2021; Carroll *et al.*, 2020; Sidor & Rzymiski, 2020).

The impact of COVID-19 on Kenya's economy and food supply chain cannot be overemphasized. According to WBG (2016), 43% of Africa's population relies on cross-border trade, which is usually affected the most by imposed travel restrictions. Border restriction measures, especially from neighbouring countries such as Kenya-Tanzania and Kenya-Uganda borders, negatively affected fresh food supply to Kenyan markets. This can be explained by the fact that more time was needed in border screening of goods in transit as well as drivers before getting into the country to avoid further spreading the pandemic. Cessation of movement by road, air or road was directed into and out of high-risk disease-infected counties like Nairobi metropolitan, Mombasa, Kilifi, Kajiado, Nakuru and Kwale. Losses were incurred due to the logistic delays in delivering highly perishable agricultural products to the destination markets (Okoth *et al.*, 2020). Moreover, the partial closure of hotels reduced the demand for agricultural products, hence the loss of farm income for farmers who supply their produce.

In addition, Kenya's food system is heavily dominated by small, independent transporters as the link between producers and consumers. Produce markets are at the heart of urban distribution, serving consumers and smaller retailers. This traditional informal system accounts for about 90% of the market. The closure of many of these markets in the urban and peri-urban areas, accompanied by a reasonable measure to avoid crowding, disrupted food supply systems, especially for fresh produce. Low-income urban households were hardest hit since they rely on these informal food markets.

Moreover, the urban slum dwellers in densely populated slums were more vulnerable since urban areas were an entry point for the disease (Ouko *et al.*, 2020). In addition, a majority of households in urban areas depended on informal jobs characterized by low-skill labour, which required face-to-face interactions (Besart & Gaurav, 2020). As a result, the containment measures significantly impacted their livelihoods due to a subsequent reduction in their income, reduced purchasing power of essential food items, and inability to provide essentials for their families following the absence of social protection programs to cushion against loss of jobs (Shikomboleni, 2020). On the other hand, workers sent on compulsory unpaid leaves and those on pay cuts were negatively affected (Besart & Gaurav, 2020).

Through its various stakeholders, the Kenyan government established the Kenya COVID-19 Fund, an emergency cash transfer to support low-income communities. In addition, Kenya's private sector and NGOs raised funds and provided emergency cash transfers for low-income households following the loss of income due to the pandemic in order to reduce further humanitarian crises. The Kenyan government took other fiscal policy measures to cushion its citizens against the negative impacts of the pandemic. These included individual income tax reduction from 30 percent to 25 percent; corporate income tax reduction from 30 percent to 25 percent; a 100 percent tax waiver to individuals earning less than USD 240; VAT reduction from 16 percent to 14 percent; injection of a USD 10 million social protection stimulus package for the elderly and underprivileged citizens; and a temporary delisting of loan defaulters from the Credit Reference Bureau (CRB). Other measures included a reduction of the turnover tax rate from three- percent to one percent for all micro, small and medium enterprises (Wanjala, 2020).

Despite the country's efforts to provide incentives to the vulnerable population, the implementation mechanism was reported to be inadequate, untargeted, and benefitting the wrong people (Okoth *et al.*, 2020). Generally, households experienced food and nutrition insecurity, reduced income, and low purchasing power as a result of the pandemic. This was also exacerbated by the disrupted food supply chains resulting from measures the Kenyan government took to curb the spread of the COVID-19 virus. Despite this acknowledgement, there is little empirical evidence existing on the effects of the COVID-19 pandemic on household food consumption patterns in Kenya, particularly Nakuru County, a gap this study seeks to fill.

2.3 Factors Influencing Changes in Household Food Consumption Patterns

Socio-demographic factors are known to impact dietary consumption habits (Carroll *et al.*, 2020; Kansiiime *et al.*, 2021). Food preferences and dietary patterns are highly complex, personal, and influenced by individuals' psychological, sociological, economic, and sensory aspects (Tariga *et al.*, 2021). Changes in eating behaviour during the pandemic varied with people's age, body mass index, gender, and educational level (Carroll *et al.*, 2020; Di Renzo *et al.*, 2020; Huber *et al.*, 2020; Jia *et al.*, 2021; Poelman *et al.*, 2021; Rodríguez-P'erez *et al.*, 2020). During the COVID-19 pandemic, older people appeared less likely to be influenced by lockdowns than younger adults (Di Renzo *et al.*, 2020; Poelman *et al.*, 2021). However, Oyando *et al.* (2021) study in Kenya found that older people were more vulnerable to experiencing

disruption due to the pandemic than younger individuals. This was similar to the findings of Giebel *et al.* (2020) study in Uganda that showed that older people (above 60 years) lacked access to enough food, lost the little income generated from selling farm produce, and could not access healthcare or interact with family and friends due to the COVID-19 regulations. According to Coulthard *et al.* (2021) and Di Renzo *et al.* (2020), a higher body mass index was associated with greater consumption of unhealthy snacks and lower diet quality during the pandemic.

Mbijiwe *et al.* (2021) found that occupation, income, education and age were significantly associated with food consumption. The COVID-19 pandemic affected food consumption and dietary patterns of male and female-headed households differently. Females faced more difficulty in accessing food as compared to their male counterparts (Fernandes & Kerneis, 2021). This was in line with a study by Shabbaz *et al.* (2022) in Pakistan, which reported that female-headed households experienced significantly greater shrinkage in consumption of food commodities as compared to male-headed households. In addition, Chege *et al.* (2020) study in Kenya found that female-headed households experienced challenges maintaining food and nutrition stability during the COVID-19 pandemic. This can be attributed to the greater roles women have in household productivity and caregiving compared to men. Therefore, when women assume the role of household heads and take on all the household responsibilities, it makes the situation challenging for them and makes it difficult to maintain household food security (Chege *et al.*, 2020). Moreover, the movement restrictions, reduction in casual labour employment that reduced income opportunities, market and school closures further exacerbated the situation by limiting physical access to food while increasing household workload with all children being at home (Chege *et al.*, 2020). However, Mbijiwe *et al.* (2021) found no significant association between gender and food consumption of the 7-food groups included in their study.

On the other hand, lower-educated households were involved in laborious activities for their livelihood, with minimum chances of working from home during the pandemic, affecting their income and food consumption (Shahbaz *et al.*, 2022). In addition, highly educated people had more knowledge and awareness about the benefits of consuming nutritious food during the pandemic as compared to low-educated people (Mbijiwe *et al.*, 2021; Poelman *et al.*, 2021). On the other hand, high-income individuals did not experience much disruptions in their food

consumption as compared to low-income individuals since they had higher savings and financial capacity to sustain the income shocks due to COVID-19 (Shahbaz *et al.*, 2022). A study by Chege *et al.* (2020) in Kenya revealed that the pandemic negatively affected vulnerable poor urban households compared to their middle-income and high-income counterparts. Given the fact that low-income urban households often rely on casual employment, the COVID-19 pandemic disrupted the possibility of working in these casual jobs, leading to reduced income.

According to Oyando *et al.* (2021) study in Kenya, married people were more vulnerable to experiencing disruption during the COVID-19 pandemic as compared to those who were unmarried. Particularly, married women experienced gender-based violence, especially when employment or income was lost as a result of the pandemic mitigation measures. Similar findings were documented during the COVID-19 pandemic in previous studies conducted in Kenya (Pinchoff *et al.*, 2021) and Zambia (Mathew *et al.*, 2020). The pandemic was a major situational influence that shaped people's behaviour to use online shopping as a means of maintaining food availability. However, online shopping was disproportionately observed among the wealthier and poorer urban and rural people, who otherwise lacked online payment sources (such as credit or debit cards) or reliable internet (Shahzad *et al.*, 2022).

In addition, changes in one's environment or daily routine can alter their eating behaviour (Jastran *et al.*, 2009). For instance, practices such as going to work or school or engaging in outdoor activities were impossible during lockdowns. Many scholars reported changes in individuals' meal habits due to such practices (Błaszczuk-Bebenek *et al.*, 2020). Others observed that more people were eating five meals per day in Poland, whereas (Di renzo *et al.* 2020) reported that more than half of Italians did not change their meal habits and consumed the same number of meals per day during the lockdown. The amount of food consumed (as snacks) during the lockdown increased in Canada, Denmark (Giacalone *et al.*, 2020), Poland (Sidor *et al.*, 2020), and the UK (Buckland *et al.*, 2021). But in Germany (Huber *et al.*, 2020) and the Netherlands (Poelman *et al.*, 2021), food intake did not change considerably.

It is therefore evident that socio-demographic factors such as income changes, age and education of the head of household/main food decision maker, marital status, household size, price volatility, and shopping frequency played a crucial role in household food consumption patterns during the pandemic, in addition to the mitigation measures such as the closure of

restaurants/eateries, and workplaces. This study aimed to establish further their significant effect on low-income household food consumption patterns.

2.4 COVID-19 Measures Effects on Household Food Consumption Patterns

The COVID-19 pandemic disrupted food systems worldwide (Cardwell & Ghazalian, 2020). After the onset of the pandemic, governments around the world adopted measures such as social distancing, dusk-to-dawn curfews, closure of borders, institutions, restaurants, markets, and mandatory quarantine for travellers from foreign countries to mitigate the spread of the virus. These restrictive measures disrupted food chains and linkages, disoriented food supply and pricing, ultimately affecting product prices and household consumption (Torero, 2020).

The urban population, particularly the low-income households, were hardest hit, given their low-income position, high likelihood of informal employment, and little or no savings (Oyando *et al.*, 2021). As a result, they were vulnerable to disruption of incomes and experienced limited food availability, affordability, utilization, and accessibility (GAIN, 2020). Closure of markets made low-income urban households vulnerable since they rely on these informal food markets (Ouko *et al.*, 2020). Moreover, vendors globally registered increased food losses due to market closures and reduced operating hours, and perishable food intended for export and local consumption was left on farms to rot (Resnick, 2020; Shahzad *et al.*, 2022). This ultimately exacerbated food and nutrition insecurity, especially in LMICs (Chege *et al.*, 2020; Okoth *et al.*, 2020). In April 2020, the World Food Programme projected that the number of acutely food-insecure people worldwide could double by the end of 2020 without concerted action (World Food Programme, 2020).

In order to cope with this shock, households drastically changed their consumption and purchase behaviour (Noah *et al.*, 2020). People chose cheaper but nutritionally poor diets to cater to immediate hunger needs (Chege *et al.*, 2020). In addition, meal rationing and portion reduction were some of the undesirable coping behaviours adopted by poor households as a result of a spike in food prices (Chege *et al.*, 2020; Kimani-Murage *et al.*, 2021). This was similar to Egger *et al.* (2021) study in Switzerland, which found that some families reported missing meals or reducing portion sizes due to inadequate resources due to income decline. In response to the lockdown directive, many countries experienced panic-buying in grocery stores and supermarkets as individuals opted for stockpiling due to the fear of the uncertain future

(Arafat *et al.*, 2020; Poelman *et al.*, 2021). In Italy, shifts in consumer purchasing behaviour were reported, with individuals being more inclined to purchase long-life grocery items and a decreased purchase of fresh food items (Bracale & Vaccaro, 2020).

On the other hand, a drop in purchasing power among those who lost income significantly affected their food shopping frequency. Income sources are essential to determining household access to food, especially in urban low-income households that mostly depend on informal employment (Besart & Gaurav, 2020; Demeke *et al.*, 2020). According to a telephone survey conducted across Kenya, about 30% of the respondents were absent from work because of temporary layoff or temporary slack for technical or economic reasons (KNBS, 2020). In Italy, Galanakis *et al.* (2021) reported that the combination of measures like school and restaurant closures, and stay-at-home orders led to supply chain disruptions, significantly reducing household food expenditure, particularly for pricier fish, meat, fruits, and vegetables. Consumption of shelf-stable foods and home-cooked meals increased. Lower-income families were disproportionately affected, exhibiting greater declines in dietary quality. Evidence by Ribeiro-Silva *et al.* (2020) and Rodriguez-Perez *et al.* (2021) corroborated findings that different combinations of COVID-19 containment measures exacerbated food insecurity and negatively reshaped diets, particularly among socioeconomically disadvantaged households.

Mbijiwe *et al.* (2020) found that as a survival mechanism, residents in the City of Nairobi decreased meat and sugar product consumption and increased their intake of cereals and fruits. Chege *et al.* (2020) study found that urban slum dwellers in Nairobi reported an increase in the consumption of kale but reduced consumption of other indigenous and exotic vegetables and fruits, which was attributed to their costs as well as availability. Regardless of the effects of COVID-19, several beneficial inventions were improvised to support business operations (Ouko *et al.*, 2020). People embraced online shopping as a way to maintain their food availability during the pandemic. This innovation offered a platform that connected farmers and customers, especially in cities (Ouko *et al.*, 2020). Social media was used as a marketing channel, and home deliveries were among the ideal mechanisms used to ensure food accessibility and availability during the pandemic (Ouko *et al.*, 2020). In addition, due to the too much time available during the stay-at-home directive, some urban households have begun innovative agricultural practices like planting vegetables on stand-up sacks and animal keeping like rabbits and poultry (Reardon *et al.*, 2020). While these previous works provide essential insights for intervention, there is still

limited evidence of how COVID-19 measures influence food consumption patterns and purchasing patterns due to COVID-19 measures for low-income households in Nakuru City.

2.5 Theoretical Framework

This study was conducted within the Maslow's hierarchy of needs framework, since food consumption patterns are based on Maslow's hierarchy of needs. The hierarchy of needs aligns to the economic cycle, which shows how consumers adjust their consumption patterns during a crisis. That is, the hierarchy of needs connects with the economic cycle so they can prioritize spending on essential food needs. Typically, needs lower down in the hierarchy should be attended to before individuals can satisfy higher needs. The food consumption pattern is expected to meet the hunger need, but fulfilling this need can manifest in various ways. Methods include consuming fresh, fast, or frozen food, cooking at home or dining out, or ordering food. Consumers are capable and desire to move up the hierarchy toward a level of self-actualization. Unfortunately, progress can be affected by a failure to meet lower-level needs. Life experiences, including loss of income or effects of pandemic measures, may cause individuals to shift between category levels of the hierarchy. Consequently, not everyone will move through the hierarchy in uni-directional progression but may move back and forth between the different types of needs.

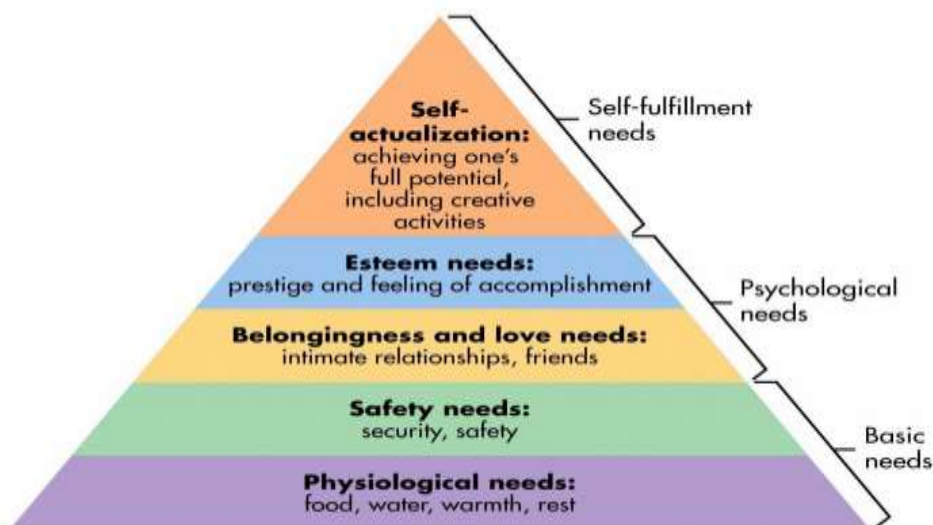


Figure 2.1: Maslow's hierarchy of needs (Harris, 2022)

Figure 2.1 shows the most fundamental need is for physical survival (air, food, drink, shelter, clothing, warmth, sleep), which will be the first thing that motivates adaptation to any behaviour. The human body cannot function optimally if these needs are not satisfied.

2.6 Conceptual Framework

Figure 2.2 below shows the conceptual framework, which reflects how the implementation of the COVID-19 measures contributed to changes in food consumption patterns. The interplay between the effects of COVID-19 measures implementation on the food chains and the resulting changes in the food environment and consumer food-related behaviours formed the core of this study's framework. The specific patterns involved in consumption - what foods to consume, where, with whom, and how often - as well as obtaining food - where acquired, how, and frequency - along with food preparation details - type of foods and methods used - and the implementation of pandemic measures all contributed in a combined way to changes in overall food consumption patterns and behaviours.

In this study, the framework recognizes that food consumption during the pandemic is correlated to food consumption before the pandemic, and household-level changes in food consumption patterns are embedded within a complex system of multilevel factors. The critical explanatory variables were identified from the literature review. They included shopping frequency, changes in food prices, the daily number of meals, changes in workplaces, changes in income, closures of restaurants and eateries and food product availability. Socio-demographic factors that potentially affect the pandemic measures' strength in changing food consumption patterns include household size, gender, education level of household head, and age (Celik & Dane, 2020; Fanelli, 2021; Kansiiime *et al.*, 2021).

Personal experiences with changes in food-related actions during the pandemic potentially influence future behaviour after the pandemic. They might also lead to changes in personal food-related values and strategies in the event of another pandemic. The closure of physical workplaces, schools, and daycare institutions interrupted people's daily lives and practically influenced whom, where, and how individuals ate meals and snacks. The same applied to the close down of work place canteens, cafés, and restaurants and the restrictions on gatherings. Government recommendations to stay at home must have affected how often and where people went food shopping.

The pandemic also potentially affected households' food-related resources, such as money and time. Some people experienced income losses due to reduced working hours. In terms of time, low-income households were affected by the pandemic differently. While certain individuals faced severe time constraints, others had more time available for food preparation and consumption than before. There are more than 800 food categorizations by FAO (2010). This study used eleven food categorisations since they included most of the daily, weekly, and fortnight foods for low-income households, and those with similar nutrients were grouped together. In this study, the empirical analysis has tested the effects of pandemic-related measures on household food consumption patterns.

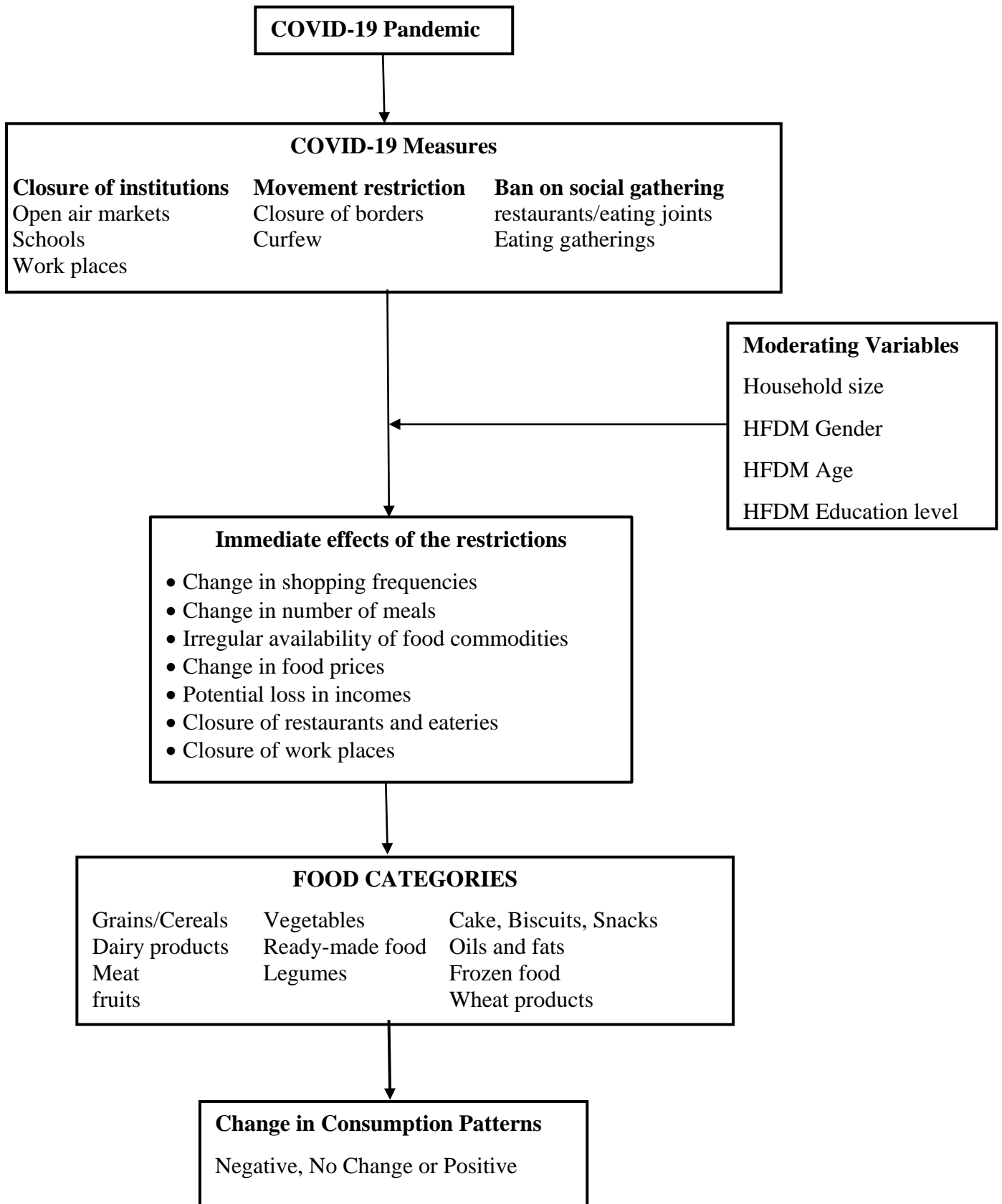


Figure 2.2: Conceptual Framework

CHAPTER THREE

METHODOLOGY

3.1 Study Area

The study was conducted in Kaptembwa, Kapkures, and Rhonda wards in Nakuru West sub-county, Nakuru County. Nakuru County extends between longitude 36° 01' and 37 ° 15' east and latitude 0° 17' and 1° 20' south. The county borders Kiambu, Narok, and Kajiado Counties to the south, Nyandarua and Laikipia to the east, Baringo to the north, and Bomet and Kericho counties to the west. The county occupies an area of 7,510 Km² and has a population of approximately 616,046 households, with an average of 3-4 household members (KNBS, 2019). Nakuru County comprises ten sub-counties: Kuresoi South, Kuresoi North, Molo, Njoro, Rongai, Subukia, Bahati, Nakuru West, Nakuru East, Gilgil, and Naivasha.

Nakuru, the newest fourth city in Kenya, has a vibrant and growing population. Nakuru West sub-County was purposively selected for its higher number of wards and a distinct high population density (KNBS,2019). The three wards were purposively settled on since they mainly host low-income households in the urban area (Korir, 2021; Simiyu *et al.*, 2021; Wairimu, 2021). Over 80% of these dwellers depend on daily wages and the little savings they might have accumulated over time (KNBS, 2019). The map of the study area is presented in Figure 3.1.

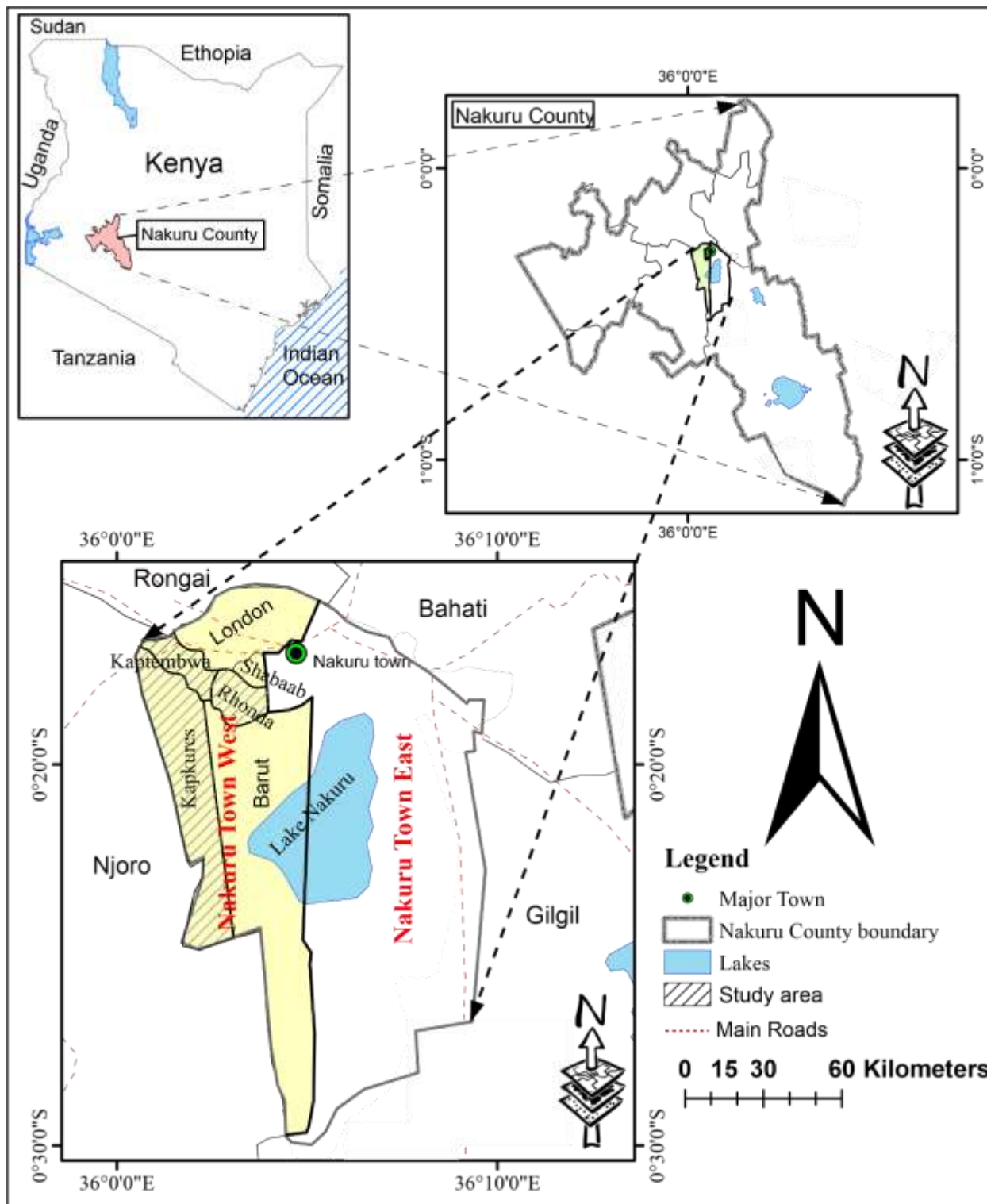


Figure 3.1: Map of Nakuru West Sub-County.

3.2 Research Design

This study used a quantitative research design through a cross-sectional survey. Results from quantitative research can be extrapolated to a larger population. Researchers can make judgements about the attitudes, actions, and opinions of the population being researched by using a sizable and diverse sample. Compared to other research approaches, cross-sectional surveys often have a greater sample size. This makes it possible to discover subtler variations between groups or variables and to increase statistical power (Kothari, 2017).

3.3 Target Population

The study targeted low-income households in Nakuru West Sub-county, specifically in Rhonda, Kaptembwa, and Kapkures wards. The total household number is 141,291 households, according to KNBS (2019).

3.4 Sample and Sampling Procedure

The sample unit for this study consisted of household members from Nakuru West sub-County, Nakuru City. The selection of respondents followed a multi-stage sampling strategy. In the first stage, Nakuru county was chosen because it was among the most severely affected areas by the COVID-19 virus. It was subsequently classified as a high-risk area by the Kenyan government. This was attributed to the vibrant, growing population (MOH-Kenya, 2020). In stage two, the Nakuru West sub-county was used for its higher number of wards. In stage three, Kaptembwa, Kapkures, and Rhonda wards were selected for their high population densities, which are low-income households (Nakuru CIDP, 2018; Simiyu *et al.*, 2021).

In the last stage, systematic random sampling was used to select the household respondent according to Table 3.1. The first household was selected randomly in the three study areas, and from which every 5th household was interviewed till the desired sample size per ward was achieved. Marek *et al.* (2017) noted that using a 5-point interval for sampling is a practical way to improve the effectiveness and representativeness of research investigations. The determination of the required sample size was through the probability sampling technique by way of a simple random sampling procedure to identify the households to be interviewed. The required sample size was determined by proportionate to the size sampling methodology (Anderson *et al.*, 2007).

$$n = \frac{pqZ^2}{E^2} \dots\dots\dots (1)$$

$$n = \frac{0.8 \times 0.2 \times 1.96^2}{0.05^2} = 245.9 \approx 246$$

Where n = Sample size; Z = confidence level ($\alpha=0.05$); p = proportion of the population containing the significant interest, $q=1-p$, and E = allowable error. It was assumed that $p= 0.8$ since a majority, more than 80% of the population, meet the desired attributes according to the census report (KNBS, 2019). Therefore, $q=1-0.8=0.2$, $Z= 1.96$, and $E = 0.05$ (acceptable error term). This resulted in a sample of 246 respondents that were interviewed. Table 3.1 shows the distribution of the respondents in the three wards proportionate to the number of households in the ward.

Table 3.1: Sample Size Per Ward

Wards	No. of Households	Proportion	Sample size
Kapkures	12,099	8.56%	21
Rhonda	33,381	23.63%	58
Kaptembwa	95,811	67.81%	167
Total	141,291	100%	246

3.5 Data Collection and Data Analysis

The study used primary data collected using a structured questionnaire. The instrument had multiple-choice answers to explore the respondents' feedback on several questions about their food consumption patterns before and after the implementation of COVID-19 measures. To determine changes in food consumption patterns, the household respondents were asked to report how often they consumed eleven categories of fresh, non-fresh, convenience, and snack food during and before the pandemic. Then, respondents were interviewed on their behaviour before and during COVID-19 on food purchase and consumption behaviour for factors like price change experiences, food availability, packaging and storage, stockpiling, panic purchasing, homemade meals, and food waste during the COVID-19 pandemic. The questionnaire contained three sections: A, B, and C. Section A included the household demographic characteristics.

Section B contained multiple answer questions that sought to determine the consumption behaviour before and after the implementation of COVID-19 measures. Section C had thirty questions that sought to identify the changes in household food behaviours before and after COVID-19.

The study also collected information regarding the channels they shopped before and after COVID-19 measures. The questions comprised the frequency of purchasing the different categories of foods, which meals were typically prepared and consumed at home, the frequency of consumption from various eateries away from home, and whether meals in the household had been missed due to lack of food, and anxiety about obtaining enough food, the main socio-demographic characteristics such as age, education, income, marital status, and household size of the respondents.

Respondents were further asked whether they had experienced specific changes due to COVID-19, including changes in household income and the closure of their physical workplace. These questions were formulated guided by previous studies investigating the consumers' food consumption patterns and purchase behaviour in general and during the COVID-19 period. Data was collected using the open data kit (ODK), and analysis was undertaken using STATA version 16.

A pre-test was carried out in the Naivasha sub-county, Viwandani ward in Karagita town since it has similar attributes to the study area (NAIVAWASCO, 2022). Thirty household respondents were interviewed; this was at least 10% of the study's required sample size. These pilot study results were used in correcting and adjusting the final questionnaires administered for the study.

3.6 Analytical Framework

3.6.1 Food Consumption Patterns and COVID-19 Measures

Descriptive statistics were used to analyze the positive, negative, or constant changes through appropriate statistical methods: frequency, percentage, variance, and the mean value of consumer consumption (t-test). Paired-sample t-tests were used to detect significant differences in the mean level of food consumption and shopping frequencies of different food categories during and before the pandemic.

Also, household changes in food consumption were analyzed by contrasting consumption frequencies during the pandemic and before. The study determined whether a household increased, decreased, or did not change its consumption frequency for each of the eleven food categories. These descriptive analyses aim at mapping changes in food-related behaviours during the pandemic.

3.6.2 Factors Influencing Changes in Consumption Patterns

The study sought to determine which factors had a significant effect on FCP. This objective was analyzed through the ordered logit model to assess key demographics, socioeconomic characteristics, and pandemic-related factors associated with changes in consumption patterns. The dependent variable is an ordered categorical measure of food consumption change, with response options: decrease, no change, and increase. The ordered nature makes an ordered logit regression appropriate, as it models cumulative probabilities of being in the higher versus lower category.

This modelling approach was used to estimate the effects of different independent variables based on prior literature on food consumption drivers, as listed in Table 3.2. like household size, geographic variables, food environment-related factors (COVID-19 measures) and resources(income) on the likelihood of decreased or increased food consumption during the pandemic. The results provided insight into how COVID-19 had heterogeneously affected eating behaviours and identified vulnerable populations whose food security was most affected. Below is the index model for latent variable food consumption patterns

$$y_i^* = x_i' \beta + u_i \dots\dots\dots (2)$$

$$Y_i = j \text{ if } a_{j-1} < y_i^* \leq a_j \dots\dots\dots (3)$$

The probability that observation i was in alternative j is;

$$p_{ij} = p(y_i = j) = p(a_{j-1} < y_i^* \leq a_j) = f(a_j - x_i' \beta) - f(a_{j-1} - x_i' \beta) \dots\dots\dots (4)$$

The ordered logit model assumes that the logarithm of each cumulative odds ratio can be formulated as a linear combination of the predictors, with parallel regression effects across the odds ratios. This proportional odds framework allows estimating a single set of coefficients

while flexibly modelling the ordinal nature of the dependent variable. This framework is appropriate for this ordinal response and allows interpretation of both the direction and magnitude of variable effects on predicted food consumption changes. Odds ratios shows the odds of being in a higher consumption change category for a unit increase in a given predictor.

This analytical approach provides insight into how disruptions like COVID-19 differentially impact food access and diet quality across urban low-income households. The ordered logit model empirically estimates these relationships while accounting for the ordinal nature of the food consumption measure.

Table 3.2: Description of variables and expected signs to be included in the ordered logit regression model

Variable	Description/ Measurement	Expected sign
Dependent variable		
Y_i	Consumption patterns	
Independent variables		
Age (X_{1i})	Age of HFDM - Continuous	+/-
Gender (X_{2i})	Gender of HFDM (male=1, female=0)	+/-
LevEdu (X_{3i})	Education level of HFDM (number of years of study)	+/-
H/Comp(X_{5i})	Household Composition (household with parents and children=1, 0 = otherwise)	+/-
ClosRes(X_{4i})	Closure of cafés and restaurants (affected=1, not affected=0), (respondent had eaten there at least once a week before the pandemic but not during the first wave)	+/-

ClosWork(X_{6i})	Closure of physical workplace (not affected =1, 0= affected (respondent's physical workplace was closed during the first wave)	+/-
IncLoss(X_{7i})	Income loss due to pandemic (not affected =1, 0= affected (Respondent household had lost income due to the pandemic measures implemented)	+/-
H/Cons(X_{8i})	Change in consumption frequency in terms of the number of daily meals before and during the pandemic (Continuous variable: 6-point interval-scale)	+/-
ShopFreq(X_{9i})	Changes in shopping frequency of food (Continuous variable: sum scale of changes in shopping frequency in four categories (fresh fruit and vegetables, fresh meat and fish, other fresh food, non-fresh food))	+/-

To test and check for multicollinearity, which signifies perfect or highly intercorrelated linear relationship among some or all explanatory variables of the regression model, Variance Inflation Factor (VIF) and pairwise correlations were used. VIFs were calculated directly for continuous variables and pairwise correlations for categorical variables. This allowed examining collinearity across all variables and accounting for collinearity within and between the dummy variable sets representing each categorical predictor. The degree of correlation is a simple, standardized, unitless index, a common scale, making it the most comprehensive, interpretable, and convenient diagnostic for assessing multicollinearity in models with both continuous and categorical variables.

The VIF was calculated by regressing a variable against all other predictor variables in the model and then taking the inverse of the R-squared value for that regression. A VIF value of 1 indicates no correlation between the predictor variable and other variables in the model. In contrast, a VIF value greater than 1 suggested some correlation. The common rule of thumb was performed where a VIF value of 1-2 indicated absence/low multicollinearity, while a VIF value greater than 5 indicated high multicollinearity. Cameron and Trivedi's white test was performed

to test for heteroscedasticity in the model. This test was preferred as it incorporates both magnitude and direction of change for non-linear forms of unequal variances, overcoming the weaknesses of the Breusch-Pagan test that only detects linear forms of heteroscedasticity (Williams, 2015).

3.6.3 COVID-19 Measures Effects on Consumption Patterns

The response variables for change in consumption patterns were collected as a dummy variable (1 if household FCP was affected by COVID-19 measures and 0 otherwise). In addition, households may have been affected by a different combination of COVID-19 measures. Some were affected by one, two, or three measures in their consumption patterns determined by observable and non-observable factors. What they consumed may have had innate characteristics correlating with one or more COVID-19 measures. The study used the Multinomial Endogenous Switching Regression Model (MESRM) to control for possible bias resulting from non-observable traits like perception.

The model further determined the significant effects of COVID-19 measures on consumption patterns. Sample population responses were estimated, that is, the responses by household respondents before and after the COVID-19 measures. The model corrects for both observable and non-observable bias, providing unbiased estimates of the effects of COVID-19 measures on FCP.

This model was suitable since it estimates the average treatment effect (ATE) of COVID-19 measures on the outcome change in consumption patterns. It assumes that households aim to maximize food consumption under the different COVID-19 measures.

A maximum likelihood function was used to estimate the latent variable parameters. Three categories were formed: the first category is positive change $H=1$, the second base category is no change $H = 0$, and the third is negative change $H= -1$. Hence, the likely outcome equation for all categories was given as follows;

$$\left\{ \begin{array}{l} \text{Category one: } Q_{h1} = J_h \alpha_1 + \mu_{\eta_1} \text{ if } H=1 \\ \text{category two: } Q_{h1} = J_h \alpha_1 + \mu_{\eta_1} \text{ if } H = 0 \text{ (4)} \\ \text{category three: } Q_{h1} = J_h \alpha_1 + \mu_{\eta_1} \text{ if } H= -1 \end{array} \right.$$

Positive food consumption change was measured as an increase in food consumption in terms of an increase in the number of meals and a snack per day, increased shopping frequency,

increased visits to restaurants/ eateries, increased income/ reduced price, and increased food availability. No change was measured by a no increase or no decrease in the factors mentioned above, and negative change was measured with a decrease in the same elements.

The multinomial endogenous switching model further assumed linearity assumptions, as shown in equation 5

$$E(U_{hg} | \epsilon_{h1} \dots \epsilon_{hg}) = \sigma_g \sum_{k \neq g}^g \text{rg}(\epsilon_{hk} - E(\epsilon_{hk})) \dots \dots \dots (5)$$

With $\sum_h = 1 \text{rg} = 0$ (meaning the correlations between U's and ϵ 's sum to zero). Hence, following this assumption in the above three equations were summarized as shown below:

$$\begin{cases} \text{Category one: } Q_{h1} = J_h \alpha_1 + \sigma_h \lambda_1 + \omega_{h1} & \text{if } H=1 \\ \text{category two: } Q_{h1} = J_h \alpha_1 + \sigma_h \lambda_1 + \omega_{h1} & \text{if } H=0 \\ \text{category three: } Q_{h1} = J_h \alpha_1 + \sigma_h \lambda_1 + \omega_{h1} & \text{if } H=-1 \end{cases} \dots \dots \dots (6)$$

Where ω 's are error terms with zero expected values, α_h is the covariance between Us and ϵ s, and λ is the inverse mills' ratio (IMR), which was computed from probabilities in equation 7

$$\lambda_g = \sum_{k \neq h}^h p_h \left(\frac{p_{hk} \text{Ln}(p_{hk})}{1 - p_{hk}} + \text{ln}(p_{hg}) \right) \dots \dots \dots (7)$$

Where p is the correlation coefficient, the U's and ω 's are error terms with an expected value of zero. The multinomial endogenous switching model further examined the average treatment effect on the treated by comparing the expected outcomes of each alternative COVID-19 measure.

According to Di Falco and Veronesi (2013), we compute the ATT in the actual and counterfactual scenarios as follows:

For the substantial change in FCP in the sample, the outcome estimation model is given as

$$\begin{cases} E(Q_{h1} | H = 1) = J_h \alpha_1 + \sigma_1 \lambda_1 \dots a \\ E(Q_{h0} | H = 0) = J_h \alpha_0 + \sigma_0 \lambda_0 \dots b \\ E(Q_{h-1} | H = -1) = J_h \alpha_{-1} + \sigma_{-1} \lambda_{-1} \dots c \end{cases} \dots \dots \dots (8)$$

If households were not affected by COVID-19 measures, the counterfactual would be;

$$\begin{cases} E(Q_{h1} | H=1) = J_h \alpha_2 + \sigma_2 \lambda_2 \dots a \\ E(Q_{h0} | H=0) = J_h \alpha_0 + \sigma_0 \lambda_0 \dots b \\ E(Q_{h-1} | H=-1) = J_h \alpha_{-2} + \sigma_{-2} \lambda_{-2} \dots c \end{cases} \dots \dots \dots (9)$$

The above-estimated values helped derive unbiased estimates of the average treatment effects on treated (ATT), which were the difference between equations 9a and 8a.

$$ATT = E [Q_{i2} | I = 2] - E [Q_{i1} | I=2] = Z_i (\alpha_2 - \alpha_1) + \lambda_i (\sigma_2 - \sigma_1) \dots\dots\dots(10)$$

The first term on the right-hand side of Equation 10 represents the expected change in Household consumption patterns due to COVID-19 measures. The second term (λ) is the term that captures all potential effects of difference in the unobserved variable. Table 3.3 below shows the variables, their description, measurements, and expected signs.

Table 3.3: Description and Expected Signs of the Variables used in the Multinomial Endogenous Switching Regression Model.

List of Variables	Descriptions	Measurements	Expected signs
Age	Age of HFDM	Number of years	+/-
Gen	Gender of HFDM	Dummy 1=male, 0=female	+/-
Edu	HFDM Education level	Number of years	+
HhSz	Household size	Number of individuals-	+/-
ClosRest	Closure of restaurants and eateries	Dummy 1=yes, 0=no	+
Closwork	Closure of workplaces	Dummy 1=yes, 0=no	+
Incloss	Income loss due to pandemic measures	Dummy 1=yes, 0=no	+
FoodAva	Changes in food availability during the pandemic	Continuous variable: 5-point interval-scale	+/-
ShopFreq	Changes in food shopping frequency	Continuous variable: 5-point interval-scale	+
EatFreq	Eating frequency in terms of the number of daily meals before and during the pandemic	Continuous variable: 5-point interval-scale	+
Prichan	Changes in the price of commodities due to pandemic measure	Continuous variable: 5-point interval-scale	+/-

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents results and discussions on the effect of COVID-19 measures on food consumption patterns for low-income households in the Nakuru-west sub-county. The main measures considered in the study were movement restriction, closure of institutions, and a ban on social gatherings. These results have been outlined with reference to the objectives, which included determining the changes in FCP, assessing factors influencing changes in FCP, and determining the effects of COVID-19 measures on FCP of households in Nakuru County. Objective one was presented through descriptive statistics and paired sample t-test, objective two was analysed by ordered logit regression model and objective three was analysed through the multinomial endogenous switching regression model.

4.2 Descriptive Statistics

4.2.1 Demographic characteristics of respondents

The findings in Table 4.1 summarize the socioeconomic profile of the households. In the survey, 57% of the respondents were female, while 43% were male. This finding is similar to other COVID-19-related studies that reported a higher participation rate of women than men (Kudaisi, 2021; Mbijwe *et al.*, 2021). Results indicate that 49% of the respondents had attained a secondary school level education. This could be associated with the nature of the study, a structured interview in urban low-income households. Most of the household heads were aged 19-35 years, a characteristic of urban settlers of young age, and these findings collaborate with those of Kaur (2020), who found out that young adults between the ages 19 to 35 prefer urban centres due to job hunting and desire for urban lifestyles.

From the findings, 90% of the households had children, comprising more than six members, with a mean household member above 5. From the sample, 80% were married and were in the monthly income brackets between Kenya shillings, 5,000-20,000 (Kes) (~\$ 50-200 USD). The data collection comprised more than 90% of household heads in charge of food acquisition in a household, either providing money and/or going to the market and /or groceries in the household.

Table 4.1: Socioeconomic characteristics of respondents

Categorical Variables		Frequencies	Percentages(%)
Gender of HFDM	Female	141	57.32
	Male	105	42.68
Marital status	Single	27	10.98
	Married	196	79.67
	Widow/widower	9	3.66
	Separated	13	5.28
	Divorced	1	0.41
	Education level of HFDM	No formal schooling	2
HFDM	Primary	93	37.80
	Secondary	120	48.78
	Tertiary/university	31	12.61
Age of HFDM	18–35	106	43.09
	36–49	86	34.96
	50–65	47	19.11
	66+	7	2.84
Household composition	Single households with no children	23	9.35
	Households with parents and children	223	90.65
Household monthly income	<5,000	37	15.04
	5,001 -10,000	93	37.80
	10,001 -20,000	81	32.93
	20,001 - 30,000	26	10.57
	30,001 - 40,000	6	2.44
	>50,001	3	1.22
Continuous Variable		Mean	Std. Err.
Total household size		5.0285	0.2021

4.2.2 Missing meals before and after COVID-19 due to less meals

Missing meals refers to when households are unable to consume all the meals they require in a day or a week due to a variety of circumstances. Table 4.2 shows the frequency of missing meals in low-income households before and after the COVID-19 pandemic due to pandemic measures. Before the COVID-19 pandemic, most households (72%) had never missed a meal, with only 5% missing meals occasionally. However, following the pandemic measures, a more significant proportion (49%) of households occasionally missed a meal, followed by those who never missed a meal (39%). A closer examination of both periods reveals that those who had never missed a meal before COVID-19 had their missed meal frequency changed from 72% to 39%, indicating that nearly half of these households fell in the occasionally/frequently missed meals category, which suggests a negative change on FCP.

Ideally, before the pandemic measures, households were free to move around and spend their money, and food items were more often than not available and affordable. Nonetheless, incomes fluctuated during the COVID-19 period, and food availability in stores and markets became insufficient to meet all households' needs, resulting in changing household consumption lifestyles. This study supports the findings of Loopstra (2020) and Raifman *et al.* (2021), who discovered that after COVID-19, about half of the interviewed households faced financial constraints due to loss of income, and food availability became scarce, causing them to skip meals or consume less compared to what they consumed before COVID-19 measures.

Table 4.2: Household frequency of missing meals before and after COVID-19 due to less food

Variable		Frequencies	Percentages(%)
Missing meals before COVID-19	Frequently	12	4.88
	Never	177	71.95
	Occasionally	57	23.17
Missing meals after COVID-19	Frequently	31	12.60
	Never	95	38.62
	Occasionally	120	48.78

4.2.3 Stockpiling before and after COVID-19

Stockpiling implies to the act of gathering and storing a considerable amount of food for future consumption of food essentials like maize and wheat flour, rice, legumes such as dry beans and lentils, fats and oils, sugar, and snacks. With regards to the COVID-19 pandemic, most of the household respondents indicated to have significantly reduced this tendency after COVID-19 measures. The percentage of households who stockpiled frequently reduced from 29% to 10%, and those who stockpiled occasionally reduced from 30% to 27%, as indicated in Table 4.3 below. For those who had never stockpiled even before, after COVID-19, their percentage increased from 41% to 62%, implying a negative change to FCP.

All this was attributed to factors caused by the pandemic measures like inaccessible food items, increased commodity prices, reduced household incomes, and the increased demand for consumption in the household now that most family members remained at home. Due to the arousal of panic to consumers, the majority of households in the middle and high income were able to stockpile due to their characteristic of having adequate savings and incomes. This affected food availability for households which can only manage to do daily shopping for food products at their lowest divisible level, a characteristic of low-income households, ultimately leading to higher food prices, further worsening the access of food items to this kind of households (Poudel *et al.*, 2020).

Table 4.3: Frequency of stock pilings before and after COVID-19

Variable		Frequencies	Percentages(%)
Stock pilings before COVID-19	Frequently	72	29.27
	Never	100	40.65
	Occasionally	74	30.08
Stock pilings after COVID-19	Frequently	26	10.57
	Never	153	62.20
	Occasionally	67	27.24

4.2.4 Changes in household food behaviour after the implementation of COVID-19 measures compared with before

Most households experienced a decrease in the amount of food consumed per family member after the implementation of the COVID-19 measures, as shown in Table 4.4. This was due to the fewer and pricier food options available for purchase. The few households that recorded more food consumption could be attributed to having few or no children and members being at home with available food. The increase in money spent on food resulted from the volatile prices of food commodities, mostly on the higher side after COVID-19. Some households were forced to walk longer distances to find shops with lower food prices, especially those from Kapkures ward, attributed to their far proximity to the central business district. Households would now plan their meals in advance in a bid to budget for the available food resources for survival during the uncertain pandemic period. Cheap and, most times, free food items that some households would get or request from their rural social networks were no longer accessible after the implementation of the pandemic Measures.

Due to a lack of food resources, 80% of the households did not experiment with new recipes. The few who tried new recipes included a shift from drinking tea to porridge for breakfast, increased intake of low-price food items like arrow roots and cassava, and using grade two maize flour to make *ugali*. All these survival strategies aimed to make the meal heavier, in order to last the household members more extended periods, without the urgent feeling of partaking of another meal, which worked well for households with many members. In support of these strategies, 53% of the households experienced less frequent meals taken by household members. 96% of households indicated increased food prices of commodities like maize flour, fats, and oils after COVID-19, attributed to the closure of the border and movement restrictions measures. 72% of the households either did not have or significantly reduced food waste after COVID-19. Some did not have enough to consume, while others had more time to consume since most members were at home. These food behaviours indicated a negative change in FCP.

Table 4.4: Household food change behaviours

Variables		Frequencies	Percentages(%)
Food eaten	1. Much less	14	5.69
	2. A little less	126	51.22
	3. No change	28	11.38
	4. A little more	49	19.92
	5. Much more	29	11.79
Money spent	1. Much less	6	2.44
	2. A little less	15	6.10
	3. No change	13	5.28
	4. A little more	79	32.11
	5. Much more	133	54.07
The extent of planning advance meals	1. Much less	47	19.11
	2. A little less	36	14.63
	3. No change	51	20.73
	4. A little more	87	35.37
	5. Much more	25	10.16
Any new recipe often used	1. Much less	47	19.11
	2. A little less	47	19.11
	3. No change	100	40.65
	4. A little more	45	18.29
	5. Much more	7	2.84
Meals frequency	1. Much less	32	13.01
	2. A little less	98	39.84
	3. No change	59	23.98
	4. A little more	42	17.07
	5. Much more	15	6.10
Food prices	1. Much less	2	0.81
	2. A little less	2	0.81
	3. No change	5	2.03
	4. A little more	59	23.98

	5. Much more	178	72.35
Any food thrown away	1. Much less	145	58.94
	2. little less	31	12.60
	3. No change	46	18.70
	4. little more	12	4.88
	5. Much more	12	4.88

4.2.5 Household food consumption before and after COVID-19 Paired Sample T-tests

The paired samples t-tests were done to compare the means of household food consumption before and after the COVID-19 pandemic. The results in Table 4.5 indicate significant average differences between various variables. Significant decreases were observed in the frequency of intake of dairy, meat, fruits, snacks, and wheat products (all p -values < 0.001). Notably, there was an overall decrease in consumption of household food categories, and it is worth noting that the study reported consumption changes in all food categories after the implementation of COVID-19 measures, indicating that all low-households faced similar COVID-19 measures, explaining the converging similarity in the change in consumption patterns.

Results show a significant average decrease in dairy products consumption before and after the COVID-19 pandemic ($t_{238} = -4.067, p < 0.001$). On average, the household dairy products consumption was 0.40 units lower than before the COVID-19 pandemic (97% CI [-0.59, -0.21]), indicating that households had reduced their dairy products consumption following the COVID-19 pandemic. Another key finding was the average significant difference in household fruits consumption before and after the COVID-19 pandemic ($t_{235} = -2.883, p < 0.001$). Averagely, household fruits consumption after COVID-19 decreased by 0.28 units as indicated (95% CI [-0.89, -0.09]). Household meat consumption decreased by 0.51 units after the effects of COVID-19 (95% CI [-0.71, -0.31]), indicated by the average significant difference in meat products consumption before and after COVID-19 ($t_{225} = -5.089, p < 0.001$). In contrast to these findings, Tan *et al.* (2022) found that households were more willing to consume more fruits, as evidenced by increased fruit intake, while protein intake (meat and dairy) did not change significantly after COVID-19.

In addition, the household consumption of snacks before and after COVID-19 had a significant difference of ($t_{145} = -2.995, p < 0.001$), indicating that household snacks consumption

went down by 0.43 units following the COVID-19 pandemic 95% CI [-0.71, -0.14]). The above results are in collaboration with those of Hoteit *et al.* (2022) and Jia *et al.* (2021), who noted a significant decrease in food consumption patterns of meat, dairy, fruits, sweet snacks, and vegetables (p-value=0.001) after the implementation of COVID-19 measures.

Finally, household wheat consumption also went down after the COVID-19 pandemic. This was indicated by the average significant difference between wheat products before and after COVID-19 ($t_{236} = -4.770, p < 0.001$), indicating that its consumption was 0.47 units lower than before COVID-19 (95% CI [-0.67, -0.28]). These findings contrast with those of Jia *et al.* (2021), who discovered that consumption of wheat products increased after the COVID-19 pandemic compared to other foods (vegetables, rice, and meat products).

Table 4.5: Paired samples t-test for household food consumption before and after COVID-19

		Paired Differences					t-test	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error	95% C. I of the Difference				
				Mean	Lower	Upper			
Pair 1	Grains cereals - Grains cereals	0.097	1.445	0.094	-0.088	0.283	1.036	235	0.301
Pair 2	Dairy products - Dairy products	-0.397	1.511	0.098	-0.590	-0.205	-4.067	238	0.000***
Pair 3	Fruits - Fruits	-0.284	1.513	0.098	-0.478	-0.090	-2.883	235	0.001***
Pair 4	Meat products - Meat products	-0.509	1.503	0.100	-0.706	-0.312	-5.089	225	0.000***
Pair 5	Vegetables- Vegetables	0.037	1.184	0.076	-0.113	0.188	0.489	240	0.625
Pair 6	Readymade food- Readymade food	-0.025	1.296	0.103	-0.229	0.178	-0.245	157	0.806

Pair	Legumes -	0.009	1.360	0.090	-0.169	0.187	0.098	226	0.922
7	Legumes								
Pair	Snacks -	-0.425	1.713	0.142	-0.705	-0.144	-2.995	145	0.000***
8	Snacks								
Pair	Oils and Fats -	-0.021	1.571	0.102	-0.222	0.180	-0.206	237	0.837
9	Oils and Fats								
Pair	Frozen foods -	0.035	0.547	0.051	-0.066	0.137	0.684	113	0.495
10	Frozen foods								
Pair	wheat product -	-0.473	1.525	0.099	-0.668	-0.277	-4.770	236	0.000***
11	wheat products								

Note: *** 1% significance level; **5% significance level; *10% significance level; std = standard; CI= confidence interval; df = degrees of freedom

4.2.6 Household food shopping frequency Before and After COVID-19

Shopping frequency describes how households normally visit the shops, supermarkets or other retail outlets to buy food and other home necessities. The study clearly shows the mean frequency of shopping in most food categories decreased after COVID-19 measures compared to before. Meat products, ready-made foods, snacks, legumes, oils, and fats had the most significant rate of decrease. In more than 62% of the households, the combined proportion of people who decreased consumption depending on the food category experienced a negative change. At the same time, frozen foods had the lowest decrease rate of change in the food categories, explained by the fact that a few low-income households shop for frozen foods like fish, beans, pizza, peas, sausages and sea products.

The paired samples t-tests were done to compare the means of household food shopping frequency before and after the COVID-19 pandemic. The results in Table 4.6 indicate that there were significant average differences between various variables. Results suggest a significant average difference in meat products shopping frequency before and after the COVID-19 pandemic ($t_{234} = -4.153, p < 0.001$). On average, the household meat products shopping frequency was 0.09 units lower than before the COVID-19 pandemic (95% CI [0.05, 0.14]), indicating that households had decreased their meat products shopping frequency following the COVID-19 pandemic. Another key finding was the average significant difference in household fruits shopping frequency before and after the COVID-19 pandemic ($t_{242} = -2.524, p < 0.001$).

On average, the household fruits shopping frequency after COVID-19 decreased by 0.07 units as indicated (95% CI [-0.13, -0.07]). Which further explains the low fruits consumption by most households.

A significant difference was also observed in the vegetable shopping frequency before and after the pandemic ($t_{238} = -3.735, p < 0.001$), indicating that there was a decrease in the shopping frequency by 0.13 units (95% CI [-0.19, -0.06]). Households changed their behaviour after COVID-19 was declared an emergency. In contrast, the study assumed that because of the pandemic, households would buy food in bulk out of fear of limited access to food, which was also established by Il'in *et al.* (2021). However, in low-income areas, the majority of households are accustomed to purchasing food from local markets. The purchasing frequency of vegetables decreased due to the shifting/closure of open markets and reduced movements due to fear of contracting the virus. These findings are consistent with those of Jeewska-Zychowicz *et al.* (2020), who discovered that the frequency of grocery shopping (including vegetables) had decreased in roughly half of the households studied.

Ready-made food shopping frequency among households also faced an average significant difference between the two periods ($t_{153} = 3.556, p < 0.001$). Due to the pandemic, most households preferred buying ready-made foods over preparing meals, like *githeri*, a mixture of beans and maize, *mandazi*, and chips. This can be explained by movement restrictions, which possibly acted as a hindrance to purchasing different kinds of ingredients from the markets. This was indicated by a 0.15-unit increase in shopping frequency for ready-made foods (95% CI [-0.13, -0.07]).

The paired t-test sample statistics further indicate an increase in the shopping frequency of snacks among households by 0.25 units (95% CI [0.17,0.32]). This meant an average positive significant difference in the shopping frequency of snacks before and after the pandemic ($t_{194} = 6.504, p < 0.001$). Regarding shopping frequency for frozen foods, the study found a positive average significant difference before and after the COVID-19 pandemic ($t_{72} = 3.734, p < 0.001$), indicating a 0.205-unit increase in shopping frequency. A plausible justification for this is that with the closure of open-air markets and food unavailability in stores, the uptake of frozen foods went upwards to replace fresh foods and groceries. As much as wheat products are essential for human consumption, there was a negative average significant difference before and after the

COVID-19 pandemic ($t_{240} = -24.839, p < 0.001$). This was indicated by a decrease of 1.04 units (95% CI [-1.13, -0.96]).

Table 4.6: Household food shopping frequency paired samples test

Variables	Paired Differences					T-test	df	Sig. (2-tailed)	
	Mean	Std. Dev.	Std. Err.	C.I. diff.	(95%)				
				Mean	Lower	Upper			
Pair 1	DairyPrdctsShopFreqB - DairyPrdctsShopFreqA	-0.012	0.391	0.025	-0.062	0.037	-0.492	242	0.623
Pair 2	MeatPrdctsShopFreqB - MeatPrdctsShopFreqA	0.094	0.346	0.023	0.049	0.138	4.153	234	0.000***
Pair 3	FruitsShopFreqB - FruitsShopFreqA	-0.074	0.458	0.029	-0.132	-0.016	-2.524	242	0.012**
Pair 4	VegetablesShopFreqB - VegetablesShopFreqA	-0.126	0.520	0.034	-0.192	-0.059	-3.735	238	0.000***
Pair 5	ReadymadeShopFreqB - ReadymadeShopFreqA	0.149	0.521	0.042	0.066	0.232	3.556	153	0.001***
Pair 6	LegumesShopFreqB - LegumesShopFreqA	0.047	0.444	0.030	-0.013	0.107	1.548	211	0.123
Pair 7	SnacksShopFreqB - SnacksShopFreqA	0.246	0.528	0.038	0.172	0.321	6.504	194	0.000***
Pair 8	OilsandFatsShopFreqB - OilsandFatsShopFreqA	0.025	0.339	0.022	-0.018	0.068	1.135	242	0.258
Pair 9	FrozenShopFreqB - FrozenShopFreqA	0.205	0.470	0.055	0.096	0.315	3.734	72	0.000***
Pair 10	WheatShopFreqB - WheatShopFreqA	-1.046	0.654	0.042	-1.129	-0.963	-	240	0.000***
							24.839		

Note: *** 1% significance level; **5% significance level; *10% significance level; std = standard; CI = confidence interval; df = degrees of freedom

4.3 Factors Influencing Changes in Consumption Patterns

4.3.1 Changes in household consumption patterns

Changes in household consumption patterns are depicted in Figure 4.1. The majority (78%) of households in Nakuru west Sub-county reduced their household food consumption patterns, as shown below. COVID-19 arguably brought its own set of difficulties, such as job losses, income loss, food price increases, and food insecurity in various stores and markets. As a result of all of this, consumption patterns shifted as households adjusted to the situation. An additional 15% experienced an increase in their consumption patterns due to COVID-19, while only 7% recorded no change in their household consumption patterns due to COVID-19 measures.

These findings are consistent with those of Jafri *et al.* (2020) and Wachyuni and Wiweka (2020), who found that the COVID-19 pandemic decreased food consumption patterns in the majority of households. However, while food consumption patterns decreased, food items such as canned foods, frozen foods, and vegetables (Wachyuni and Wiweka, 2020) increased primarily due to food scarcity. Janssen *et al.* (2021) also indicated a decrease in consumption compared to before the pandemic.

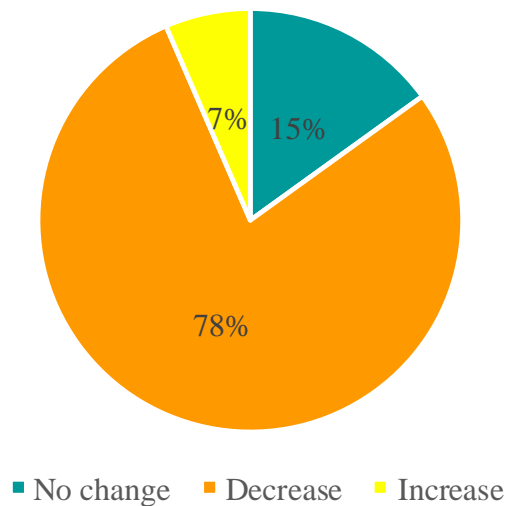


Figure 4.1: Changes in household consumption patterns

4.3.2 Factors influencing household food consumption patterns

To ensure compliance and consistency of the data, pre-estimation tests and diagnostics, including the VIF, pairwise correlation, and white test, were conducted to test for multicollinearity and heteroscedasticity, respectively. The VIF and pairwise results are shown in Tables 4.7 and 4.8. Accordingly, the results indicated an overall VIF of 1.03. This value was less than 5, indicating no strong association among the continuous explanatory variables used in the ordered logit model (Mutale *et al.*, 2017).

Table 4.7: VIF test for continuous predictors in the Ordered Logistic Regression model

Variable	VIF	1/VIF
Dairy_meatshopfreq	1.05	0.950588
NonFreshShopFreq	1.05	0.951471
Otherfreshshopfreq	1.03	0.967087
FatsShopFreq	1.03	0.967367
Fruits_vegesshpfreq	1.03	0.969827
TotalHHSize	1.00	0.997688
Mean VIF	1.03	

On the other hand, the pairwise correlation results showed that the ban on social gatherings and closure of institutions variables were highly correlated with a coefficient of 0.7094 above the accepted threshold of 0.7 (Heit *et al.*, 2017; Vu *et al.*, 2015). As a result, the closure of institutions variable was dropped from the ordered logit model.

McFadden's Pseudo R-squared (Pseudo R^2) was 0.1334, indicating an explanatory power of 13.34%. On the other hand, Cameron and Trivedi's white test was done to test for heteroscedasticity in the model. This test was preferred as it incorporates both magnitude and direction of change for non-linear forms of unequal variances, therefore overcoming the weaknesses of the Breusch-Pagan test that only detects linear forms of heteroscedasticity (Williams, 2015). The results are presented in Table 4.9, indicating a p-value of heteroscedasticity as 0.5301, which is above the 0.05 cutoff. So, the null hypothesis of homoscedasticity could not be rejected. This meant that there were insignificant levels of unequal variance.

Table 4.8: Pairwise coefficients for categorical variables in the Ordered Logistic Regression model.

Variable	HHSexI D	HHMarStatu s	HHLevEdu c	HHAg e	HHCom p	HHOccupatio n	HHMonthlyincom e
HHSexID	1.0000						
HHMarStatus	-0.1403	1.0000					
HHLevEduc	0.1347	-0.1147	1.0000				
HHAge	0.1786	0.1550	-0.1144	1.0000			
HHComp	-0.1463	0.2459	-0.0650	0.0799	1.0000		
HHOccupation	0.0911	-0.0765	-0.0054	0.1577	0.0178	1.0000	
HHMonthlyincome	0.2599	-0.0772	0.4035	0.0705	0.0919	-0.0963	1.0000
IncChangeDueCOV	0.0077	0.0329	-0.1026	0.0017	0.1831	0.2230	-0.0843
Moneyspent	0.0022	-0.0475	0.0866	-0.0631	0.0245	0.0966	0.1662
ChangesinFoodPrices	-0.0840	-0.0421	0.0673	0.0103	0.0139	0.0518	-0.0719
FoodPurchasePersonChang e	0.0507	0.0552	-0.1139	0.0942	-0.2349	-0.0024	-0.0347
banon_socialgatherings	0.0506	-0.0372	-0.0695	0.0816	0.1017	0.1639	0.0116
mov_restrictions	0.0078	0.0256	-0.0144	-0.0085	0.1187	-0.0310	0.0346

Variable	IncChangeDue COV	Moneyspent	ChangesinFoodPrices	FoodPurchase PersonChange	Ban on_social gatherings	mov_restrictions
IncChangeDueCOV	1.0000					
Moneyspent	-0.0262	1.0000				
ChangesinFoodPrices	0.1101	0.0382	1.0000			
FoodPurchase	-0.1384	0.0300	-0.1461	1.0000		
PersonChange						
banon_socialgatherings	0.1260	0.0330	0.0474	0.0269	1.0000	
mov_restrictions	0.1613	0.0330	0.0574	-0.0742	0.6867	1.0000

Table 4.9: White test for Heteroscedasticity

Source	Chi ²	df	p
Heteroscedasticity	186.87	189	0.5301
Skewness	31.48	19	0.0357
Kurtosis	30.15	1	0.0000
Total	248.51	209	0.0318

The ordered logit results are presented in Table 4.10. The model constants included two values (cut1 and cut2), 2.207589 and 7.402173 respectively. The log-likelihood of the fitted ordered logit model was -139.22192, indicating that the model conveyed with the predictors used was significantly different from zero. As shown in the ordered logistic regression results, the number of observations was 246, indicating no missing data for any of the variables. The likelihood (LR Chi² (19)) was 42.85 with a corresponding p-value of 0.0014, indicating that all the parameters were jointly significant at 5%, further confirming that the model had a good fit.

The household head's age was positively associated with decreased household food consumption patterns. As one age, the body's functioning requires more strength, so consumption rises. Furthermore, because COVID-19 had a significant effect on the ageing population, it was necessary to increase food consumption, particularly among the elderly, to boost their immunity, which is contrary to the findings of this study. These findings collaborate with Shahbaz et al. (2022), who discovered a significant decrease in food consumption patterns in households with older people, implying that COVID-19 affected older people more than younger people. Older individuals were more vulnerable to COVID-19 and needed to reduce trips for food shopping to lower exposure risk. However, Shahzad *et al.* (2021) found that old age was likely associated with better household consumption patterns because they had more knowledge and experience obtaining food during various crises.

Income change due to COVID-19 measures was positively associated with an increase in FCP. This means that increases in income due to COVID-19 predict a substantially higher likelihood of increased food consumption change. A change in income commonly causes substitution, that is, an increase in one product while decreasing the consumption of another.

Most urban low-income households lost their incomes during the COVID-19 measures due to their nature of being in the informal employment sector.

Table 4.10: Ordered logit regression model estimates for factors influencing changes in consumption patterns and the marginal effects

Variables	Marginal effects			
	Coef.	dy/dx0	dy/dx1	dy/dx2
HHSexID	-0.588	0.0604	-0.0372	-0.0232
HHMarStatus	-0.446*	0.0441	-0.0260	-0.0181
HHLevEduc	0.114	-0.0112	0.0067	0.0046
HHAge	0.443**	-0.0438**	0.0258*	0.0180*
TotalHHSize	-0.051	0.0051	-0.0030	-0.0021
HHComp	0.042	-0.0042	0.0025	0.0017
HHOccupation	-0.104	0.0103	-0.0061	-0.0042
HHMonthlyincome	0.059	-0.0059	0.0035	0.0024
Moneyspent	0.467***	-0.0462***	0.0272**	0.0190**
ChangesinFoodPrices	1.164*	-0.1151*	0.0678*	0.0473*
IncChangeDueCOV	0.906**	-0.1126*	0.0838	0.0288**
FoodPurchasePerson	2.491***	-0.1094***	-0.1798	0.2892
fruits_vegesshpfreq	-0.537**	0.0530**	-0.0312*	-0.0218**
dairy_meatshopfreq	0.223	-0.0220	0.0130	0.0090
NonFreshShopFreq	-0.13	0.0128	-0.0076	-0.0053
otherfreshshopfreq	0.05	-0.0050	0.0029	0.0020
FatsShopFreq	0.545	-0.0540	0.0317	0.0221
banon_socialgather	-0.864*	0.0855*	-0.0503	-0.0351*
mov_restrictions	0.929*	-0.0918*	0.0541	0.0377
/cut1	2.208			
/cut2	7.402			
Model Fit				
LR Chi ² (19)	= 42.85	Pseudo R2	= 0.1334	
Prob > chi2	= 0.0014	Log pseudolikelihood	= -139.22192	

Note: *** p<0.01, ** p<0.05, * p<0.1

This meant that the majority of the households were surviving on half pay or had been retrenched, hence no income to cater for food items. Whatever available amount of money they had meant that the households needed to plan for the meals, therefore cutting down on some meals to have enough cash to survive in subsequent days. Low-income households were forced to skip some meals and even reduce their consumption of foods such as dairy products, meat, fruits, wheat, and snacks while increasing their vegetable intake in extreme cases. Finally, these households weighed foodstuffs that they thought were reasonably priced and easily accessible (vegetables) that they could afford while also spending money on other household items. These findings are consistent with those of Shahbaz *et al.* (2022) and Thanh *et al.* (2022), who discovered that low-income people choose to consume cheaper food commodities rather than the consumption of high-priced food commodities.

Money spent had a significant positive correlation with an increase in household food consumption patterns with a coefficient of 0.5. During the pandemic, most households worried about sustaining their families due to low income and had to prioritize spending on food. With COVID-19 measures in place, children at home, limited purchasing, and concern about food availability, most low-income households spent bigger proportions of their money on acquiring food items. Furthermore, any increase in money spent, meant that households purchased foodstuffs to feed their families, increasing food consumption patterns (Oyando *et al.*, 2020).

Food price changes were found to have a positive and statistically significant correlation with a decrease in household consumption patterns. One possible explanation is that during the COVID-19 pandemic period, household purchasing power fell significantly due to income and economic shocks. The limited flow of goods to urban areas led to impaired food supply chains, which caused food prices to rise. With less income and increased food prices, most low-income households could afford less food, resulting in lower consumption. FAO (2020) and UNCTAD (2020) established similar findings, acknowledging that SSA countries were negatively affected by a rise in food prices, which negatively affected their food access during the pandemic. Also, during the COVID-19 measures, some households chose to stockpile, resulting in food scarcity and increased food prices. Due to financial constraints, low-income households could not access or even afford food to stockpile, further decreasing their consumption patterns.

Changes in the primary person who used to purchase food before COVID-19 also exhibited a significant positive association with a decrease in consumption patterns. Notably,

before the pandemic, the primary person who used to buy food had their own methods and places of purchase and would limit food purchases to cover other expenses. Some of those who used to buy food in the sampled area were females divorced from their husbands due to COVID-19. This meant that other household members had to take on the responsibility of purchasing food, significantly reducing their food purchases over time. This is most likely because they lacked knowledge, experience, and networks for efficient food shopping compared to the previous shopper. According to the findings of Maharajan and Joshi (2000) and Shahzad *et al.* (2021), changing the primary food purchaser has a negative effect on food consumption, including a lack of physical access to resources, purchase networks, and knowledge of what to prepare, which causes such households to struggle with food purchases.

Ban on social gatherings had a significant negative association with an increase in food consumption patterns. Households had to avoid/reduce dining out. Restrictions on dining out at restaurants and attending gatherings where food was served resulted in reduced opportunities for food consumption outside the household. With bans in place, households could not go out to eat as frequently and, therefore, consumed less food overall compared to pre-pandemic times when dining out was readily available. These results suggest that unable to dine at restaurants due to COVID-19 bans on social gatherings, households, on average, decreased their food consumption rather than substituting all dining out meals with home-cooked replacements. By reducing options for food intake outside the home, bans on gatherings made it likely households decreased food consumption rather than increased or maintained pre-pandemic levels.

Movement restrictions positively influenced higher consumption patterns, possibly due to more at-home meals. Limitations prevented people from commuting to workplaces, travelling, and dining out. With more time spent at home due to movement restrictions, households likely prepared and ate more meals at home. Increased time at home for food preparation and more family members present in the household throughout the day due to movement restrictions could have facilitated higher overall food consumption. Since purchasing food away from home was also restricted.

4.4 Effects of COVID-19 Measures on Food Consumption Patterns

4.4.1 Alternative combinations of COVID-19 measures

The study considered the effects of three different interrelated COVID-19 measures: movement restrictions(M), closure of institutions (C), and a ban on social gatherings (B). The

effects of these measures were measured as a categorical variable: 1 for positive effect, 0 for no effect, and -1 for negative effect. Joint probability estimation was conducted to establish the interrelationship across the three COVID-19 measures, generating eight possible COVID-19 combined effects. This was based on the configurational joint effects theory, which focuses on how the specific combination or configuration of the COVID-19 measures produced a distinct joint effect on food consumption patterns. The resulting combinations had an estimated joint probability reflecting the interrelationships between the measures. Through examining the most probable combinations, the joint analysis gave a more complete picture than the individual analysis of each measure, which quantified the likelihood of households experiencing those specific joint effect configurations. Therefore, combinations provided insights into the predominant interrelated effects of imposing the COVID-19 measures.

As indicated in Table 4.9, out of the sampled 246 households, more than half (63.01%) were affected negatively by the three COVID-19 measures ($M_nC_nB_n$). About 7.32% experienced no effect following the combination of all three COVID-19 measures ($M_oC_oB_o$), while 6.10% experienced positive effects from the COVID-19 measure ($M_pC_pB_p$).

During the COVID-19 pandemic, the majority of households experienced negative effects as a result of alternative measures combinations. Due to movement restrictions, there was less trade and transportation of goods within and outside the country (Ouko *et al.*, 2020; Rohwerder, 2020). This had a direct negative effect on the income sources of individuals in the country as well as food supply chains, resulting in food unavailability and price increases. The government's designation of certain areas as high-risk worsened the situation, as curfews and quarantines were enforced in those areas. These restrictions on movement made it difficult for households to access and obtain food.

Similar findings were documented by Kodish *et al.* (2019) and Ouko *et al.* (2020), who argued that with the rise in COVID-19, containment measures implemented across the country had negative consequences for households, including the movement of food along supply chains leading to spoilage of highly perishable goods (Okoth *et al.*, 2020), income losses due to institution closures and bans on social gatherings, and nutritional insecurity. While containment measures reduced virus spread, the country also suffered significant economic losses, including foreign exchange earnings from the tourism and hospitality industries, due to movement restrictions (Wangari *et al.*, 2021).

Nonetheless, the containment measures had some positive effects, which were felt by only 6% of the total interviewed respondents. The benefits accrued from various interventions by the Kenyan government and various stakeholders were among the positive effects of the COVID-19 measures. Among these initiatives are the COVID-19 cash transfer programs, given directly, which targeted low-income households, the elderly, and the most vulnerable (Wangari *et al.*, 2021). Income tax reduction from 30% to 25%, 100% tax exemption for individuals earning less than KES 24000, and VAT reduction from 16% to 14% (Wanjala, 2020) were some of the positive effects of the Kenyan government's COVID-19 measures.

Table 4.11: Alternative combinations of COVID-19 measures (n=246 households)

COVID-19 Measures Combinations	Frequencies	Percentages(%)	
0	M _o C _o B _o	18	7.32
1	M _n C _o B _n	11	4.47
2	M _n C _n B _n	155	63.01
3	M _n C _n B _o	19	7.72
4	M _n C _o B _o	16	6.50
5	M _p C _p B _p	15	6.10
6	M _o C _n B _o	7	2.85
7	M _o C _n B _n	5	2.03

Note: COVID-19 Measure combination represents the eight possible combinations of closure of institutions (C), Ban on social gathering (B), and movement restrictions (M) measures

4.4.2 Determinants of exposure to effects of alternative combinations of COVID-19 measures

A variance inflation factor was used for objective three analysis to ascertain multicollinearity among the independent variables. The multicollinearity tests indicated that the VIF was less than 2.00 for all the independent variables, with an overall mean of 1.33. This indicated absence/low multicollinearity, as shown in Table 4.10.

Table 4.12: Multicollinearity test for objective three

Variable	VIF	1/VIF
Meals frequency	1.98	0.5057
Food thrown away	1.64	0.6102
New recipes often used	1.60	0.6231
Household monthly income	1.46	0.6828
Extent of advance meal plans	1.40	0.7146
Food eaten	1.36	0.7346
HFDM level of education	1.33	0.7491
Money spent	1.30	0.7698
Age of HFDM	1.27	0.7904
Occupation of household head	1.19	0.8380
Farming before COVID-19	1.17	0.8564
Gender of HFDM	1.15	0.8701
Total household size	1.13	0.8836
Income change due to COVID-19	1.12	0.8911
Distance to buy foodstuff	1.11	0.9000
Changes in food prices	1.06	0.9461
Mean VIF	1.33	

The results of the multinomial regression estimates are presented in Table 4.11, with their corresponding marginal effects shown in Table 4.12. The estimated coefficients differ significantly across different household food consumption patterns.

The age of the household food decision-maker had a significant and positive relationship with the negative effects of movement restrictions, institution closures, and social gathering bans ($M_nC_nB_n$). This suggests that as household food decision-makers age, they are more likely to be negatively affected by COVID-19 measures. A possible explanation for this is that most older people were affected by the pandemic, so the COVID-19 measures did not benefit them but worsened the situation because they could not move around as freely as the younger generation as they were more susceptible to the virus. However, the age of the household food decision-maker had a significant and negative relationship with the negative effects of movement restrictions ($M_nC_oB_o$). This is consistent with the findings of Shahbaz *et al.* (2022), who

discovered that with government restrictions for older people in most countries, it was difficult for them to obtain food, negatively affecting their livelihoods. Oyando *et al.* (2021) also found that older people were likely to be affected by disruptions following the pandemic measures.

The occupation of the household head was found to have a significant and negative association with the negative effects of movement restrictions and institution closures ($M_n C_n B_o$) and movement restrictions ($M_n C_o B_o$). The occupation of the household head was a significant determinant of how the COVID-19 measures would affect household food consumption patterns. Ideally, the closure of institutions such as schools and workplaces, combined with movement restrictions, had a negative effect on the majority of household heads, who were either laid off from work, went on half-pay, or missed work due to movement restriction, particularly within counties. It was worse for the self-employed who had to get products from different counties. As a result, the COVID-19 measures had a negative effect on such household food consumption patterns.

The study also found occupation was positively associated with the negative effects of institution closures and social gathering bans ($M_o C_n B_n$). One plausible explanation for this is that, with the closure of eateries/restaurants, people were forced to shift from doing business physically to doing business online to retain their clientele and keep their jobs. While on the same, most residents in the study area are employed on a contract basis or are casual staff in schools, restaurants, or companies. Thus, COVID-19 measures caused stress in their occupations, negatively affecting their income (Kundu *et al.*, 2020). Despite their limited resources, they were able to do various activities/businesses to help support their families.

The findings showed a significant negative relationship between monthly household income and the negative effects of movement restrictions, institution closures, and social gathering bans ($M_n C_n B_n$). Loss of jobs, half-pay, business failures that resulted in lower income, and income loss that forced households to bear the burden of the negative effects of the COVID-19 measures such as food insecurity, food price increases, and a lack of socializing amongst themselves. In contrast, monthly household income was found to have a positive relationship with the positive effects of movement restrictions, institution closures, and social gathering bans ($M_p C_p B_p$). Many households in the study area were forced to consider alternative business ideas to generate income due to income reductions. This allowed businesses and individuals to reinvent themselves to reap the benefits of these positive effects. Mask production and sales,

tailoring, and food deliveries at home and work were among these businesses considered at that time, resulting in an increase in their monthly income and demonstrating their entrepreneurial and innovative nature.

Kansiime *et al.* (2021) observed that despite all possible entrepreneurial strategies, citizens in Kenya and Uganda experienced job losses and business closures/reductions, resulting in either a loss of income or a reduction or delay in payments. This contributed significantly to the measures' negative effects because households could not buy food on time, pay their debts and bills on time, and there were disruptions in income-earning activities (ILO, 2020. Martin & Labonde, 2020) because they lacked the necessary capital/resources.

The household's daily food consumption frequency was positively associated with the positive effects of COVID-19 measure combinations ($M_pC_pB_p$). With most of the household members at home, most families experimented with new recipes, and the exchange of ideas on what to eat and the nutritional benefits of the foods was a primary concern. As a result, the beneficial effects of the COVID-19 measures were realized during the pandemic. These included deciding on what food to prepare, preparing food as a family, and spending family time together during meals, which was uncommon prior to the COVID-19 measures. Notably, households' daily food consumption frequency was found to be positive and significantly correlated with the positive effect of COVID-19 measures, according to Profeta *et al.* (2021).

A negative significant relationship was discovered between household money spending and the positive effects of COVID-19 measures ($M_pC_pB_p$). An increase in spending would reduce the beneficial effects of COVID-19 measures. With COVID-19 presenting several challenges to households, they were now required to allocate funds equally among all household items, including food. Furthermore, consumers were sharply reducing their discretionary spending, preventing households from benefiting from the positive effects of COVID-19 measures. Being from a low-income household predisposes them to miss out on the benefits of COVID-19 measures. This is because, being from such low socioeconomic status, there is a good chance that they have little or no savings, and their informal employment limits their ability to spend money. As a result, their spending is limited, as documented by Oyando *et al.* (2021), who indicate that due to their low-income status, such households are more vulnerable to the negative effects of COVID-19 mitigation measures and hence disproportionately affected.

Contrary to expectations, the extent of advance meal planning had a negative significant association with the positive effects of movement restrictions, institution closures, and social gathering bans ($M_pC_pB_p$). This meant that improving household meal planning would reduce the positive effects of COVID-19 measures. Following the COVID-19 pandemic, households had more time and were expected to be more efficient in food management. That is, planning for adequate and nutritious meals to strengthen their immunity against the COVID-19 virus. However, findings suggest that even with meal planning, households may not be able to reap the benefits of COVID-19 measures. Principato *et al.* (2022) established contradictory results, documenting that households were more cautious about what food they needed daily. So they planned adequately for their meals, allowing them to benefit from the positive effects of COVID-19 measures by ensuring available food stock last longer and avoiding food waste.

The frequency with which households tried out new recipes was negatively and significantly related to the positive effects of COVID-19 measures ($M_pC_pB_p$). New recipes frequently have significant costs associated with them, such as research, recipe costs, and risks associated with them, especially during a pandemic. Instead of spending this money on developing new recipes, households would rather keep their old ones to reap the benefits such as immune system boosts and nutritional benefits. Nonetheless, trying out new recipes was the new norm in most parts of the world due to dietary changes and coping with food insecurity that the household experienced (Hassen *et al.*, 2020). Contrary to the study's findings, trying out new recipes generally contributed to the positive well-being of households during the pandemic.

Meal frequency due to household behaviour change is key in determining whether households would reap the benefits of COVID-19 measures. From this study, the variable was found to be positively and significantly related to the negative effects of the movement restrictions and social gatherings ($M_nC_oB_n$) and a combination of the three measures ($M_nC_nB_n$). One plausible explanation is that every unit increase in household meal consumption increases the negative effects of COVID-19 measures. During the pandemic, most households arguably had to change their lifestyles, including their food and eating habits. This meant that whatever income they had, had to be distributed among various household items, or they would be unable to sustain the effects of the measures. Similarly, meal frequency was discovered to have a negative but significant association with the positive effects of the three COVID-19 measures

($M_pC_pB_p$). With each unit increase in meal frequency, the positive effects of COVID-19 measures are reduced.

As a result, any increase in meal frequency would require households to forego other necessities. This increased the adverse effects of the measures, such as being unable to pay rent, buy other household items, pay utilities, or obtain medical services due to the strain on their income. Janssen *et al.* (2021) also associated meal frequency with negative effects resulting from COVID-19 measures.

COVID-19 measures focused heavily on movement restrictions, with people being advised to stay indoors and exercise movement as little as possible. In this regard, the distance travelled to buy groceries from home was negatively and significantly associated with the negative effects of movement restrictions ($M_nC_oB_o$) and ban on social gatherings ($M_nC_oB_n$) at a 0.1 significance level. Needless to say, every kilometre a household member moved to buy food increased their chances of contracting the COVID-19 virus. As a result, other household members would be at risk of contracting the virus. Furthermore, given the uncertainty of the pandemic, purchasing food away from home would require household members to buy food in bulk to cover the other days' meals, increasing food insecurity in stores for other households. As a result, every distance travelled to purchase food increased the negative effects of the COVID-19 measures, such as the risk of contracting the virus, food insecurity, and a rise in food prices.

Market visits became scarce as the country's public transportation cost increased. According to NBS-WB (2020), travelling far from the homestead only intensified the effects of mobility measures because public transportation costs had increased, causing households to spend more on travel. Furthermore, due to the closure of open-air markets, the only available food stores were supermarkets, which benefited from monopoly benefits (Adewopo *et al.*, 2021). They raised product prices, negatively affecting urban low-income households compared to rural households. Furthermore, the distance travelled to buy food was also discovered to have a positive and significant relationship with the positive effects of COVID-19 measures ($M_pC_pB_p$). Essentially, this means that, due to the negative effects of travel, some households earned income through local door-to-door deliveries during the pandemic.

Income change due to COVID-19 was found to have a negative significant relationship with negative effects resulting from the closure of institutions ($M_oC_nB_o$). Coming from a low-income family, even a small change in income means that the entire household budget must be

affected. Because of the pandemic, most people lost their jobs or were forced to work on a rotating schedule with other colleagues, affecting their financial situation. Additionally, those who relied on their businesses, such as grocery sales in open-air markets, were affected by the closure/shifting of such markets. Therefore, as much as households attempted to balance household budgets within a limited budget, they found it tough. To survive the pandemic's harsh economic times, a likely transition in their day-to-day life would be required, such as missing meals, food rationing, dietary changes, and increased short-term food availability. These findings were supported by Shahzad *et al.* (2021), who found that after income changes, households were negatively affected by the negative effects of COVID-19 measures and that the government and charitable organizations had to step in to assist some families by providing financial assistance.

Farming by households before COVID-19 was positively and significantly related to the positive effects of COVID-19 measures ($M_p C_p B_p$). Households that practised farming before the COVID-19 pandemic had a continuous supply of some food categories for their families and were able to sell farm products to get money to cater for other household items, thus greatly benefiting from the positive effects of COVID-19 measures. In their study, Kansiime *et al.* (2021) found that most of those who practised farming reported losing business due to COVID-19 measures such as school lockdowns, which contradicted the study's findings. Some respondents stated that they used to sell their products in schools, but with restaurants and schools closed, they had no market for their produce, contributing to postharvest losses and thus could not benefit from the measures.

Table 4.13: Parameter estimates of alternative COVID-19 measures - using a multinomial logit selection model

Variables (Base category $M_0C_0B_0$)	$M_nC_0B_n$ n=11	$M_nC_nB_n$ n=155	$M_nC_nB_0$ n=19	$M_nC_0B_0$ n=16	$M_pC_pB_p$ n=15	$M_0C_nB_0$ n=7	$M_0C_nB_n$ n=5
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Household characteristics							
Gender of HFDM	0.3258	0.5885	-0.1142	0.7311	-0.5914	-0.0016	3.8391
HFDM level of education	-0.3598	0.2372	0.4067	0.2368	-0.9614	1.0756	-1.4076*
Age of HFDM	-0.6460	0.2566	0.4428	-0.8746	0.2616	0.7189	-2.2129
Total household size	-0.0695	0.1094	0.1455	0.1117	0.1524	0.2175	0.3362
Occupation of HOH	-0.6356	0.0610	-0.7477	-0.6670	0.5806	0.2278	10.6685**
Household monthly income	-0.5429	-0.2852	-0.5033	0.2979	1.6274**	-0.2048	1.1778
Household Behaviour Change							
Food eaten	-0.2701	0.1239	0.1481	0.1258	2.4224***	-0.5562	0.6199
Money spent on food	-0.0906	0.1079	0.1651	-0.0997	-1.7042**	0.1231	-1.4266
Extent of advance meal plans	-0.0254	0.1061	-0.1391	0.2167	-1.3914**	-0.1034	0.8262
New recipes often used	-0.4084	0.2571	0.5504	0.6126	-1.0585	-0.3355	-0.0854
Meals frequency	0.6928	-0.0618	-0.2854	-0.5770	-2.5107***	0.6916	-4.4715*
Distance to buy food items	-0.8463*	-0.0872	-0.0142	-0.5814	1.1021**	-0.4365	-0.7519
Food thrown away	0.2055	-0.4305*	-0.4995	-0.5549	0.6602	0.0444	2.8357
Income change due to COVID-19	0.3723	1.1675*	1.7682*	0.6400	-0.3351	-0.8847	-0.8110
Changes in food prices	-0.6148	0.4356	0.7853	0.2481	4.0751	-0.1969	-2.1733

Farming before COVID-19	1.3784	0.1602	0.5651	-0.4300	1.9233*	-1.5956	-1.2535
_cons	6.4064*	-0.9278	-2.2728	1.7828	-4.3980	-4.0663	-22.7541

Note: *** 1% significance level; **5% significance level; *10% significance level.

Coef = Coefficient; n = Number of respondents

Table 4.14: Marginal effect, estimates from multinomial logit model (dy/dx)

Variables (Base category M _o C _o B _o)	M _n C _o B _n	M _n C _n B _n	M _n C _n B _o	M _n C _o B _o	M _p C _p B _p	M _o C _n B _o	M _o C _n B _n
	n=11	n=155	n=19	n=16	n=15	n=7	n=5
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Household characteristics							
Gender of HFDM	0.0296	0.0307	-0.0327	0.0222	-0.0308	-0.0100	0.0452
HFDM level of education	-0.0207	0.0358	0.0168	0.0040	-0.0285	0.0221	-0.0185
Age of HFDM	-0.0293	0.0748*	0.0229	-0.0553*	0.0077	0.0156	-0.0299
Total household size	-0.0065	0.0031	0.0031	0.0006	0.0011	0.0028	0.0028
Occupation of household head	-0.0252	-0.0070	-0.0535**	-0.0392**	-0.0009	-0.0006	0.1320**
Household monthly income	-0.0143	-0.0603*	-0.0235	0.0261	0.0473***	-0.0008	0.0143
Household Behaviour change							
Food eaten	-0.0157	-0.0180	-0.0014	-0.0022	0.0614***	-0.0160	0.0028
Money spent on food	-0.0040	0.0553	0.0111	-0.0056	-0.0449**	0.0028	-0.0156
Extent of advance meal plans	-0.0023	0.0384	-0.0124	0.0107	-0.0404**	-0.0042	0.0120
New recipes often used	-0.0229	0.0335	0.0250	0.0236	-0.0343*	-0.0122	-0.0014
Meals frequency	0.0326*	0.0710*	-0.0079	-0.0215	-0.0572***	0.0211	-0.0509
Distance to buy foodstuff	-0.0278*	0.0185	0.0073	-0.0258*	0.0344***	-0.0066	-0.0097

Food thrown away	0.0191	-0.0762**	-0.0126	-0.0147	0.0217	0.0065	0.0378
Income change due to COVID-19	-0.0193	0.1303	0.0580	-0.0159	-0.0324	-0.0411*	-0.0190
Changes in food prices	-0.0393	0.0025	0.0228	-0.0112	0.1038	-0.0116	-0.0377
Farming before COVID-19	0.0470	-0.0126	0.0257	-0.0355	0.0495**	-0.0409	-0.0196

Note: *** 1% significance level; **5% significance level; *10% significance level.

Coef = Coefficient; n = Number of respondents

4.4.3 Effects of COVID-19 combinations on household food consumption patterns

The effects of COVID-19 measures combinations on household food consumption patterns are shown in Table 4.13. These effects were measured in three ways: positive, negative, and no effects. The MESRM model was used to calculate the estimated effects on household food consumption patterns from the COVID-19 measures for both the ATT and ATU effects. Thus, the results in Table 4.13 were interpreted in two ways: (1) household food consumption patterns were affected by a single COVID-19 measure (ban on social gatherings, closure of institutions, and movement restrictions), and (2) household food consumption patterns were affected by two or three COVID-19 measures.

The findings from the study indicate the ATE effect is positive for household food consumption patterns that were affected by a combination of $M_nC_nB_n$ at 1% and $M_nC_nB_o$ and $M_oC_nB_n$ at 5% significant levels. The results revealed that negative effects from a combination of movement restrictions, the ban on social gatherings, and the closure of institutions ($M_nC_nB_n$) would increase negative changes in household food consumption patterns by 0.28 units. Ideally, with COVID-19 measures in place, most households made bulk purchases of foodstuffs and stockpiles to protect themselves from periods of food scarcity. Fear of the unknown led to a desire to store food due to the ban on social gatherings and movement restrictions.

On the other hand, $M_nC_nB_o$ and $M_oC_nB_n$ combinations resulted in an increase in the negative changes in food consumption patterns by 0.11 and 0.16 units, respectively. The most likely explanation is that, due to the negative effects of movement restrictions such as border closures and curfews, as well as the closure of institutions (schools, open-air markets, and workplaces), most households had to readjust, necessitating negative effects on consumption patterns. The restrictions on movement restriction, combined with the closure of institutions, critically impacted urban low-income household's ability to reliably access and afford food.

In contrast, however, $M_nC_oB_n$, $M_nC_oB_o$, and $M_pC_pB_p$ had a significant but negative ATE value at a 1% significant level. The causal implication is that the effects of these combinations ($M_nC_oB_n$, $M_nC_oB_o$, and $M_pC_pB_p$) are likely to reduce the negative changes in household food consumption by 0.21, 4.15 units, and reduce the positive effects on households by 0.38 units, respectively. This means households would be better off if neither of the measures combinations was present.

COVID-19 measures combinations of $M_nC_nB_n$, $M_nC_nB_o$, and $M_oC_nB_o$ had a significant ATE value at a 1% significance level, as indicated in Table 4.13 below. This shows that the effects of

these combinations of COVID-19 measures were likely to increase the negative changes in household food consumption patterns by 1.95, 2.00, and 2.00, respectively.

Table 4.15: The average treatment effect of COVID-19 measures on household food consumption patterns: multinomial endogenous switching regression estimation

COVID-19 Measures		Household food consumption patterns		
Combinations (CMC)		Associated with CMC	Not associated with any CMC	Treatment effect: ATT/ATU
M _n C _o B _n	Associated	1.73	1.65	0.08
	Not associated	1.64	1.85	-0.21***
	Heterogeneity effect	0.09	-0.20	0.29
M _n C _n B _n	Associated	1.95	1.81	0.13***
	Not associated	1.95	1.67	0.28***
	Heterogeneity effect	0.00	0.14	-0.15
M _n C _n B _o	Associated	2.00	1.91	0.93**
	Not associated	2.00	1.89	0.11***
	Heterogeneity effect	0.00	0.02	0.82
M _n C _o B _o	Associated	0.76	1.85	-1.09
	Not associated	2.27	1.88	-4.15***
	Heterogeneity effect	-3.03	-0.03	-3.06
M _p C _p B _p	Associated	2.06	2.09	-0.04
	Not associated	1.46	1.84	-0.38***
	Heterogeneity effect	0.60	0.25	0.34
M _o C _n B _o	Associated	1.55	1.83	1.69
	Not associated	1.78	1.86	-0.08
	Heterogeneity effect	-0.23	-0.03	1.77
M _o C _n B _n	Associated	2.00	1.67	0.33**
	Not associated	2.00	1.84	0.16***
	Heterogeneity effect	0.00	-0.17	0.17

Note: *** 1% significance level; **5% significance level; *10% significance level. M - movement restriction, C – closure of institutions, B – ban on social gathering; n – negative effect, p – positive effect, o – no effect

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the research study's summary, conclusions, and recommendations. This study examined the significant changes in food consumption patterns among urban low-income populations following the implementation of COVID-19 measures and the importance of investigating these patterns in relation to socio-demographic factors. The key findings of the study objectives are summarized, and conclusions are drawn from each research question. Following that, the study's recommendations are discussed, and the areas for future research are proposed.

5.2 Conclusions

- i. There was a significant decrease in household meat, dairy, fruit, snack, and wheat product consumption, a substantial decline in the frequency of shopping for readymade food, snacks, and meat products and a significant increase in the frequency of shopping for vegetables and wheat products and fruits. COVID-19 measures caused significant changes in household food consumption patterns. Due to the pandemic measures, households had to miss meals, could not stockpile, and saw a decrease in food consumed per family member.
- ii. The factors including HFDM age, Change in food prices, income changes and change in the person in charge of food before COVID-19, fruits and vegetables shopping frequency, and the ban on social gatherings significantly affected the decrease in food consumption patterns while money spent on food and movement restrictions significantly affected an increase in FCPs.
- iii. Households FCP were affected positively by the combination of the negative effects of alternative COVID-19 measures ($M_p C_p B_p$, $M_n C_n B_o$, and $M_o C_n B_n$). On the other hand, the negative effects of movement restriction and the positive effects of alternative combinations of COVID-19 measures had a significant but negative ATU value at the 1% significance level. The causal effect is that the effects of these combinations reduced household food consumption. Finally, pandemic measures negatively affected 78% of urban low-income households.

5.3 Recommendations

From the findings of the study, the following are some of the policy recommendations that can be derived;

- i. Policy makers should increase their understanding of food cultures and vital food categories for low-income urban residents. This will enable them to develop crisis policies prioritizing the accessibility of essential food categories such as grains/cereals, vegetables, oils and fats, legumes, dairy products, and fruits and vegetables. Policies like food subsidies for staple foods like maize flour should be implemented to ensure households can acquire, purchase, prepare, and consume critical food items during a crisis, despite any shifts in how they typically access them.
- ii. The national and county governments can use this study's findings to address the factors that make households, especially low-income ones, vulnerable to a decrease in FCP during the pandemic. Factors such as household size, income loss, fluctuating food prices, limited shopping opportunities, and reduced availability of certain food items due to workplace closures can be examined and mitigated through localized approaches. This can be achieved by having educational programs that seek to enlighten the public on such factors, increasing and decreasing the negative effects of a crisis. This will contribute to more food-resilient households.
- iii. Measures taken by the Kenyan Government resulted in significant changes and effects in the household FCP; it is essential that policymakers and the government effectively communicate these measures and their implications before and during implementation. This would help households adjust to new lifestyles without significant negative effects and enable entrepreneurs or businesses to produce locally the materials and tools necessary during a crisis. This spurs household incomes, subsequently minimizing any adverse effects from the policies by tapping any positive opportunity from such policies.

5.4 Further Research

While this study focused on the pre-COVID-19 period of 2019 and the COVID-19 period (March-2020-March 2021), data on the post-COVID-19 effects was not captured. As a result, future research can concentrate on the effects of the COVID-19 period (before, during and after) on household food consumption in Kenya. A further comparative study focusing on both high-income and low-income earners would also be interesting to compare how COVID-19 affected the different segments' household food consumption patterns. Finally, because the study focused on urban households, a future study could be conducted to determine the effects of COVID-19 on household food consumption patterns in Kenyan rural households.

REFERENCES

- Adewopo, J. B., Solano-Hermosilla, G., Colen, L., & Micale, F. (2021). Using crowd-sourced data for real-time monitoring of food prices during the COVID-19 pandemic: Insights from a pilot project in northern Nigeria. *Global Food Security*, 29(2021), 1-10.
- Ahzad, M. A., Qing, P., Rizwan, M., Razzaq, A., & Faisal, M. (2021). COVID-19 pandemic, determinants of food insecurity, and household mitigation measures: a case study of Punjab, Pakistan. *Healthcare*, 9(6), 621-637.
- Al-Samarrai, S., Gangwar, M., & Gala, P. (2020). *The impact of the COVID-19 pandemic on education financing (Report No. 33739)*. World Bank. <https://doi.org/10.1596/33739>
- Ammar, A., Brach, M., & Trabelsi, K. (2020). Effects of COVID-19 home confinement on eating behavior and physical activity: Results of the ECLB-COVID-19 international online survey. *Nutrients*, 12(6), 1583-1596. <https://doi.org/10.3390/nu12061583>
- Ben Hassen, T., El Bilali, H., & Allahyari, M. S. (2020). Impact of COVID-19 on food behavior and consumption in Qatar. *Sustainability*, 12(17), 6973-6990. <https://doi.org/10.3390/su12176973>
- Béné, C. (2020). Resilience of local food systems and links to Food Security – a review of some important concepts in the context of COVID-19 and other shocks. *Food Security*, 12(4), 805–822. <https://doi.org/10.1007/s12571-020-01076-1>
- Berggrund, E. (2017, February 24). "you can choose your friends, but not your neighbours": A field study of the informal practice of restorative justice and its ties to Community Resilience in rural communities in Nakuru County, Kenya. DIVA. <http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1071409>
- Besart A. and Gaurav N. (2020). When face-to-face interactions become an occupational hazard: Jobs in the time of COVID-19. Brookings. <https://www.brookings.edu/blog/future-development/2020/03/30/when-face-to-face-interactions-become-an-occupational-hazard-jobs-in-the-time-of-covid-19/>
- Błaszczyk-Bębenek, E., Jagielski, P., Bolesławska, I., Jagielska, A., Nitsch-Osuch, A., & Kawalec, P. (2020). Nutrition behaviors in Polish adults before and during COVID-19 lockdown. *Nutrients*, 12(10), 3084-3099. <https://doi.org/10.3390/nu12103084>
- Boniface, P., & Loannides, D. (2017). *Tasting tourism: Travelling for food and drink*. Routledge.
- Buckland, N. J., Swinnerton, L. F., Ng, K., Price, M., Wilkinson, L. L., Myers, A., & Dalton, M. (2021). Susceptibility to increased high energy dense sweet and savoury food intake in

- response to the COVID-19 lockdown: The role of Craving Control and acceptance coping strategies. *Appetite*, 158, 105017. <https://doi.org/10.1016/j.appet.2020.105017>
- Canello, R., Soranna, D., Zambra, G., Zambon, A., & Invitti, C. (2020). Determinants of the lifestyle changes during COVID-19 pandemic in the residents of Northern Italy. *International Journal of Environmental Research and Public Health*, 17(6287), 1-13.
- Coulthard, H., Sharps, M., Cunliffe, L., & van den Tol, A. (2021). Eating in the lockdown during the COVID-19 pandemic; self-reported changes in eating behaviour, and associations with BMI, eating style, coping and Health Anxiety. *Appetite*, 161, 105082. <https://doi.org/10.1016/j.appet.2020.105082>
- Celik, B., & Dane, S. (2020). The effects of COVID-19 pandemic outbreak on food consumption preferences and their causes. *Journal of Research in Medical and Dental Science*, 8(3), 169-173.
- County Government of Nakuru. (2018). Nakuru County Integrated Development Plan. Nakuru, Kenya. <https://nakuru.go.ke/wp-content/uploads/2021/11/3.-NAKURU-CIDP-2018-2022-FINAL.-copy.pdf>
- Dammeyer, J. (2020). An explorative study of the individual differences associated with consumer stockpiling during the early stages of the 2020 coronavirus outbreak in Europe. *Personality and Individual Differences*, 167, 110263. <https://doi.org/10.1016/j.paid.2020.110263>
- Demeke , M., Kariuki , J., & Wanjiru, M. (2020). *The impact of COVID-19 on sport, physical activity and well-being and its effects on social development | DISD*. United Nations. <https://www.un.org/development/desa/dspd/2020/05/COVID-19-sport/>
- Devine, C. M., Farrell, T. J., Blake, C. E., Jastran, M., Wethington, E., & Bisogni, C. A. (2009). Work conditions and the food choice coping strategies of employed parents. *Journal of Nutrition Education and Behavior*, 41(5), 365–370. <https://doi.org/10.1016/j.jneb.2009.01.007>
- Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., Larigauderie, A., Adhikari, J. R., Arico, S., Báldi, A., Bartuska, A., Baste, I. A., Bilgin, A., Brondizio, E., Chan, K. M. A., Figueroa, V. E., Duraiappah, A., Fischer, M., Hill, R., ... Zlatanova, D. (2015). The IPBES conceptual framework — connecting nature and people. *Current Opinion in Environmental Sustainability*, 14, 1–16. <https://doi.org/10.1016/j.cosust.2014.11.002>
- Fanelli, R. M. (2021). Changes in the food-related behaviour of Italian consumers during the COVID-19 pandemic. *Foods*, 10(1), 169-184.

- Food and Agriculture Organization. (2020). *Q&A COVID-19 Pandemic-Impact on Food and Agriculture*. FAO: Rome, Italy.
- George, A., Li, C., Lim, J. Z., & Xie, T. (2021). From SARS to COVID-19: The evolving role of China-ASEAN Production Network. *Economic Modelling*, 101, 105510, 1-12. <https://doi.org/10.1016/j.econmod.2021.105510>
- Giacalone, D., Frøst, M. B., & Rodríguez-Pérez, C. (2020). Reported changes in dietary habits during the COVID-19 lockdown in the Danish population: The Danish COVID-19 diet Study. *Frontiers in Nutrition*, 7, 592112, 1-10. <https://doi.org/10.3389/fnut.2020.592112>
- Guerrero, L., Guàrdia, M. D., Xicola, J., Verbeke, W., Vanhonacker, F., Zakowska-Biemans, S., Sajdakowska, M., Sulmont-Rossé, C., Issanchou, S., Contel, M., Scalvedi, M. L., Granli, B. S., & Hersleth, M. (2009). Consumer-driven definition of traditional food products and innovation in traditional foods. A qualitative cross-cultural study. *Appetite*, 52(2), 345–354. <https://doi.org/10.1016/j.appet.2008.11.008>
- Hassen, T. B., El Bilali, H., & Allahyari, M. S. (2020). Impact of COVID-19 on food behavior and consumption in Qatar. *Sustainability*, 12(17), 6973-6991.
- Holdsworth, M., Pradeilles, R., Tandoh, A., Green, M., Wanjohi, M., Zotor, F., Asiki, G., Klomegah, S., Abdul-Haq, Z., Osei-Kwasi, H., Akparibo, R., Bricas, N., Auma, C., Griffiths, P., & Laar, A. (2020). Unhealthy eating practices of city-dwelling Africans in deprived neighbourhoods: Evidence for policy action from Ghana and Kenya. *Global Food Security*, 26, 100452. <https://doi.org/10.1016/j.gfs.2020.100452>
- Hoehn-Velasco, L., Balmori de la Miyar, J. R., Silverio-Murillo, A., & Farin, S. M. (2023). Marriage and divorce during a pandemic: the impact of the COVID-19 pandemic on marital formation and dissolution in Mexico. *Review of Economics of the Household*. <https://doi.org/10.1007/s11150-023-09652-y>
- Hoteit, M., Mortada, H., Al-Jawaldeh, A., Ibrahim, C., & Mansour, R. (2022). COVID-19 home isolation and food consumption patterns: Investigating the correlates of poor dietary diversity in Lebanon: A cross-sectional study. *F1000Research*, 11, e113.
- Il'in, M., Kalinina, L., Zelenskaya, I., Kalinin, N., Vlasenko, O. G., & Zhdanova, N. Y. (2021). Impact of COVID-19 on the production and consumption of agricultural food. In *E3S Web of Conferences*, 247, (p. 01061). EDP Sciences.
- ILO, I. (2020). *COVID-19 and the world of work: Impact and policy responses*. ILO Monitor.

- Jafri, A., Mathe, N., Aglago, E. K., Konyole, S. O., Ouedraogo, M., Audain, K., ... & Sanou, D. (2021). Food availability, accessibility and dietary practices during the COVID-19 pandemic: a multi-country survey. *Public Health Nutrition*, *24*(7), 1798-1805.
- Jahanshahi, A. A., Dinani, M. M., Madavani, A. N., Li, J., & Zhang, S. X. (2020). The distress of Iranian adults during the COVID-19 pandemic – more distressed than the Chinese and with different predictors. *Journal of Affective Disorders*, *278*, 108-115. <https://doi.org/10.1016/j.jad.2020.09.074>
- Janssen, M., Chang, B. P., Hristov, H., Pravst, I., Profeta, A., & Millard, J. (2021). Changes in food consumption during the COVID-19 pandemic: Analysis of Consumer Survey data from the first lockdown period in Denmark, Germany, and Slovenia. *Frontiers in Nutrition*, *8*, 635859. <https://doi.org/10.3389/fnut.2021.635859>
- Jeżewska-Zychowicz, M., Plichta, M., & Królak, M. (2020). Consumers' fears regarding food availability and purchasing behaviors during the COVID-19 pandemic: The importance of trust and perceived stress. *Nutrients*, *12*(9), 2852-2861.
- Jia, P., Liu, L., Xie, X., Yuan, C., Chen, H., Guo, B., Zhou, J., & Yang, S. (2021). Changes in dietary patterns among youths in China during COVID-19 epidemic: The COVID-19 impact on Lifestyle Change Survey (COINLICS). *Appetite*, *158*, 105015. <https://doi.org/10.1016/j.appet.2020.105015>
- Kansiime, M. K., Tambo, J. A., Mugambi, I., Bundi, M., Kara, A., & Owuor, C. (2021). COVID-19 implications on household income and food security in Kenya and Uganda: Findings from a rapid assessment. *World development*, *137*(2021), 1-14.
- Kansiime, M. K., Tambo, J. A., Mugambi, I., Bundi, M., Kara, A., & Owuor, C. (2021). COVID-19 implications on household income and food security in Kenya and Uganda: Findings from a rapid assessment. *World Development*, *137*, 105199. <https://doi.org/10.1016/j.worlddev.2020.105199>
- Kartari, A., Özen, A. E., Correia, A., Wen, J., & Kozak, M. (2021). Impacts of COVID-19 on changing patterns of Household Food Consumption: An intercultural study of three countries. *International Journal of Gastronomy and Food Science*, *26*, 100420. <https://doi.org/10.1016/j.ijgfs.2021.100420>
- KNBS. (2020). Survey on socio-economic impact of COVID-19 on household report. Kenya National Bureau of Statistics, Nairobi, Kenya. Available at: <https://bit.ly/3gigS0c>
- KNBS. (2019). 2019 Kenya Population and Housing Census: Volume II. Kenya National Bureau of Statistics. <https://housingfinanceafrica.org/app/uploads/VOLUME-II-KPHC-2019.pdf>

- Kodish, S. R., Bio, F., Oemcke, R., Conteh, J., Beauliere, J. M., Pyne-Bailey, S., ... & Wirth, J. P. (2019). A qualitative study to understand how Ebola Virus Disease affected nutrition in Sierra Leone—A food value-chain framework for improving future response strategies. *PLoS Neglected Tropical Diseases*, *13*(9), e0007645.
- Kundu, S., Al Banna, M. H., Sayeed, A., Sultana, M. S., Brazendale, K., Harris, J., ... & Khan, M. S. I. (2021). Determinants of household food security and dietary diversity during the COVID-19 pandemic in Bangladesh. *Public Health Nutrition*, *24*(5), 1079-1087.
- Loopstra, R. (2020). Vulnerability to food insecurity since the COVID-19 lockdown. *London: The Food Foundation*.
- Matsungu, T. M., & Chopera, P. (2020). The effect of the COVID-19 induced lockdown on nutrition, health and lifestyle patterns among adults in Zimbabwe. *BMJ Nutrition, Prevention & Health*. *6*(3), 3-6. <https://doi.org/10.1101/2020.06.16.20130278>
- Mbijiwe, J., Kiiru, S., Konyole, S., Ndungu, N., & Kinyuru, J. (2021). Impact of COVID-19 Pandemic on Food Consumption Pattern in the Population of Nairobi, Kenya. *Journal of Agriculture, Science, and Technology*, *20*(3), 16-26.
- MOH-Kenya. (2020). Ministry of Health—Republic of Kenya. Coronavirus Dashboard; MOH-Kenya: Nairobi, Kenya.
- Naivasha Water and Sanitation Company. (2022). Annual Report on Water and Sanitation for Special Interest Groups. NAIVAWASCO.
- NBS-WB. (2020). *COVID-19 Impact Monitoring, Nigeria, Round 3*. National Bureau of Statistics, Nigeria & LSMS, The World Bank.
- Nouh, F., Elfagi, S., & Omar, M. (2020). Coronavirus: the paradox between food insecurity and weight gain. *EAS Journal of Nutrition and Food Sciences*, *2*(2), 39-43.
- OECD. (2020). The Territorial Impact of COVID-19: Managing the Crisis across Levels of Government. OECD. <https://www.oecd.org/coronavirus/policy-responses/the-territorial-impact-of-covid-19-managing-the-crisis-across-levels-of-government-d3e314e1/>
- Okoth, S., Chemingingwa, G., Jakinda, D., Omwenga, M., & Njeri, M. (2020). DVC Rie COVID Seminar Series. Understanding the Effects of the COVID19 Pandemic on Food Security in Kenya and GloballyDVC. *Rie COVID Seminar Series*, *3*,1-35.
- Ouko, K. O., Gwada, R. O., Alworah, G. O., Onganga, Z. M., Ochieng, S. V., & Ogola, J. R. O. (2020). Effects of Covid-19 pandemic on food security and household livelihoods in Kenya. *Review of Agricultural and Applied Economics (RAAE)*, *23*(1340-2021-017), 72-80.

- Ovaskainen, M.-L., Reinivuo, H., Tapanainen, H., Hannila, M.-L., Korhonen, T., & Pakkala, H. (2006). Snacks as an element of energy intake and food consumption. *European Journal of Clinical Nutrition*, 60(4), 494–501. <https://doi.org/10.1038/sj.ejcn.1602343>
- Owuor, S. (2006). *Bridging the urban-rural divide: Multi-spatial livelihoods in Nakuru*. https://www.researchgate.net/publication/28641775_Bridging_the_urban-rural_divide_multi-spatial_livelihoods_in_Nakuru_town_Kenya
- Oyando, R., Orangi, S., Mwangi, D., Pinchoff, J., Abuya, T., Muluve, E., ... & Barasa, E. (2021). Assessing equity and the determinants of socio-economic impacts of COVID-19: results from a cross-sectional survey in three counties in Kenya. *Wellcome Open Research*, 6, 339. <https://doi.org/10.12688/wellcomeopenres.16336.1>
- Piret, J., & Boivin, G. (2022). Corrigendum: Pandemics throughout history. *Frontiers in Microbiology*, 13, 22–34. <https://doi.org/10.3389/fmicb.2022.988058>
- Poelman, M. P., Gillebaart, M., Schlinkert, C., Dijkstra, S. C., Derksen, E., Mensink, F., Hermans, R. C. J., Aardening, P., de Ridder, D., & de Vet, E. (2021). Eating behavior and food purchases during the COVID-19 lockdown: A cross-sectional study among adults in the Netherlands. *Appetite*, 157, 105002. <https://doi.org/10.1016/j.appet.2020.105002>
- Poudel, P. B., Poudel, M. R., Gautam, A., Phuyal, S., Tiwari, C. K., Bashyal, N., & Bashyal, S. (2020). COVID-19 and its global impact on food and agriculture. *Journal of Biology and Today's World*, 9(5), 221-225.
- Principato, L., Secondi, L., Cicatiello, C., & Mattia, G. (2022). Caring more about food: The unexpected positive effect of the COVID-19 lockdown on household food management and waste. *Socio-Economic Planning Sciences*, 82, 100953. <https://doi.org/10.1016/j.seps.2021.100953>
- Profeta, A., Siddiqui, S. A., Smetana, S., Hossaini, S. M., Heinz, V., & Kircher, C. (2021). The impact of Corona pandemic on consumer's food consumption: Vulnerability of households with children and income losses and change in sustainable consumption behavior. *Journal of Consumer Protection and Food Safety*, 16(4), 305-314.
- Raifman, J., Bor, J., & Venkataramani, A. (2021). Association between receipt of unemployment insurance and food insecurity among people who lost employment during the COVID-19 pandemic in the United States. *JAMA Network Open*, 4(1), e2035884-e2035884.
- Reardon, T., Bellemare, M. F., & Zilberman, D. (2020). How COVID-19 may disrupt food supply chains in developing countries. *IFPRI Book Chapters*, 13(4), 78-80.






- Renzo, L. D., Gualtieri, P., Pivari, F., Soldati, L., Attinà, A., Cinelli, G., Leggeri, C., Caparello, G., Barrea, L., Scerbo, F., Esposito, E., & De Lorenzo, A. (2020). *Eating habits and lifestyle changes during COVID-19 lockdown: An Italian survey*. Research Square. <https://doi.org/10.21203/rs.3.rs-30403/v1>
- Rodríguez-Pérez, C., Molina-Montes, E., Verardo, V., Artacho, R., García-Villanova, B., Guerra-Hernández, E. J., & Ruíz-López, M. D. (2020). Changes in dietary behaviours during the COVID-19 outbreak confinement in the Spanish COVID-19iet study. *Nutrients*, *12*(6), 1730. <https://doi.org/10.3390/nu12061730>
- Rohwerder, B. (2020). *Secondary impacts of major disease outbreaks in low-and middle income countries*. K4D Helpdesk Report 756. Brighton, UK: Institute of Development Studies. Available at: <https://www.gov.uk/dfid-research-outputs/secondary>
- Schmidt, S., Benke, C., & Pané-Farré, C. A. (2021). Purchasing under threat: Changes in shopping patterns during the COVID-19 pandemic. *PLoS One*, *16*(6), e0253231.
- Seale, J. L., Regmi, A., & Bernstein, J. (2003). *International evidence on food consumption patterns*. USDA ERS. <https://www.ers.usda.gov/publications/pub-details/?pubid=47430>
- Shahbaz, P., ul Haq, S., Boz, I., Aziz, B., & Hafeez, A. (2022). Gendered impact of COVID-19 on consumption of perishable and nonperishable food commodities in Pakistan. *Journal of Agribusiness in Developing and Emerging Economies*. Advance online publication. <https://doi.org/10.1108/JADEE-12-2021-0212>
- Shahzad, M. A., Razaq, A., Qing, P., Rizwan, M., & Faisal, M. (2022). Food availability and shopping channels during the disasters: Has the COVID-19 pandemic changed peoples' online food purchasing behavior? *International Journal of Disaster Risk Reduction*, *83*, 103443. <https://doi.org/10.1016/j.ijdrr.2022.103443>
- Shupler, M., Mwitari, J., Gohole, A., Anderson de Cuevas, R., Puzzolo, E., Čukić, I., Nix, E., & Pope, D. (2021). COVID-19 impacts on Household Energy & Food Security in a Kenyan informal settlement: The need for integrated approaches to the sdgs. *Renewable and Sustainable Energy Reviews*, *144*, 111018. <https://doi.org/10.1016/j.rser.2021.111018>
- Shikomboleni, H. (2020). COVID-19 and food security in Africa: Building more resilient food systems [version 1; peer review: 1 approved]. *AAS Open Res*, *3*:27 <https://doi.org/10.12688/aasopenres.13078.1>
- Sidor, A., & Rzymski, P. (2020). Dietary choices and habits during COVID-19 lockdown: Experience from Poland. *Nutrients*, *12*(6), 1657-1657. <https://doi.org/10.3390/nu12061657>

- Simiyu, S., Chumo, I., & Mberu, B. (2021). Fecal sludge management in low income settlements: Case study of Nakuru, Kenya. *Frontiers in Public Health*, 9, 1-8. <https://doi.org/10.3389/fpubh.2021.750309>
- Tan, S. T., Tan, C. X., & Tan, S. S. (2022). Changes in dietary intake patterns and weight status during the COVID-19 lockdown: a cross-sectional study focusing on young adults in Malaysia. *Nutrients*, 14(2), 280. <https://doi.org/10.3390/nu14020280>
- Tariga, J. N., Nolasco, D. P., & Barayuga, S. J. (2021). Food consumption habits of consumers in the Philippines: Changes amidst the pandemic. *International Journal of Public Health Science (IJPHS)*, 10(3), 662-674. <https://doi.org/10.11591/ijphs.v10i3.20823>
- Torero, M. (2020, April 23). *Without food, there can be no exit from the pandemic*. Nature News. <https://www.nature.com/articles/d41586-020-01181-3>
- UNCTAD. (2020). *How COVID-19 Is Changing the World: A Statistical Perspective II*. CCSA, New York, USA.
- Wachyuni, S. S., & Wiweka, K. (2020). The changes in food consumption behavior: a rapid observational study of COVID-19 pandemic. *International Journal of Management Innovation & Entrepreneurial Research*, 6(2), 77-87.
- Wangari, E. N., Gichuki, P., Abuor, A. A., Wambui, J., Okeyo, S. O., Oyatsi, H. T., ... & Kulohoma, B. W. (2021). Kenya's response to the COVID-19 pandemic: a balance between minimising morbidity and adverse economic impact. *AAS Open Research*, 4, 3.
- Wanjala, K. (2020). The Economic Impact Assessment of the Novel Coronavirus on Tourism and Trade in Kenya: Lessons from Preceding Epidemics. *Finance and Economics Review*, 2(1), 1-10. <https://doi.org/10.38157/finance-economics-review.v2i1.57>
- Were, S. O. (2016). *Cultural Determinants of Food Choices by Hospitality Clientele in Commercial Catering Outlets Within Kisumu County, Kenya*. Repository Home. <https://ir-library.ku.ac.ke/>
- Wolfson, J. A., & Bleich, S. N. (2014). Is cooking at home associated with better diet quality or weight-loss intention? *Public Health Nutrition*, 18(8), 1397–1406. <https://doi.org/10.1017/s1368980014001943>
- World Bank Group. (2016). 2014-2015 West Africa Ebola Crisis: Impact Update. Available at: <https://www.worldbank.org/en/topic/macroeconomics/publication/2014-2015-west-africa-ebola-crisis-impact-update>
- World Bank (2020). Joint Statement on COVID-19 Impacts on Food Security and Nutrition. World Bank. <https://www.worldbank.org/en/news/statement/2020/04/21/joint-statement-on-covid-19-impacts-on-food-security-and-nutrition>

- World Health Organization. (2020). *Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19): Interim guidance, 19 March 2020*. World Health Organization. <https://apps.who.int/iris/handle/10665/331497>
- Zhao, B., Ni, C., Gao, R., Wang, Y., Yang, L., Wei, J., Lv, T., Liang, J., Zhang, Q., Xu, W., Xie, Y., Wang, X., Yuan, Z., Liang, J., Zhang, R., & Lin, X. (2020). Recapitulation of SARS-COV-2 infection and cholangiocyte damage with human liver ductal organoids. *Protein & Cell*, 11(10), 771–775. <https://doi.org/10.1007/s13238-020-00718-6>

APPENDICES

Appendix A: NACOSTI Research Permit

 REPUBLIC OF KENYA	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
RefNo: 109037	Date of Issue: 16/March/2023
RESEARCH LICENSE	
	
<p>This is to Certify that Mr. Kelvin Mungai Mworira of Egerton University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nakuru on the topic: EFFECT OF COVID-19 MEASURES ON FOOD CONSUMPTION PATTERNS FOR URBAN LOW-INCOME HOUSEHOLDS IN NAKURU COUNTY KENYA for the period ending: 16/March/2024.</p>	
License No: NACOSTI/P/23/24187	
109037 Applicant Identification Number	 Director General NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
	Verification QR Code 
<p>NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.</p>	
See overleaf for conditions	

Appendix B: ETHICAL APPROVAL

EGERTON

TEL: (051) 2217808
FAX: 051-2217942



UNIVERSITY

P. O. BOX 536
EGERTON

EGERTON UNIVERSITY INSTITUTIONAL SCIENTIFIC AND ETHICS REVIEW COMMITTEE

EU/RE/DIR/009

Approval No. EUISERC/APP/233/2023

26th April 2023

Mworia Kelvin Mworia
P.O.Box 536-20115
Egerton
Telephone: 0714013812
Email: mungaimworia@gmail.com

Dear Mworia,

RE: ETHICAL APPROVAL: EFFECT OF COVID-19 MEASURES ON FOOD CONSUMPTION PATTERNS FOR LOW-INCOME HOUSEHOLDS IN NAKURU COUNTY KENYA

This is to inform you that *Egerton University Institutional Scientific and Ethics Review Committee* has reviewed and approved your above research proposal. Your application approval number is **EUISERC/APP/233/2023**. The approval period is **26th April, 2023 –27th April, 2024**

This approval is subject to compliance with the following requirements;

- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by *Egerton University Institutional Scientific and Ethics Review Committee*.
- iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to *Egerton University Institutional Scientific and Ethics Review Committee* within 72 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to *Egerton University Institutional Scientific and Ethics Review Committee* within 72 hours.
- v. Clearance for Material Transfer of biological specimens must be obtained from relevant institutions.

- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to *Egerton University Institutional Scientific and Ethics Review Committee*.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.

Yours sincerely.



Prof. Raphael M. Ngure
**CHAIRMAN, EGERTON UNIVERSITY INSTITUTIONAL SCIENTIFIC AND ETHICS
REVIEW CTTEE**

RMN/BK/

Appendix C: QUESTIONNAIRE

My name is I am conducting a household survey on "Effects of COVID-19 measures on food consumption patterns". I want to ask some questions about you and your household consumption patterns before and after the implementation of COVID-19 measures, foods you ate in your household, how it was and is acquired and prepared, how often, with whom, and who does what jobs. The interview will take about one hour. Everybody is asked the same questions. You will not be judged in any way, and your identity will be kept anonymous. If you don't want to answer something, that won't be a problem. I will use this information for academic purposes and, more so, to understand the effects of COVID-19 measures on the food consumption patterns of households in the Nakuru West sub-county. Please answer on behalf of all the people in or connected to your household who are typically involved in obtaining, preparing, and eating food, not just yourself. If someone else in your household has more knowledge than you about some of the questions, please feel free to ask them.

General Information

SECTION A:

HOUSEHOLD IDENTIFICATION AND HOUSEHOLD DEMOGRAPHICS

Questionnaire number	Code	Name
Interviewer's name		
County		
Sub-County		
ward		
Village		
Starting time		

A1) What is the name of the household food decision-maker?

A2) What is the sex of the household food decision-maker?

1=Male, 0=Female

A3) What is the marital status of the household food decision-maker?

1 = Single, 2 = married, 3= widow/widower, 4=Separated, 5=divorced

A4) What is the highest level of education for the household food decision-maker?

1= No school, 2= Primary, 3= Secondary, 4= University/tertiary institution

A5) What is the age of the household food decision-maker?

A6) How many people lived in your household (2019-2020)?

Number of adults in the household	Number of children in the household	Total household size
Male.....Female.....	Male Female	
Total.....	Total ...	

A7) Occupation of the household head? 1=Unemployed, 2=Self-employed, 3=Employed, 4=Retired

A8) what is the average household monthly income? 1= <5,000 2= 5.000-10,000 3= 10,000-20,000 4= 20,000-30,000 5=40,000-50.000 6=40,000-50,000 7= >50,000

SECTION B

B1) What main ways did your household obtain food before and after COVID-19 measures?

Before COVID-19	After COVID-19 measures
Own purchase	Own purchase
charities	charities
Grew own	Grew own
Direct from a local producer	Direct from a local producer
Other Means	Other Means

B2) What were the main sources of buying your household's food categories before the implementation of COVID-19 measures?

Food Category	Supermarkets	Wholesale Discount shops	Butchery, small grocery	Market	local producer	Retail Shop
Grains/cereals						
DAIRY PRODUCTS						
MEAT PRODUCTS						
FRUITS						
VEGETABLES						

READY-MADE FOOD						
LEGUMES						
SNACKS						
OILS and FATS						
FROZEN FOODS						
WHEAT PRODUCTS						

B3) What were the primary/main sources of buying your household's food categories after the implementation of COVID-19 measures?

Food Category	Supermarkets	Wholesale Discount shops	Butchery, small grocery	Market	local producer	Retail shops
Grains/cereals						
DAIRY PRODUCTS						
MEAT PRODUCTS						
FRUITS						
VEGETABLES						
READY-MADE FOOD						
LEGUMES						
SNACKS						
OILS and FATS						
FROZEN FOODS						

WHEAT PRODUCTS						
----------------	--	--	--	--	--	--

B4) How often did your household obtain the following food types before COVID-19 measures?

Food Category	Daily	weekly 4 to 6 times	weekly 2 to 3 times	Once a week	Within a fortnight	More than a fortnight
Grains/cereals						
DAIRY PRODUCTS						
MEAT PRODUCTS						
FRUITS						
VEGETABLES						
READY-MADE FOOD						
LEGUMES						
SNACKS						
OILS and FATS						
FROZEN FOODS						
WHEAT PRODUCTS						

B5) How often did your household obtain the following food types after COVID-19 measures?

Food Category	Daily	weekly 4 to 6 times	weekly 2 to 3 times	Once a week	Within a fortnight	More than a fortnight
Grains/cereals						
DAIRY PRODUCTS						
MEAT PRODUCTS						
FRUITS						
VEGETABLES						
READY-MADE						

FOOD						
LEGUMES						
SNACKS						
OILS and FATS						
FROZEN FOODS						
WHEAT PRODUCTS						

B6) Which meals are usually prepared and eaten at home by at least one household member each day before and during COVID-19?

Before COVID-19 measures		After COVID-19 measures	
Breakfast		Breakfast	
Midday meal		Midday meal	
Evening meal		Evening meal	
Random snacks		Random snacks	
Other (please specify)		Other (please specify)	

B7) What are the main ways your household food is prepared before and during COVID-19? Tick as many options as are relevant

Before COVID-19		After COVID-19 measures	
Cooking at home		Cooking at home	
Takeaway meals		Takeaway meals	
Ready to heat/cook meals		Ready to heat/cook meals	
Home-made mainly from processed ingredients		Home-made mainly from processed ingredients	
Other (please specify)		Other (please specify)	

B8) When eating away from home, how often did you/household members use the following places before COVID-19 measures?

Food Category	Daily	weekly 4 to 6 times	weekly 2 to 3 times	Once a week	Within a fortnight	More than a fortnight
Work Canteens						
Restaurants, Cafés, Hotels, or similar						
Street vendors						
Free food by well- wishers or similar						

B9) When eating away from home, how often did you/household member use the following places after COVID-19 measures?

Food Category	Daily	weekly 4 to 6 times	weekly 2 to 3 times	Once a week	Within a fortnight	More than a fortnight
Work Canteens						
Restaurants, Cafés, Hotels, or similar						
Street vendors						
Free food by well- wishers or similar						

SECTION C

In the questions on the following pages, we are interested in your household's behaviour and attitudes to food during the COVID-19 pandemic compared to before it started.

C1) How much has your household's food behaviour changed after the implementation of COVID-19 measures compared with before?

Change in How much	Much more	A little more	No Change	A little less	Much less
Food eaten?					
Money spent on food?					
Food obtained from local producers?					
Any food thrown away?					
Varied range of food eaten in the HH?					
To what extent do you plan meals and your grocery list in advance?					
Often new recipes and ingredients were used?					
The overall importance of food in your daily life					
How far do you travel to food shops?					
Food Prices?					

C2) Has anyone in your household missed a meal because there was not enough food before and during COVID-19?

Before COVID-19	After COVID-19 measures
Frequently	Frequently
Occasionally	Occasionally
Never	Never

If frequently, how many meals were missed in a day.....

C3) How often did your household do stockpiling shopping?

Before COVID-19		After COVID-19 measures	
Frequently		Frequently	
Occasionally		Occasionally	
Never		Never	

C4) Did your household income change as a result of COVID-19 measures?

Yes..... No.....

C5) If yes, was it an increase or a decrease in income level

C6) On average, how many thousand were the changes in monthly income.....

C7) Do you think there was a change if spending on food commodities compared to other commodities after the implementation of COVID-19 measures?

Yes..... No.....

C8) If yes, was it an increase or a decrease in the spending

C9) On average, by how much thousands were the changes in monthly food spending.....

C10) On which food category was the change in spending biggest.....

C11) On average, how much was the change in thousands per month?

C12) Did your household stock up on more food than in the period before COVID-19 measures?

Yes..... No.....

If yes,

C13) what categories of food do you stock more.....?

C14) what categories did you stock up less.....?

C15) On average, how much was the change in stocking in kg per month?

C16) Did the person(s) in your household responsible for obtaining or preparing food change after the COVID-19 pandemic measures?

Yes..... No.....

C17) If yes, please explain the changes of the specific person(s) in responsibility for obtaining or preparing food

C18) After the implementation of COVID-19, were there food categories that were not readily available for purchase compared to before?

Yes..... No.....

C19) If yes, please explain which categories and why you think they were not readily available.....

C20) How do you think the COVID-19 pandemic measures affected your Household food consumption patterns?

Positively..... No effect..... Negatively.....

C21) If affected, please explain those other changes due to COVID-19 measures?

.....

C22) Have there been significant changes in food prices due to COVID-19 pandemic measures?

Increase..... No change..... Decrease.....

C23) If there was a change, please explain which categories' prices changed due to COVID-19 measures.....

C24) On average, how much were the price changes.....

C25) Did you do farming before the implementation of the COVID-19 measures in 2019?

Yes..... No.....

C25) If yes, which food item did you farm?

C26) Did farming change in any way after the implementation of COVID-19 measures?

.....

C27) How different was household food waste after the implementation of COVID-19 measures?

.....

C28) Were there food categories the household was taking before the implementation of COVID-19 measures (2019), which stopped after the implementation of the COVID-19 measures?.....

C29) Were there food categories the household began taking after the implementation of the COVID-19 Measures (2020)?

C30) Which measures from the COVID-19 pandemic caused changes beyond your control?

COVID-19 Measures	Positively	No change	Negatively
Movement restrictions			
Closure of Institutions			
Ban on social gathering			

Time finished.....

I want to thank you very much for helping with the study.


```
. mfx, predict(outcome(0))
```

Marginal effects after ologit

```
Y = Pr(ConsumptionPatterns==0) (predict, outcome(0))
= 0.11127043
```

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
HHSexID*	.0604176	.03888	1.55	0.120	-.015782	.136617		.426829
HHMarS~s	.0440914	.0269	1.64	0.101	-.008627	.096809		2.04472
HHLevE~c	-.0112284	.02735	-0.41	0.681	-.064824	.042367		2.73171
HHAge	-.0438006	.02165	-2.02	0.043	-.086227	-.001374		1.81707
TotalH~e	.0050721	.00527	0.96	0.336	-.005254	.015398		5.02846
HHComp*	-.0041908	.06573	-0.06	0.949	-.133016	.124635		.906504
HHOccu~n	.0102927	.02229	0.46	0.644	-.033394	.05398		2.56504
HHMont~e	-.0058837	.01752	-0.34	0.737	-.040214	.028447		2.52439
Moneys~t	-.0461546	.0168	-2.75	0.006	-.079091	-.013218		4.29268
Change~s	-.1151175	.0619	-1.86	0.063	-.236438	.006203		.96748
IncCha~V*	-.1126273	.06724	-1.68	0.094	-.244408	.019154		.825203
FoodPu~e*	-.1093748	.0226	-4.84	0.000	-.153667	-.065083		.036585
f~hpfreq	.0530664	.02226	2.38	0.017	.009447	.096686		-.231707
dairy_..	-.0220285	.0244	-0.90	0.367	-.069844	.025787		.020325
NonFre~q	.0128593	.01051	1.22	0.221	-.007733	.033452		-3.02033
otherf~q	-.0049797	.03331	-0.15	0.881	-.07026	.0603		.04878
FatsSh~q	-.0539028	.04598	-1.17	0.241	-.14403	.036224		.020325
banon_~s	.0854747	.04665	1.83	0.067	-.005955	.176904		.817073
mov_re~s	-.0918327	.05572	-1.65	0.099	-.20105	.017385		.939024

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx, predict(outcome(1))
```

Marginal effects after ologit

```
y = Pr(ConsumptionPatterns==1) (predict, outcome(1))
= .84630819
```

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
HHSexID*	-.0372126	.02675	-1.39	0.164	-.089649	.015224	.426829	
HHMarS~s	-.0259795	.01752	-1.48	0.138	-.060313	.008354	2.04472	
HHLevE~c	.006616	.01624	0.41	0.684	-.025212	.038444	2.73171	
HHAge	.0258082	.01482	1.74	0.082	-.003246	.054862	1.81707	
TotalH~e	-.0029886	.00321	-0.93	0.352	-.009276	.003299	5.02846	
HHComp*	.0025181	.04025	0.06	0.950	-.076363	.081399	.906504	
HHOccu~n	-.0060647	.01325	-0.46	0.647	-.032026	.019896	2.56504	
HHMont~e	.0034668	.01037	0.33	0.738	-.016862	.023795	2.52439	
Moneys~t	.0271952	.01251	2.17	0.030	.002675	.051716	4.29268	
Change~s	.0678295	.04089	1.66	0.097	-.012306	.147965	.96748	
IncCha~V*	.0838229	.05779	1.45	0.147	-.029449	.197095	.825203	
FoodPu~e*	-.1798315	.17741	-1.01	0.311	-.527543	.16788	.036585	
f~hpfreq	-.0312678	.01622	-1.93	0.054	-.063053	.000518	-.231707	
dairy_..	.0129796	.01477	0.88	0.380	-.01597	.041929	.020325	
NonFre~q	-.007577	.00651	-1.16	0.245	-.020342	.005188	-3.02033	
otherf~q	.0029341	.01966	0.15	0.881	-.035596	.041464	.04878	
FatsSh~q	.0317606	.02879	1.10	0.270	-.024658	.08818	.020325	
banon_~s	-.0503634	.03123	-1.61	0.107	-.111566	.010839	.817073	
mov_re~s	.0541096	.03659	1.48	0.139	-.017609	.125828	.939024	

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx, predict(outcome(2))
```

Marginal effects after ologit

```
y = Pr(ConsumptionPatterns==2) (predict, outcome(2))
= .04242138
```

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
HHSexID*	-.0232049	.01467	-1.58	0.114	-.051965 .005555	.426829
HHMarS~s	-.0181119	.01157	-1.56	0.118	-.040795 .004572	2.04472
HHLevE~c	.0046124	.01125	0.41	0.682	-.017442 .026666	2.73171
HHAge	.0179924	.00945	1.90	0.057	-.000531 .036516	1.81707
TotalH~e	-.0020835	.00221	-0.94	0.346	-.006421 .002254	5.02846
HHComp*	.0016727	.02549	0.07	0.948	-.048288 .051633	.906504
HHOccu~n	-.0042281	.00919	-0.46	0.646	-.022248 .013792	2.56504
HHMont~e	.0024169	.00721	0.34	0.737	-.011708 .016542	2.52439
Moneys~t	.0189594	.0079	2.40	0.016	.003471 .034448	4.29268
Change~s	.047288	.02746	1.72	0.085	-.006538 .101114	.96748
IncCha~V*	.0288044	.01288	2.24	0.025	.003567 .054042	.825203
FoodPu~e*	.2892062	.18644	1.55	0.121	-.076214 .654626	.036585
f~hpfreq	-.0217987	.00967	-2.25	0.024	-.040756 -.002842	-.231707
dairy_..	.0090489	.01025	0.88	0.377	-.011039 .029136	.020325
NonFre~q	-.0052824	.00448	-1.18	0.239	-.014067 .003502	-3.02033
otherf~q	.0020456	.01367	0.15	0.881	-.02475 .028841	.04878
FatsSh~q	.0221422	.01915	1.16	0.248	-.015391 .059675	.020325
banon_~s	-.0351113	.02012	-1.75	0.081	-.074538 .004315	.817073
mov_re~s	.0377231	.02371	1.59	0.112	-.008744 .08419	.939024

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Multinomial logistic regression

Number of obs = 213
 LR chi2(38) = 69.84
 Prob > chi2 = 0.0012
 Pseudo R2 = 0.2505

Log likelihood = -104.48006

ConsumptionPatterns	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
No_change	(base outcome)					
Increase						
HHSexID	-.6132718	.5156366	-1.19	0.234	-1.623901	.3973573
HHAge	.3346516	.3103798	1.08	0.281	-.2736816	.9429849
HHOccupation	-.1823533	.3256813	-0.56	0.576	-.8206769	.4559703
HHMarStatus	-.1963102	.39998	-0.49	0.624	-.9802567	.5876362
HHLevEduc	.1923934	.3840084	0.50	0.616	-.5602493	.9450361
TotalHHSIZE	-.1005004	.0594794	-1.69	0.091	-.2170779	.0160772
HHMonthlyIncome	.3261458	.2510499	1.30	0.194	-.1659029	.8181945
IncChangeDueCOV	1.294465	.5848726	2.21	0.027	.1481355	2.440794
fruits_vegesshpfreq	-.1415781	.3221491	-0.44	0.660	-.7729788	.4898227
dairy_meatshopfreq	.5967106	.3583816	1.67	0.096	-.1057044	1.299126
NonFreshShopFreq	-.0710977	.1364902	-0.52	0.602	-.3386136	.1964182
otherfreshshopfreq	-.5450113	.5275185	-1.03	0.302	-1.578929	.4889059
FatsShopFreq	-.0821326	.6930978	-0.12	0.906	-1.440579	1.276314
hcons	.0524614	.0578593	0.91	0.365	-.0609408	.1658636
ChangesinFoodPrices	1.823966	.9872732	1.85	0.065	-.1110534	3.758986
Moneyspent	.5975987	.2261723	2.64	0.008	.1543091	1.040888
ClosInsti	.9659276	.6575184	1.47	0.142	-.3227848	2.25464
Bansocialgather	-1.004886	.6536146	-1.54	0.124	-2.285947	.2761752
FoodPurchasePersonChange	1.078157	1.332112	0.81	0.418	-1.532733	3.689048
_cons	-3.925906	1.970902	-1.99	0.046	-7.788804	-.0630082
Decrease						
HHSexID	-2.605222	1.063832	-2.45	0.014	-4.690294	-.5201494
HHAge	.8899848	.5202241	1.71	0.087	-.1296358	1.909605
HHOccupation	.0537245	.5971391	0.09	0.928	-1.116647	1.224096
HHMarStatus	-.671778	.7657705	-0.88	0.380	-2.172661	.8291046
HHLevEduc	1.016442	.6709008	1.52	0.130	-.2984991	2.331384
TotalHHSIZE	-.0480616	.1794089	-0.27	0.789	-.3996965	.3035734
HHMonthlyIncome	.1902568	.4244246	0.45	0.654	-.6416001	1.022114
IncChangeDueCOV	2.982751	1.587805	1.88	0.060	-.12929	6.094793
fruits_vegesshpfreq	-1.030405	.4942753	-2.08	0.037	-1.999167	-.0616436
dairy_meatshopfreq	.0536201	.5911347	0.09	0.928	-1.104983	1.212223
NonFreshShopFreq	-.2607883	.3020254	-0.86	0.388	-.8527473	.3311707
otherfreshshopfreq	-1.384301	.9341864	-1.48	0.138	-3.215273	.4466707
FatsShopFreq	.6235971	1.197277	0.52	0.602	-1.723023	2.970217
hcons	.3701408	.1634892	2.26	0.024	.0497079	.6905737
ChangesinFoodPrices	1.568404	1.531839	1.02	0.306	-1.433946	4.570753
Moneyspent	-.204372	.3888735	-0.53	0.599	-.96655	.5578061
ClosInsti	1.004698	1.133274	0.89	0.375	-1.216478	3.225873
Bansocialgather	-1.698071	1.136858	-1.49	0.135	-3.926271	.530129
FoodPurchasePersonChange	4.758717	1.794239	2.65	0.008	1.242072	8.275361
_cons	-7.486495	3.565347	-2.10	0.036	-14.47445	-.4985423

Appendix E: Parameter estimates of effects of COVID-19 measures on household food consumption patterns – using a multinomial logit selection model

Multinomial logistic regression
 Log likelihood = -240.02692

Number of obs = 246
 LR chi2(112) = 183.11
 Prob > chi2 = 0.0000
 Pseudo R2 = 0.2761

CMS	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
0	(base outcome)					
1						
	HHSexID	.3257639	.9627171	0.34	0.735	-1.561127 2.212655
	HHLevEduc	-.3598256	.6800023	-0.53	0.597	-1.692606 .9729544
	HHAge	-.6459892	.6500607	-0.99	0.320	-1.920085 .6281063
	TotalHHSsize	-.0694636	.2552909	-0.27	0.786	-.5698244 .4308973
	HHOccupation	-.6356306	.5827135	-1.09	0.275	-1.777728 .5064669
	HHMonthlyincome	-.5428888	.5097163	-1.07	0.287	-1.541914 .4561368
	Foodeaten	-.2700566	.456433	-0.59	0.554	-1.164649 .6245357
	Moneyspent	-.0905951	.4325096	-0.21	0.834	-.9382984 .7571082
	ExtAdvMealPlans	-.0253689	.4317884	-0.06	0.953	-.8716585 .8209208
	Newrecipeoftenused	-.4084206	.5764726	-0.71	0.479	-1.538286 .7214449
	MealsFrequency	.69284	.5853723	1.18	0.237	-.4544686 1.840149
	DstnchbyFdStuff	-.8462788	.4792264	-1.77	0.077	-1.785545 .0929877
	Foodthrowaway	.2054583	.4338107	0.47	0.636	-.644795 1.055712
	IncChangeDueCOV	.3723022	1.020384	0.36	0.715	-1.627614 2.372218
	ChangesinFoodPrices	-.6147561	1.527277	-0.40	0.687	-3.608164 2.378652
	FarmingBfrCov	1.378425	1.044899	1.32	0.187	-.6695388 3.426388
	_cons	6.406415	3.734212	1.72	0.086	-.9125065 13.72534
2						
	HHSexID	.4069876	.5884599	0.69	0.489	-.7463725 1.560348
	HHLevEduc	.2371756	.433533	0.55	0.584	-.6125334 1.086885
	HHAge	.2565723	.3691002	0.70	0.487	-.4668508 .9799955
	TotalHHSsize	.1094419	.14602	0.75	0.454	-.1767521 .3956358
	HHOccupation	.0609763	.3443116	0.18	0.859	-.6138621 .7358147
	HHMonthlyincome	-.2852002	.3083311	-0.92	0.355	-.889518 .3191176
	Foodeaten	.1238825	.2838149	0.44	0.662	-.4323844 .6801495
	Moneyspent	.1078944	.3080271	0.35	0.726	-.4958275 .7116164
	ExtAdvMealPlans	.106077	.2461967	0.43	0.667	-.3764597 .5886136
	Newrecipeoftenused	.2571271	.3247372	0.79	0.428	-.3793461 .8936003
	MealsFrequency	-.0618059	.3440584	-0.18	0.857	-.736148 .6125362
	DstnchbyFdStuff	-.0871738	.3047875	-0.29	0.775	-.6845463 .5101987
	Foodthrowaway	-.4305409	.2588747	-1.66	0.096	-.9379261 .0768443
	IncChangeDueCOV	1.167459	.6151459	1.90	0.058	-.0382044 2.373123
	ChangesinFoodPrices	.4355697	.9735889	0.45	0.655	-1.472629 2.343769
	FarmingBfrCov	.1602021	.6418176	0.25	0.803	-1.097737 1.418142
	_cons	-.9278437	2.451791	-0.38	0.705	-5.733265 3.877578
3						
	HHSexID	-.1141835	.7821714	-0.15	0.884	-1.647211 1.418844
	HHLevEduc	.4067369	.589296	0.69	0.490	-.748262 1.561736
	HHAge	.4428334	.4950116	0.89	0.371	-.5273715 1.413038
	TotalHHSsize	.1454705	.1805462	0.81	0.420	-.2083935 .4993345
	HHOccupation	-.7476919	.464045	-1.61	0.107	-1.657203 .1618196
	HHMonthlyincome	-.5032647	.4236376	-1.19	0.235	-1.333579 .3270496
	Foodeaten	.1480806	.3699947	0.40	0.689	-.5770957 .8732569
	Moneyspent	.1651339	.3997687	0.41	0.680	-.6183984 .9486662
	ExtAdvMealPlans	-.1390675	.3182481	-0.44	0.662	-.7628223 .4846873
	Newrecipeoftenused	.5503715	.4185793	1.31	0.189	-.2700288 1.370772
	MealsFrequency	-.2853877	.4466751	-0.64	0.523	-1.160855 .5900795
	DstnchbyFdStuff	-.0141935	.3874053	-0.04	0.971	-.7734939 .745107
	Foodthrowaway	-.4994504	.3703093	-1.35	0.177	-1.225243 .2263426
	IncChangeDueCOV	1.768198	.9895246	1.79	0.074	-.1712349 3.70763
	ChangesinFoodPrices	.7852503	1.44577	0.54	0.587	-2.048406 3.618907
	FarmingBfrCov	.5651254	.8152716	0.69	0.488	-1.032778 2.163029
	_cons	-2.272846	3.290309	-0.69	0.490	-8.721732 4.176041
4						
	HHSexID	.7310628	.8326139	0.88	0.380	-.9008304 2.362956
	HHLevEduc	.2367872	.638854	0.37	0.711	-1.015344 1.488918
	HHAge	-.8745907	.6637859	-1.32	0.188	-2.175587 .4264058
	TotalHHSsize	.1116633	.1920019	0.58	0.561	-.2646535 .4879801
	HHOccupation	-.6669951	.4737218	-1.41	0.159	-1.595473 .2614825
	HHMonthlyincome	.2979418	.4295497	0.69	0.488	-.5439601 1.139844
	Foodeaten	.1258315	.3990277	0.32	0.752	-.6562485 .9079114
	Moneyspent	-.0996981	.4456667	-0.22	0.823	-.9731887 .7737925
	ExtAdvMealPlans	.2166887	.3449122	0.63	0.530	-.4593268 .8927041
	Newrecipeoftenused	.6126384	.4708845	1.30	0.193	-.3102783 1.535555
	MealsFrequency	-.5770022	.5066356	-1.14	0.255	-1.56999 .4159853
	DstnchbyFdStuff	-.5814358	.4140529	-1.40	0.160	-1.392965 .2300929
	Foodthrowaway	-.5549264	.4328038	-1.28	0.200	-1.403206 .2933534
	IncChangeDueCOV	.6399719	.8909628	0.72	0.473	-1.106283 2.386227
	ChangesinFoodPrices	.2480744	1.509063	0.16	0.869	-2.709634 3.205783
	FarmingBfrCov	-.4300165	.9961966	-0.43	0.666	-2.382526 1.522493
	_cons	1.782824	3.35154	0.53	0.595	-4.786074 8.351722

5							
	HHSexID	- .5913938	1.093906	-0.54	0.589	-2.735409	1.552622
	HHLevEduc	- .9613827	.8957146	-1.07	0.283	-2.716951	.7941856
	HHAge	.2615947	.7529734	0.35	0.728	-1.214206	1.737395
	TotalHHSIZE	.1524294	.2562854	0.59	0.552	-.3498807	.6547395
	HHOccupation	.5805513	.7983168	0.73	0.467	-.9841209	2.145223
	HHMonthlyIncome	1.627365	.7028646	2.32	0.021	.2497757	3.004954
	Foodeaten	2.422363	.7963962	3.04	0.002	.8614553	3.983271
	Moneyspent	-1.704186	.8218114	-2.07	0.038	-3.314907	-.0934652
	ExtAdvMealPlans	-1.391416	.7025576	-1.98	0.048	-2.768404	-.0144287
	Newreciipeoftenused	-1.058465	.8757445	-1.21	0.227	-2.774893	.6579622
	MealsFrequency	-2.51071	.9397659	-2.67	0.008	-4.352618	-.6688031
	DstnchyFdStuff	1.102117	.5199255	2.12	0.034	.0830822	2.121153
	Foodthrowaway	.6601867	.7384316	0.89	0.371	-.7871126	2.107486
	IncChangeDueCOV	-.3350908	1.560208	-0.21	0.830	-3.393043	2.722861
	ChangesinFoodPrices	4.075085	2.598271	1.57	0.117	-1.017432	9.167602
	FarmingBfrCov	1.923328	1.0922	1.76	0.078	-.2173451	4.064
	_cons	-4.397993	4.182354	-1.05	0.293	-12.59526	3.799271
6							
	HHSexID	-.0016485	1.151976	-0.00	0.999	-2.259481	2.256184
	HHLevEduc	1.075617	.8840524	1.22	0.224	-.6570943	2.808327
	HHAge	.7188885	.6663714	1.08	0.281	-.5871755	2.024952
	TotalHHSIZE	.2175059	.1611704	1.35	0.177	-.0983823	.533394
	HHOccupation	.2277951	.6610256	0.34	0.730	-1.067791	1.523382
	HHMonthlyIncome	-.2048329	.5467042	-0.37	0.708	-1.276353	.8666878
	Foodeaten	-.5561758	.6318124	-0.88	0.379	-1.794505	.6821537
	Moneyspent	.1231006	.6224209	0.20	0.843	-1.096822	1.343023
	ExtAdvMealPlans	-.1033908	.5081578	-0.20	0.839	-1.099362	.8925801
	Newreciipeoftenused	-.3354944	.6767852	-0.50	0.620	-1.661969	.9909803
	MealsFrequency	.691588	.6994355	0.99	0.323	-.6792803	2.062456
	DstnchyFdStuff	-.4365262	.6507056	-0.67	0.502	-1.711886	.8388334
	Foodthrowaway	.0443508	.4915933	0.09	0.928	-.9191543	1.007856
	IncChangeDueCOV	-.8846947	1.101049	-0.80	0.422	-3.042712	1.273323
	ChangesinFoodPrices	-.1968752	1.672589	-0.12	0.906	-3.475089	3.081339
	FarmingBfrCov	-1.595573	1.478274	-1.08	0.280	-4.492937	1.301791
	_cons	-4.066298	4.378688	-0.93	0.353	-12.64837	4.515773
7							
	HHSexID	3.839111	2.307756	1.66	0.096	-.6840068	8.362229
	HHLevEduc	-1.407594	1.536393	-0.92	0.360	-4.418868	1.60368
	HHAge	-2.212871	1.541579	-1.44	0.151	-5.23431	.8085687
	TotalHHSIZE	.3361599	.2404064	1.40	0.162	-.1350279	.8073477
	HHOccupation	10.66853	5.22422	2.04	0.041	.4292509	20.90782
	HHMonthlyIncome	1.17783	1.235296	0.95	0.340	-1.243305	3.598965
	Foodeaten	.6198958	.9949031	0.62	0.533	-1.330078	2.56987
	Moneyspent	-1.426572	1.071578	-1.33	0.183	-3.526825	.6736821
	ExtAdvMealPlans	.8262328	.8838259	0.93	0.350	-.9060341	2.5585
	Newreciipeoftenused	-.0854065	1.367015	-0.06	0.950	-2.764707	2.593894
	MealsFrequency	-4.471515	2.502051	-1.79	0.074	-9.375445	.4324148
	DstnchyFdStuff	-.7518713	1.869786	-0.40	0.688	-4.416584	2.912841
	Foodthrowaway	2.835672	2.052267	1.38	0.167	-1.186696	6.858041
	IncChangeDueCOV	-.8110073	2.505043	-0.32	0.746	-5.720801	4.098787
	ChangesinFoodPrices	-2.173312	2.96802	-0.73	0.464	-7.990523	3.6439
	FarmingBfrCov	-1.253461	2.234479	-0.56	0.575	-5.632959	3.126036
	_cons	-22.7541	14.72124	-1.55	0.122	-51.6072	6.098993

Appendix F: Marginal effects, estimates from multinomial logit model (dy/dx) on effects of COVID-19 measures on household food consumption patterns

```
. margins, dydx(*) predict (outcome(1))

Average marginal effects      Number of obs =      246
Model VCE      : OIM

Expression      : Pr(CMS==1), predict(outcome(1))
dy/dx w.r.t.   : HHSexID HHLevEduc HHAge TotalHHSIZE HHOccupation HHMonthlyincome Foodeaten Moneyspent ExtAdvMealPlans
                Newrecipeoftenused MealsFrequency DstncbyFdStuff Foodthrowaway IncChangeDueCOV ChangesinFoodPrices
                FarmingBfrCov
```

	Delta-method				
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]
HHSexID	.0000847	.0296262	0.00	0.998	-.05799816 .0581509
HHLevEduc	-.0207237	.0208392	-0.99	0.320	-.0615678 .0201204
HHAge	-.0293133	.0208849	-1.40	0.160	-.070247 .0116204
TotalHHSIZE	-.0064595	.0082342	-0.78	0.433	-.0225981 .0096792
HHOccupation	-.0252024	.0181116	-1.39	0.164	-.0607092 .0103043
HHMonthlyincome	-.0143369	.0156437	-0.92	0.359	-.0449981 .0163242
Foodeaten	-.0156537	.0137605	-1.14	0.255	-.0426237 .0113163
Moneyspent	-.0040333	.0123211	-0.33	0.743	-.0281823 .0201157
ExtAdvMealPlans	-.002288	.0135666	-0.17	0.866	-.0288781 .0243021
Newrecipeoftenused	-.0229157	.0185171	-1.24	0.216	-.0592085 .0133772
MealsFrequency	.0326362	.0181434	1.80	0.072	-.0029241 .0681965
DstncbyFdStuff	-.0277879	.014518	-1.91	0.056	-.0562426 .0006668
Foodthrowaway	.0190852	.0138474	1.38	0.168	-.0080552 .0462256
IncChangeDueCOV	-.0192522	.0316308	-0.61	0.543	-.0812474 .042743
ChangesinFoodPrices	-.0392705	.0484039	-0.81	0.417	-.1341403 .0555993
FarmingBfrCov	.0469722	.0324004	1.45	0.147	-.0165313 .1104757

```
. margins, dydx(*) predict (outcome(2))

Average marginal effects      Number of obs =      246
Model VCE      : OIM

Expression      : Pr(CMS==2), predict(outcome(2))
dy/dx w.r.t.   : HHSexID HHLevEduc HHAge TotalHHSIZE HHOccupation HHMonthlyincome Foodeaten Moneyspent ExtAdvMealPlans
                Newrecipeoftenused MealsFrequency DstncbyFdStuff Foodthrowaway IncChangeDueCOV ChangesinFoodPrices
                FarmingBfrCov
```

	Delta-method				
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]
HHSexID	.0307419	.0641794	0.48	0.632	-.0950474 .1565313
HHLevEduc	.035782	.049025	0.73	0.465	-.0603051 .1318692
HHAge	.0748441	.0426531	1.75	0.079	-.0087544 .1584426
TotalHHSIZE	.0031338	.0134729	0.23	0.816	-.0232727 .0295403
HHOccupation	-.0070055	.0528331	-0.13	0.895	-.1105565 .0965455
HHMonthlyincome	-.0602549	.0345443	-1.74	0.081	-.1279604 .0074506
Foodeaten	-.0179649	.0304173	-0.59	0.555	-.0775818 .0416519
Moneyspent	.0552802	.0339905	1.63	0.104	-.01134 .1219003
ExtAdvMealPlans	.0383903	.0276593	1.39	0.165	-.0158209 .0926015
Newrecipeoftenused	.033476	.0365257	0.92	0.359	-.0381131 .1050651
MealsFrequency	.0710098	.0404098	1.76	0.079	-.008193 .1502106
DstncbyFdStuff	.0185145	.0328846	0.56	0.573	-.0459382 .0829671
Foodthrowaway	-.0761596	.034469	-2.21	0.027	-.1437175 -.0086016
IncChangeDueCOV	.1302687	.080213	1.62	0.104	-.0269458 .2874832
ChangesinFoodPrices	.0025452	.1209527	0.02	0.983	-.2345178 .2396082
FarmingBfrCov	-.0125622	.0691795	-0.18	0.856	-.1481515 .1230272

```
. margins, dydx(*) predict (outcome(3))

Average marginal effects      Number of obs =      246
Model VCE      : OIM

Expression      : Pr(CMS==3), predict(outcome(3))
dy/dx w.r.t.   : HHSexID HHLevEduc HHAge TotalHHSIZE HHOccupation HHMonthlyincome Foodeaten Moneyspent ExtAdvMealPlans
                Newrecipeoftenused MealsFrequency DstncbyFdStuff Foodthrowaway IncChangeDueCOV ChangesinFoodPrices
                FarmingBfrCov
```

	Delta-method				
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]
HHSexID	-.0327224	.0372013	-0.88	0.379	-.1056356 .0401908
HHLevEduc	.0167635	.0286431	0.59	0.558	-.0393759 .0729029
HHAge	.022945	.0233964	0.98	0.327	-.022911 .0688011
TotalHHSIZE	.00312	.0076622	0.41	0.684	-.0118977 .0181377
HHOccupation	-.0534636	.0224874	-2.38	0.017	-.0975382 -.0093891
HHMonthlyincome	-.0235102	.0207431	-1.13	0.257	-.0641659 .0171455
Foodeaten	-.0014233	.0163851	-0.09	0.931	-.0335375 .0306909
Moneyspent	.0110514	.0185223	0.60	0.551	-.0252517 .0473545
ExtAdvMealPlans	-.0124059	.0144249	-0.86	0.390	-.0406781 .0158664
Newrecipeoftenused	.0249614	.0187726	1.33	0.184	-.0118322 .061755
MealsFrequency	-.0079132	.0192565	-0.41	0.681	-.0456551 .0298288
DstncbyFdStuff	.0073391	.0165625	0.44	0.658	-.0251229 .0398011
Foodthrowaway	-.0126293	.0186993	-0.68	0.499	-.0492791 .0240206
IncChangeDueCOV	.0579656	.0551387	1.05	0.293	-.0501043 .1660356
ChangesinFoodPrices	.0228345	.0771416	0.30	0.767	-.1283601 .1740292
FarmingBfrCov	.025717	.0361184	0.71	0.476	-.0450738 .0965078

Appendix F: Publications



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Assessing the Changes in Consumption Patterns of Households Due to COVID-19 Measures in Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This article assessed the changes in household consumption patterns due to COVID-19 interventions in Kenya. COVID-19 measures brought about several challenges globally. The COVID-19 pandemic impacted many elements of people's lives, including their financial well-being. Households had to adapt their buying patterns and food consumption patterns to cope with the new economic realities due to COVID-19 measures in Kenya, such as a ban on social gatherings, closure of institutions, and movement restrictions through lockdowns and curfews. The descriptive approach was used in the study, which used a cross-sectional survey using a structured questionnaire to collect data from 246 households. Results revealed that household intake of meat, dairy, fruits, snacks, and wheat products decreased significantly (p-values <0.001). Findings also demonstrated a substantial drop in the frequency of shopping for pre-packaged meals, snacks, and meat products (p-values <0.001) and a significant rise in the frequency of shopping for vegetables

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