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**Environment and Sustainable
Development Program**



Assessing Food Consumption and Waste during the COVID-19 Pandemic in the Kingdom of Bahrain

A Thesis submitted in Partial Fulfilment of the Requirements for the
Master Degree in Environment and Sustainable Development

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☐ Without making any changes to the thesis.

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Abstract

Globally, there were changes in food consumption and food waste generation during the COVID-19 pandemic, and this study aims to assess these changes and the reasons behind them in the Kingdom of Bahrain. A quantitative approach was selected and a cross-sectional study was performed through a structured survey which was distributed between February and March 2022 which resulted in accepting 390 responses, the rejected responses were either filled by respondents under 18 years or participants that did not live in Bahrain two years prior to filling out the survey. The results revealed stability in consumption of four food groups while high rates of consumption of unhealthy meals and snacks was noticed during the pandemic. Furthermore, there were few changes in the mode of purchasing food while the demand of buying food from online stores and food delivery services skyrocketed. A positive awareness was noticed among the participants since majority of them did not stockpile food and 44.6% of them always prepared shopping list before visiting grocery shops. The results in the food waste section revealed that the most common method to treat the leftover food was eating it the following day and majority of the respondents tried to control food waste and were aware of the problem of food waste in the Kingdom of Bahrain, these were found to be the respondents that minimized food waste generation. Close to 50% of the respondents did not change the amount of food waste generated during the pandemic, and the increased generation of food waste was due to increased consumption of most of the food groups and increased grocery shopping. The limitations present in this research are the presence of bias since most responses were university degree holders and Bahraini citizens, and absence of benchmark and data related to food consumption and food waste. The main recommendations suggested are to perform further studies by weighing the amount of household food waste and finding its composition, increasing campaigns on the need to decrease the amount of food consumed and the number of trips to food outlets, the need to prepare shopping lists prior to visits to the grocery, and lastly, providing assurance to support vulnerable individuals during times of distress.

Keywords: Food consumption, Food waste, COVID-19 pandemic, Kingdom of Bahrain.

Dedication

This thesis would not be possible if it were not for the ease and grace of Allah. I would like to dedicate this thesis to family members, especially my parents who supported my choice to pursue higher education through this program and to my colleagues who encouraged me during this journey. I would also like to extend my gratitude to my friends who encouraged me throughout this journey.

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List of Abbreviations

BD	Bahraini Dinar.
COVID-19	Coronavirus Disease 2019.
GCC	Gulf Cooperation Countries.
GHG	Green House Gases.
FAO	Food and Agriculture Organization
KSA	Kingdom of Saudi Arabia.
MENA	Middle East and North Africa.
POS	Point of Sale.
PPE	Personal Protective Equipment.
SDG	Sustainable Development Goals.
UAE	United Arab Emirates.
UK	United Kingdom.
UN	United Nations.
UNEP	United Nations Environmental Programme.
US	United States.
WHO	World Health Organization.

Chapter One

Introduction to the Study

1.1 Introduction

1.2 Research Problem

1.3 Research Questions

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1.1 Introduction

Food is an important source of energy to human beings and other living organisms (“Food”, 1100). The consumption of food has increased steadily globally from the year 2015, and by the year 2021 the amount of food consumed surpassed 2.5 billion metric tonnes and the food groups that were consumed the most in that year were bread and cereals followed by vegetables, dairy products and eggs (Statista, 2022). According to the Food and Agriculture Organization (FAO), food supply also increased steadily, the daily per capita kilocalorie supply in North America is the highest compared to other continents, while Asia and Africa has the lowest daily per capita kilocalorie supply. In this decade, the Gulf Cooperation Countries (GCC) have always recorded higher daily per capita kilocalorie supply and the Kingdom of Bahrain is the highest out of the neighbouring GCCs (FAO, 2023).

Stressful events such as the COVID-19 pandemic lead to changes and disruptions in the food sector, whether it is at the consumer level or the production level (UN, 2020). Due to this, there have been disruptions in the food agricultural sector, moreover, the supply of food varies depending on several factors such as a person’s mobility, the restrictions and lockdown imposed, as well as the presence of employees in the workplace during the pandemic since there were different restrictions in different periods (Power et al., 2020). Consumers may impose threats and challenges to the environment by increasing the demand on food products such as red meats, shrimp from shrimp farms, dark chocolate and dairy products, as these food items have an association with producing the highest greenhouse gases (GHG) emission compared to other food categories (Poore & Nemecek, 2018).

Waste is an ongoing problem that pressurizes public health in particular and the environment in general. This requires proper management as it is interlinked with several global issues such as climate change, producing and consuming sustainably, food security, and various health issues (Wilson, 2015). There are three main categories of waste, which are based on the technique used in collecting, treating, and disposing of it, these include; hazardous waste, municipal waste, and industrial waste, their treatment and management is crucial to minimize their environmental effect. Different waste treatments consist of recycling, composting, incinerating the waste, or throwing the waste into landfills (GCC-STAT, 2017).

Waste management can globally reduce GHG emissions by 15%, this percentage could be increased through preventing the generation of waste. Globally, a successful attempt in reducing GHGs emissions was reported in Germany between the years 1990 and 2006, a reduction of 56 million tonnes of carbon dioxide equivalent/annually (mt CO₂ eq/a), led to the decrease in GHGs in Germany during that period by 24% (Wilson et al., 2015). In the GCC, the waste generated is estimated to be around 93.6 million tonnes in the year 2019, 98.2% of them were non-hazardous waste, of the total non-hazardous waste, the source of 40% was household waste. The countries which contributed to the increase of this ratio were Sultanate of Oman, Kingdom of Saudi Arabia (KSA) and Kingdom of Bahrain. In 2020, it was recorded that KSA had the highest per capita household waste (kg/day) among the GCC countries with each person contributing to around 2 kg of waste daily, while in Bahrain, each individual contributed to 1.1 kg/day of household waste, this amount was similar to Kuwait and Oman (GCC-STAT, 2022). Another reference indicated that Bahrain was one of

the countries with the highest average household food waste 132 kg/capita/year (UNEP, 2021).

Food waste, which is categorized as municipal waste, poses pressure on landfills as they emit GHGs which in turn amplifies the problem of climate change. This requires households, retail shops, restaurants and farms to change their behaviour and commit to minimizing food loss and waste generation by adopting positive food practices like preparing shopping lists, recycling food or donating it as long as it is edible to ease the burden on landfills and try to tackle the problem of food waste in a sustainable manner (UNEP, 2021).

Prior to the COVID-19 pandemic, the projection to achieve the Sustainable Development Goals (SDGs) by the year 2030 was challenging not to mention the spread of the virus worldwide in 2020 which made it more difficult, this led to reshaping the journey to achieve the SDGs. Nutritionally, there has been a spike in the number of undernourished individuals across different income groups, with the low-income economies hit the hardest, this complicates achieving SDGs 2 and 3 (Zero hunger and Good health and well-being). The healthcare centres have taken a huge hit during the pandemic, adding to it, maternal mortality increased and a slight increase in child death was detected. Economically, the spread of the virus led to an economic deficit which will increase poverty in 2030 by 213 million individuals, and thus achieving SDG 1 will be challenging (Hughes et al., 2021).

Since the first case of the COVID-19 virus was detected in Bahrain on 24th February 2020, there have been many policies and restrictions imposed by the government of Bahrain to maintain the well-being and welfare of the residents. A vital decision was establishing the National Medical Taskforce for Combatting the Coronavirus (Covid-19), this

taskforce issued all the directives, decisions, and guidelines related to combating the virus and minimizing its spread. Such decisions include providing and administering the vaccine which was provided free of cost to all the residents and providing free care to COVID-19 patients without any discrimination. As of 1st September 2022, there were more than 3.4 million vaccine doses administered to more than 1.24 million individuals in the Kingdom of Bahrain. Other efforts include adopting working and schooling from home for several periods from the start of the pandemic to May 2022 which ensured no one is denied the right to education and the right to work. Furthermore, the ability to postpone loan payments for up to six months without any additional charge, along with covering electricity and water bills for three months starting from March 2020 for all the subscribers to ease any economic and financial difficulties caused by the pandemic (WHO COVID-19 Dashboard, 2020; IGA, 2022b).

During the pandemic, 17 essential sectors remained open no matter what the health status of Bahrain was, for instance; hospitals and health centres, pharmacies, all types of food outlets (supermarkets, groceries, bakeries, restaurants that provide pickup or delivery services, etc.), banks, offices which can operate without the presence of customers, factories, construction, etc have all operated throughout the pandemic and followed the precautionary measures set by the National Medical Taskforce for Combatting the Coronavirus (Covid-19) (GOB, 2022).

Regarding the amount of money from card transactions (Debit and Credit cards), in the second half of the year 2019, the amount spent in restaurants was just above BD 61 million, while in 2020, the amount spent in supermarkets was BD 176.4 million, whereas, restaurants accounted for BD 122.8 million. In 2021, the demand of both sectors increased, supermarkets card transactions grew to BD 331.6 million and the restaurant

sector reported an increase to BD 260.1 million, it is important to note that in 2021 both these sectors were among the top three sectors in terms of the value of transactions, only behind the governmental services (CBB, 2020, 2021, 2022).

When assessing food consumption during the pandemic, it is vital to consider dietary changes as it was noticed as one of the changes that occurred due to the pandemic. In some countries, there was a shift to a healthier diet, while others tend to increase the consumption of comfort food and snacks whereas some people were deprived of their dietary needs due to the lockdown imposed (Amicarelli & Bux, 2021; Cheikh Ismail et al., 2020; Chenarides et al., 2021; Lamy et al., 2022). Several reports suggested that one of the important elements to maintaining well-being and supporting our immune system is consuming a healthy diet mainly fruits and vegetables along with minimizing the consumption of unhealthy meals, this trend was reported by several studies (Rodríguez-Pérez et al., 2020).

An issue that is related to dietary change is its relation with GHGs emissions, the increase of these emissions is related to the increased consumption of red meats, shrimp from shrimp farms and dairy products which thus accelerates the issue of climate change. The production of meat is usually accompanied with the removal of vegetation and plants from grasslands and thus release gases such as CO₂ from the forest to the environment. Dairy production is associated to cattle that release methane to the environment when the feed on grass, moreover, in the pastures, GHGs are emitted through the cattle waste as well as using fertilizers that the crops used for feeding the cattle. The man-made shrimp farms as well rice production contribute to the GHGs emissions (Poore & Nemecek, 2018).

An overlooked factor associated to the change in the consumption of food is the presence of negative emotions which may result in emotional eating due to over-eating or food deprivation where they decrease the consumption of food due to these negative emotions (Evers et al., 2018). Furthermore, in China, being in quarantine led to an increase of negative feelings such as anxiety, depression, boredom and stress, these could then lead to adopting unhealthy food habits as noticed in Italy where respondents reported the presence of anxiety caused eating comfort foods (Scarmozzino & Visioli, 2020; Wang et al., 2020).

Another change that occurred during the pandemic is the change in food shopping behaviour. Grocery visits were restricted in some countries, while others allowed them without any restriction. Moreover, the utilization of online platforms to purchase food and grocery products skyrocketed in some countries, this could be due to minimizing their visits to supermarkets and grocery shops to maintain social distancing and to lower the probability of catching the virus, others tend to buy more food than needed and thus stockpiling food to decrease their shopping frequency (Chenarides et al., 2021).

One of the human caused environmental challenge in the world is food waste. It was estimated that approximately a third of edible portions of food are wasted all over the world which accounts for almost 931 million tonnes of food, and the source of more than 570 million tonnes of it are from households. In Western Asia, according to United Nations Environment Programme (UNEP) report, Bahrain was one of the countries with the highest average household food waste (132 kg/capita/year). The presence of this issue may lead to insecurities in the food system across vulnerable countries and thus it is important to address it and try to minimize it to achieve SDGs 2 and 12 (UNEP, 2021).

The waste management sector underwent few changes especially in handling medical waste as it increased intensely due to the increased use of personal protective equipment (PPE) in the medical sector as well as the compulsory use of facemasks or face shield. Other changes may include the increase in household food waste which could be due to stockpiling food and inappropriate storage of food along with the shift in food waste from the workplace to the households due to the lockdown imposed in most countries while other countries implemented working from home (remote working) and the educational institutes offered online classes, whereas, other scenarios were seen such as decreased food waste mainly due to concerns related to their management (Baker et al., 2020; Jribi et al., 2020; Principato et al., 2022).

The previously mentioned changes in food consumption and waste that occurred all over the world show how the impact of the pandemic may differ from one country to another, furthermore, reasons for these variations might be due to the economic conditions of the individuals, the epidemiological status of the country or even the effectiveness of healthcare (HLPE, 2020).

The case of the Kingdom of Bahrain in this topic is interesting as the government maintained a lenient approach with minimal restrictions compared to many countries as it did not impose lockdowns since the start of the COVID-19 virus spread and this research will assess in finding if there were changes in the food consumption and waste of the individuals living in Bahrain along with the reasons and associations related to it.

1.2 Research Problem

Maintaining adequate food consumption is vital to minimize its pressure on the agricultural sector, manufacturers, producers, and waste

treatment, as the high demand of food products leads to its increased production which in turn amplifies the climate change issue through the increased emissions of GHGs. Another important environmental topic is food waste, which is an issue of mishandling and mismanagement of food which leads to throwing it away to landfills and thus cause the emission of GHGs. During the pandemic, the Bahraini public were advised to stay at home to minimize their exposure to the COVID-19 virus which could have led to a change in the generation of household food waste.

This research will investigate and assess the relation some of the sociodemographic characteristics (such as gender, age, social status, etc.) with the change in the consumption of various food groups (such as meats, dairy, baked products, etc.) and the generation of food waste across the Kingdom of Bahrain. Furthermore, examining the behavioural changes adopted in regards to food purchase and household food waste management. This research will also inspect if pandemic related variables caused a change in food consumption and food waste generation.

1.3 Research Questions

The research questions that will be examined to assess the effect of the COVID-19 pandemic on food consumption and waste are:

1. Were there any variations in food consumption and waste in Bahrain during the pandemic?
2. What are the factors that influenced change in food consumption during the pandemic?
3. What are the factors that influenced change in generation of food waste during the pandemic?
4. Were there any food related habits that changed during the pandemic?

1.4 Research Objectives

The study objectives are as follows:

1. To assess the variations in food consumption and generating food waste in the Kingdom of Bahrain during the pandemic.
2. To inspect the factors that influenced change in food consumption during the pandemic.
3. To inspect the factors that influenced change in generation of food waste during the pandemic.
4. To examine the food related habits that changed during the pandemic.

1.5 Research Significance

The significance of conducting this research is to explore how the people living in Bahrain changed their food consumption, generation of food waste and food related habits during the COVID-19 pandemic. Moreover, it assesses the factors that affected their food consumption and food waste such as their socio-demographics, shopping pattern, buying habits, and behaviour during the pandemic. This study provides insight to the reaction of the participants living in countries that did not impose any kind of lockdown throughout the pandemic and thus the results will not only serve the governmental organizations, manufacturers, and retail sellers in the Kingdom of Bahrain but also the results will benefit the international organizations and other countries to identify the food consumption and waste behaviour of individuals that were not put to lockdown during times of stress. Additionally, this is the first study that included participants who were COVID-19 patients either during or before participating in the study to assess how their behaviour changed.

1.6 Research Setting

The research is set in the Kingdom of Bahrain, which is situated in the Middle East and a part of the GCC, with a land area estimated to be 786.5 km². According to the official statistics in December 2021, the population of Bahrain is above 1.5 million present in the four governorates, the Northern, Southern, Capital, and Muharraq governorates. About 47.8% of them are Bahraini nationals while the majority are non-Bahrainis, the males account for 61.5% whereas the females account for 38.5%. The main labour force in Bahrain is the private sector which employs over 563,000, whereas the public sector is almost a tenth of them, 57,281 employees, and, the percentage of unemployed individuals was reported to be 4.7%. The internet subscribers in the Kingdom are found to be over 2 million subscribers (IGA, 2022a; Najeeb, 2022).

During the pandemic, a lockdown was not imposed, rather, several restrictions were implemented from time to time, and later the evolution of the traffic light system put forward precautionary measures to tackle the spread of the virus across various venues such as malls, restaurants, sports venues, mosques as well as educational facilities and workplace (GOB, 2022).

1.7 Definition of Terms

Assessment: Creating a judgement about a subject or something (“Assessment”, 1534).

Consumption: the act of consuming (“Consumption”, 1300).

COVID-19: “An infectious disease caused by the SARS-CoV-2 virus.” (WHO, 2020).

Food: Material which helps in providing energy to an organism and consists of carbohydrates, fat, and protein to help grow, repair and perform vital processes in the organism (“Food”, 1100).

Waste: Discarded material (“Waste”, 1300).

Lockdown: Temporary limitation of movement in a particular geographic location due to an emergency or a threat (“Lockdown”, 1973).

Pandemic: Disease outbreak that is spread in large geographical areas affecting a large percentage of the population (“Pandemic”, 1832).

Stockpile: Material that is stored and accumulated for later use (“Stockpile”, 1872).

Unhealthy meals: Food group that does not contribute to one’s health, it mainly contains fats from animal origin and salts as well as being low in vitamins and fiber (“Unhealthy food”, 2002).

Chapter Two

Literature Review

2.1 Literature Review

2.2 Theoretical Framework

2.3 Summary

2.1 Literature Review

2.1.1 Overview

Sustaining an adequate food consumption and minimizing food waste generation help to accomplish the SDGs through achieving the targets resembling them. Increased food consumption has several consequences which affects several degrees from harvesting them to consuming them and the leftover food which are not utilized may be thrown to landfills and this leads to increased emissions of GHG. Whereas, food waste possesses a global threat and it is important to assess the changes and the drivers behind its increase in previous literature.

The COVID-19 pandemic caused a lot of disruptions around the world not only in the health sector but also in the lifestyle of human beings and their daily routines. The pandemic disrupted the food sector whether it was in the agricultural systems, retail services or restaurants. Many countries imposed restrictions from the start of the outbreak which in turn affected the lifestyle of the people by minimizing their movement and many of them depended on online platforms to purchase food rather than visiting grocery shops. It was reported that there were variations in the amount of food consumed, the food waste generated and the mode of purchasing food in multiple studies and worldwide, this will be discussed thoroughly in this section. Furthermore, the reason for those fluctuations were due to different socio-demographics as well as the restrictions implemented by different governments worldwide throughout the pandemic.

2.1.2 Food Consumption during the Pandemic

The pandemic caused supply constraints and demand shock in the food market, which led to disruptions in the food agricultural sector. The supply of food varied depending on a few factors which include people's

mobility, restrictions, lockdown, and the presence of employees since due to the pandemic there were different restrictions in different periods (Power et al., 2020). The work of farmers in different parts of the world was interrupted because of the outbreak of the virus among the workers, as well as lockdowns and border restrictions. Simultaneously, it was reported that some farmers threw away milk due to a decrease in demand and trouble with transportation and thus increased avoidable food waste (UN, 2020).

Food consumption depends on several factors; these include food purchase behaviour, culture, feelings, and financial security as well as the person's appetite (Ben Hassen et al., 2020 & Jribi et al., 2020). International research conducted by Lamy et al. (2022), reported that the negative feelings did not have a significant effect on the consumption of the participants. The Romanian students revealed that the pandemic initiated a change in their food consumption as the participants were cautious to minimize waste (Burlea-Schiopoiu et al., 2021).

It was noticed that the economic effect caused by the pandemic varied from one country to another. In five Sub-Saharan African countries, it was revealed that a range (16 to 60%) of households decreased the quality or quantity of food they consumed and others revealed skipping meals to minimize the economic impact even though the amount of income loss is less than the predictable range. The countries which imposed strict policies to combat the virus experienced a greater financial impact on the households (Maredia et al., 2022)

One of the major changes that occurred due to the pandemic is the change of diet of some people since some were deprived of their dietary needs due to the lockdown (UN, 2020). Filho et al., (2021) conducted global research that included 23 countries across 5 continents, it detected an increase in consumption of packed and fresh foods by 48% and 45%

respectively between the months of March and June 2020. Similarly, another international study between 16 countries also reported an increase in the consumption of fresh foods especially fruits and vegetables along with eggs and chocolate (Lamy et al., 2022). This study divided the participants into healthy and unhealthy clusters and it revealed that there was a difference in consuming comfort foods and snacks between the two groups.

In two metropolitan cities, Arizona and Michigan, United States (US), the respondents reported no change in the consumption of most food groups, whereas the consumption of snacks increased by 41% while eating healthy meals increased by 9% only (Chenarides et al., 2021).

Various studies discussed the issue of the COVID-19 outbreak and food consumption in Europe. In Italy, homemade meals increased as well as the consumption of legumes, cereals, white meats, and hot beverages, while the consumption of fish, sweets, and baked foods decreased in the first months of the virus spread (Di Renzo et al., 2020). These results were similar to an explorative study performed on fifteen households in Italy, the researchers Amicarelli & Bux (2021) noticed that these households increased the consumption of legumes, white meat, and cereals while baked products, sweet snacks, and ready-made delivery foods decreased during this lockdown.

A study conducted in Denmark, Germany, and Slovenia, indicated high changes in frozen food followed by canned food, and cakes and biscuits, whereas, decreased consumption of fresh foods was noticed in Denmark and Slovenia due to short shelf life. Moreover, baked foods, as well as dairy products and alcoholic drinks, showed low rates of change (Janssen et al., 2021). While in Russia, during the months of October and November 2020, positive diet shifts were observed as a third of the

respondents minimized the consumption of unhealthy foods, unhealthy snacks, and sweets (Ben Hassen et al., 2021).

In Africa, Moroccan households revealed a slender increase in consuming fruits and vegetables along with a decrease in consumption of meat and canned food items during the quarantine as compared to the period before it (Ouhsine et al., 2020). While in the Gulf Cooperation Council (GCC), respondents had different eating habits since the virus outbreak. In Qatar, the citizens consumed unhealthier snacks compared to the non-Qatari residents, while an increase in the consumption of fruits and vegetables as well as healthy meals were noticed, moreover, more than 44% drank more water when compared to the period prior to the pandemic (Ben Hassen et al., 2020).

In the United Arab Emirates (UAE), a significant decrease in fast food intake was noticed, and the water intake has increased by 27.8% (Cheikh Ismail et al., 2020). While in Kuwait, a third of the participants increased their food consumption due to the lockdown imposed during the first months of the virus outbreak while 44% did not change their food consumption (AlTarrah et al., 2021). They also analysed the changes in food groups consumed in Kuwait, it was detected that an increase in consumption of healthy food (39.4%), fruits and vegetables (50.4%) home-cooked meals (86.6%) as well as legumes and pulses (41.5%).

While in another GCC country that underwent lockdown during the pandemic, the Sultanate of Oman, the participants have shifted to a healthy style of food consumption as they increased the intake of fruits and vegetables as well as healthy foods and 53.1% decreased the consumption of unhealthy meals (Ben Hassen et al., 2022).

The demand shock has escalated because of border restrictions and lockdowns in different parts of the world due to not fully knowing the nature of the virus in the first months of the pandemic (UN, 2020). A major factor that influences the demand for food is the habit of stockpiling food. This habit was seen in 28.5% of the Russian respondents, which was down to the negative emotions experienced and a similar percentage was present in Qatar (Ben Hassen, El Bilali, Allahyari, Berjan, et al., 2021; Ben Hassen et al., 2020).

Multiple studies were conducted in the US and the topic of stockpiling was assessed as they experienced multiple lockdowns during the pandemic. The habit of stockpiling was present and grocery spending increased in the months of February 2020 and the first half of March 2020 (Baker et al., 2020). Likewise, Chenarides et al. (2021) noticed an increase in stockpiling food by 33% as well as buying food more than usual among 47% of the participants. A third study in the US reported that this behaviour was among 73% of the participants (Cosgrove et al., 2021).

Almost half of the Canadian residents stockpiled food during the pandemic as the majority of the respondents minimized their trips to the grocery. While in the United Kingdom (UK), it was noticed that there was a minor increase in stockpiling food because of the lockdown (Filimonau et al., 2022; Laila et al., 2022). In another part of Europe, Greece, 47% of the respondents did not change the amount of food purchased while only 15.8% increased it (Theodoridis & Zacharatos, 2022).

However, in a study performed in 12 countries in Sub-Saharan Africa, a severe increase in food shopping was the main cause of stockpiling, the two categories which stockpiled food were females and participants who did not worry about food as they were financially and resourcefully stable during the pandemic (Amuakwa-Mensah et al., 2022). It was also noticed

that those who were worried about the economic impact caused by the pandemic bought either smaller or larger package sizes of food.

During the pandemic, Malaysian respondents showed that negative feelings had a small effect on panic buying (Lahath et al., 2021). However, in China, it was noticed that stockpiling occurred when buying fresh foods only, moreover, a new concept “Community group buying” emerged during the pandemic, which helped in minimizing panic buying and fulfilling the needs of the consumers (Hao et al., 2020). On contrary, 73.13% of the participants in Lebanon stocked up on food during the pandemic, specifically in the period before the spread of the virus in Lebanon (Ben Hassen et al., 2021).

Across the seven emirates of the UAE, 15.4% of the participants already stocked up on food by April 2020 due to the lockdown imposed, while 43.9% started stocking up food when they answered the survey (Cheikh Ismail et al., 2020). On contrary, in Oman, 62.3% of the participants did not have the habit of stockpiling food, in contrast, the majority of non-Omani participants had the habit of stock food (Ben Hassen et al., 2022).

The food shopping behaviour varied from one country to another, Lamy et al. (2022) reported that the participants prepared for shopping for food, and most of them also stated that they did not depend on online platforms for purchasing food. More than 75% of the Italian households bought their food from the supermarket, similarly, Tunisians also revealed high dependence on supermarkets for their buying their food items and only 2.1% depended on home delivery services while it is higher amongst Italians (9%) (Di Renzo et al., 2020; Jribi et al., 2020).

The frequency of purchasing food in Tunisia decreased by about 20% compared to an earlier study performed by Sassi, Capone, Abid, Debs, El Bilali, and Daaloul (2016), this was mainly due to the lockdown imposed, as well as the people were allowed to shop during the daytime (Jribi et al., 2020). A similar trend was noticed in another North African country, Morocco, as the households decreased their shopping frequencies by 21.5% for those who were shopping more than once a week, and an increase of approximately the same percentage was noticed for the ones who were shopping once a week for their groceries (Ouhsine et al., 2020). Furthermore, in Denmark, Germany, and Slovenia, a decrease in supermarket visits was noticed, these were mainly due to the strict restriction, especially in Slovenia (Janssen et al., 2021)

Looking at the utilizing the food delivery services from 2020, Baker et al. (2020) did not notice a significant change in the US citizens spending in this department. Likewise, in another study a slight increase in grocery delivery and pickup was noticed simultaneously, there was a 66% reduction in visits to grocery stores (Chenarides et al., 2021). While before the pandemic, it was reported that young individuals depended on such platforms, the increased use could be due to the presence of discount offers, busy daily schedules, or even this group being technologically literate (Ray et al., 2019).

One of the overlooked points when discussing food shopping behaviour is the preparation of a shopping list before visiting the stores, in Greece, the majority of the respondents prepared a list always and 30% mentioned that they sometimes use them, it was reported that the shopping frequencies did not fluctuate. Moreover, the pandemic affected the purchase of discounted food items as 59.4% of the Greek respondents bought such items (Theodoridis & Zacharatos, 2022). In Latin America,

Peru, and Brazil, in particular, good signs were noticed as more than 50% of the participants always planned their grocery items while 39% sometimes plan them, the participants also stated purchasing discounted food products (Cequea et al., 2021).

In the international survey conducted by Filho et al. (2021), food delivery services increased by 46% due to the lockdown imposed in most of the countries under study, while the demand for such services decreased by 16% only. The increase in such services is similar to that in Kuwait, where a lockdown was also imposed (AlTarrah et al., 2021).

In Oman, the frequency of shopping decreased among 84.2% of the respondents when compared to the period before the pandemic (Ben Hassen et al., 2022). Moreover, food deliveries increased among 26.7% of the participants, while 28.1% bought their grocery food items from online platforms, and close to 30% did not depend on these platforms whereas a quarter of the participants increased their dependence on local products. Similarly, in UAE, even though the lockdown was imposed, the percentage of participants depending on online grocery shopping was found to be 42% (Cheikh Ismail et al., 2020).

While in another GCC country, the behaviour that changed the most in the State of Qatar was online grocery shopping which increased by 35.3%, simultaneously the online platforms were never utilized to purchase food by 29.1% of the participants, it was also reported that buying local food products increased by 33.7% (Ben Hassen et al., 2020).

2.1.3 Food Waste during the Pandemic

The COVID-19 pandemic has globally altered food waste. As most countries imposed national lockdowns, most of them have introduced work from home and online schooling thus some studies reported that the food

waste that used to be discarded in their workplace shifted to their households (Baker et al., 2020).

An international study reported a 45% increase in food waste across 5 continents (Filho et al., 2021), the most discarded item were fruits and vegetables followed by meat and dairy products while potatoes, cereals, milk, and canned food were the least discarded food items.

The Brazilian participants reported that fish and seafood had significantly high amounts of waste compared to their Peruvian counterparts in the same study, while the other food groups were relatively similar in both countries (Cequea et al., 2021). Additionally, the fate of leftover food was eating it on the following day among 60% of Brazilian and 46% of Peruvian participants.

In Canada, a comparison of the quantity of food waste before and during the pandemic was conducted by noting down audits of food waste. The unavoidable fruits and vegetables and food waste increased during the pandemic, simultaneously, a decrease in avoidable food waste was noticed which thus led to no change in total food waste (Laila et al., 2022). Similarly, in another research in Canada, particularly in London, Ontario, the household waste measurements showed that fruits and vegetable waste constituted 51.9% of the participating households' waste composition and a similar percentage was measured for avoidable food waste (Everitt et al., 2022).

Comparative research between the US and India proved the presence of food waste among the females residing in India and this was due to uncertainty and lack of assurance in the availability of food items which led to the tendency to buy more food and thus waste them (Brizi & Biraglia, 2021). However, another comparative study between the US and Italy,

revealed a decrease in food waste among 49% of the respondents as 61% of the American participants minimized food waste compared to only 38% of the Italian individuals. The reason for these percentages was due to food scarcity and dependence on home cooking (Rodgers et al., 2021).

In 15 households in Italy, it was perceived that the main food groups wasted were fruits, vegetables, legumes, and fish products, moreover, they revealed reduced amounts of food waste during the lockdown, with unavoidable waste constituting the highest amount of food waste (Amicarelli & Bux, 2021). While the youth in Italy along with those who prepared food shopping lists and planned meals showed less food waste during the lockdown, this was due to the complications imposed on the grocery store visits (Principato et al., 2022). A similar trend appeared in Morocco, the households reduced the overall waste compared to the year prior to the lockdown, moreover, the participants noticed a reduction in the amount of organic waste (Ouhsine et al., 2020).

Malaysian respondents revealed that negative feelings had a minor effect on food waste (Lahath et al., 2021). While a study in China conducted on more than 1000 participants, reported that those concerned with the COVID-19 virus did not contribute to maximising food waste compared to the others (Li et al., 2022).

Managing food waste in households was examined in Greece, the main method of managing expired foods was disposing of them, this was followed by recycling them and consuming them (Theodoridis & Zacharatos, 2022). Another finding that was reported was dairy products being the highest percentage of food items disposed of during the pandemic and this was followed by fruits and vegetables.

Interesting findings were obtained in Turkey, the increase in food waste during the pandemic was reported by 17.61% of the respondents and they directly disposed of it, on the contrary, the majority of the respondents (55.77%) were involved in avoiding food waste through feeding animals, sharing leftover food with others and compositing it and the remaining respondents did not generate any food waste (Yetkin Özbük et al.2022).

According to the participants, it was noticed that in Oman, Qatar, and Tunisia, the amount of food waste decreased, in Qatar and Oman it was a result of buyers being aware and not involved in panic buying while in Tunisia it was due to the lockdown and restriction imposed (Ben Hassen et al., 2020, 2022; Jribi et al., 2020). Research performed before the pandemic in Muharraq Governorate, Bahrain, observed that the participants tend to manage food waste by feeding it to animals or fish (Abbas et al., 2020).

The reasons for food waste varied from one country to another. A study conducted prior to the pandemic reported that food spoilage was the main reason and the most discarded items were vegetables, home-cooked meals, and dairy products (Silvennoinen et al., 2014). In addition, the study did not find any connection between the rate at which the participants shopped for food and food waste.

Respondents who participated in an international study showed positive behaviour as they stated that they tried not to waste food and were aware of the expiration date of the food products (Lamy et al., 2022). While in Peru and Brazil, the two main reasons for throwing away leftover food were due to excess cooking and storing them in the refrigerator for long period (Cequea et al., 2021). Additionally, the reason for discarding food products was due to them passing the expiration date.

In the US, 50.8% of the households reported a decrease in food waste, these respondents noted that the main reason for food waste generation was stocking food as there was a significant correlation between them, additionally, the likelihood of an increase in food waste was directly related to the amounts of waste from vegetables and frozen foods (Cosgrove et al., 2021). The researchers of a study conducted in New York noticed a link between food waste and increased food purchase, in addition, an association was established between food conservation and decreasing food waste as those preserving food, eating leftovers, and planning meals had less food waste and had the intention to continue conserving food after the pandemic (Babbitt et al., 2021).

It was detected that the decreased amounts of food wasted by the residents in Italy and the US were related to their increased health worries, regular meal preparation, and minimizing their trips to the supermarket (Rodgers et al., 2021). Whereas, in Tunisia, it was due to three main reasons, namely: overcooking followed by inappropriate storage and overbuying (Jribi et al., 2020). Similarly, in the UK, the main reasons leading to increased food waste were overcooking, increased utilization of food takeaway, and delivery services (Filimonau et al., 2022).

The pandemic brought a positive change in food waste among Russian residents. About 90% did not waste more food during the pandemic while 14.5% declared that they wasted less food (Ben Hassen, El Bilali, Allahyari, Berjan, et al., 2021). Likewise, university students in Romania also showed similar encouraging behaviour, as they reduced food waste and showed a high level of awareness of food waste and its ethics (Burlea-Schiopoiu et al., 2021). In addition, the pandemic made the young participants more cautious of food waste due to worries and concerns as well as a lack of financial security.

2.2 Theoretical Framework

Changes in the public's food consumption and food waste generation occurred all over the world, the food sector was also affected at both the production level and the consumer level (Baker et al., 2020; UN, 2020). The main aim of this study is to know whether there was a change in food consumption and waste in Bahrain.

Various literature reported that food consumption and waste were altered due to the pandemic while others detected no change in them (Amicarelli & Bux, 2021; Burlea-Schiopoiu et al., 2021; Cequea et al., 2021; Maredia et al., 2022). The countries that were reviewed in the literature review section have experienced at least a single lockdown during the pandemic, while in Bahrain, a lockdown was not imposed, rather, several restrictions were implemented from time to time like the traffic light system (GOB, 2022).

In Bahrain, to date, the changes in food consumption and waste are yet to be reported and the research questions will be answered by following the theoretical framework presented in Figure 1, which thus helps in identifying the changes in food consumption and waste in the Kingdom of Bahrain during the COVID-19 pandemic as well as the drivers for these changes.

The two elements under focus are food consumption and food waste, not only their quantities but also their behaviour. According to the literature reviewed in the previous section (Amuakwa-Mensah et al., 2022; Ben Hassen, El Bilali, Allahyari, Berjan, et al., 2021; Ben Hassen et al., 2020; Hao et al., 2020; Jribi et al., 2020), food consumption and food waste are dependent on multiple key factors, six factors are taken into consideration in this study, namely:

1. Stockpiling food,
2. Financial security,
3. Having negative feelings,
4. Contract COVID-19 virus,
5. Work/study from home, and
6. Demographic characteristics.

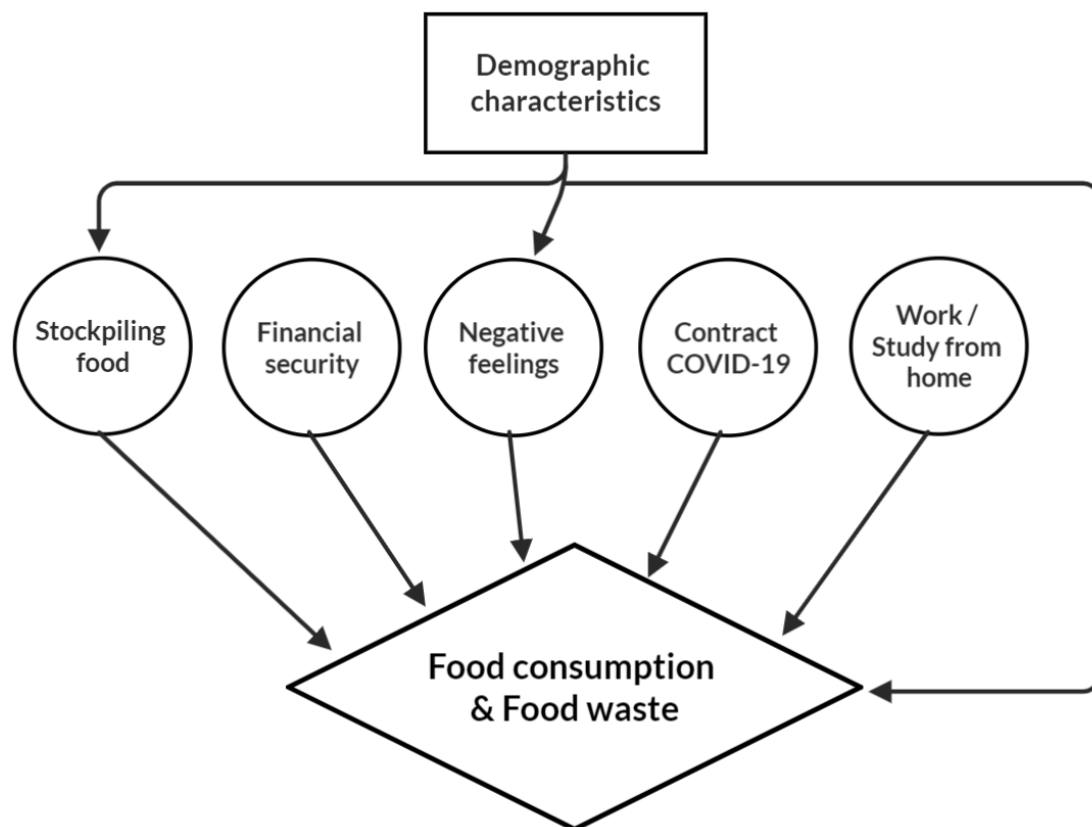


Figure (2.1): Theoretical framework.

The most important factor is the demographic characteristics as they not only affect food consumption and waste but also had a significant influence on stockpiling food and having negative feelings during the pandemic (Amuakwa-Mensah et al., 2022; Ben Hassen et al., 2020; Brizi & Biraglia, 2021; Maredia et al., 2022). In this study demographic characteristics such as gender, age, educational attainment, social status, etc, are tested against food consumption and waste, stockpiling, and having negative feelings to discover if there is a link between them.

Stockpiling food is another major point in this study as it is interconnected with various factors, the presence of this behaviour can lead to a change in food consumption and waste. Moreover, its increase could be due to financial security or having negative feelings or even one of the demographic characteristics while the absence of it is linked to financial security since it was found due to difficult economic impact on the households, they stopped stockpiling food (Ben Hassen, El Bilali, Allahyari, & Charbel, 2021; Ben Hassen et al., 2020, 2022; Chenarides et al., 2021; Cosgrove et al., 2021; Jribi et al., 2020; Lahath et al., 2021; Maredia et al., 2022; Power et al., 2020).

An important factor in the change in food waste is the presence of negative feelings among the participants as multiple studies indicated its presence led to an increase in stockpiling food while a couple of them indicated it did not affect food behaviour (Ben Hassen, El Bilali, Allahyari, Berjan, et al., 2021; Ben Hassen et al., 2020, 2022; Lahath et al., 2021; Lamy et al., 2022).

The fourth factor present in the theoretical framework is the effect of contracting the COVID-19 virus on food consumption and waste, unfortunately, no evidence has been found regarding the changes that occurred among COVID-19 patients and cured individuals. Testing the effect of this factor will help in filling the gap in the literature.

The final factor is working/studying from home. In Bahrain, during the pandemic, most occupations were working from home and educational institutions started online classes in the first few months of the virus outbreak in Bahrain. The online classes continued till August 2022 while working from home ended in May 2022. Working from home showed both positive and negative impacts, some studies reported an increase in consumption of various food groups, simultaneously, other studies

reported a decrease in consumption of the same food group, this trend was similar to food waste as some studies highlighted the fact that food waste transferred from workplace/educational institutions to homes while other studies revealed it decreased as the participants were aware of the food they wasted (AlTarrah et al., 2021; Amicarelli & Bux, 2021; Baker et al., 2020; Chenarides et al., 2021; Filho et al., 2021; Janssen et al., 2021; Lamy et al., 2022; Ouhsine et al., 2020). Examining the six factors will help in assessing the effect of the COVID-19 pandemic on food consumption and waste in the Kingdom of Bahrain.

2.3 Summary

The topic of the COVID-19 pandemic triggered an increase in scientific publications and the topic of food consumption and generating food waste was globally studied (Riccaboni & Verginer, 2022). Different studies reported fluctuations in the consumption of different food groups, whereas multiple studies revealed a significant shift in the consumption of healthy meals, unhealthy foods, and snacks. Moreover, there were significant differences between the change in consumption of a few food groups and the demographic of the participants in these studies (AlTarrah et al., 2021; Amicarelli & Bux, 2021; Chenarides et al., 2021; Di Renzo et al., 2020; Filho et al., 2021; Janssen et al., 2021; Lamy et al., 2022).

The mode of purchasing food revealed different practices depending on the country's restrictions and lockdowns since few studies stated increase in dependence on local food outlets, and multiple studies noticed the increased dependence on online and delivery services while the ones that were having difficulties with the use of online platforms didn't restore to their use and depended on the in-person shopping despite the fear of the

COVID-19 virus (Ben Hassen et al., 2020, 2021; Cheikh Ismail et al., 2020; Jribi et al., 2020; Lahath et al., 2021).

Studies related to food waste section revealed contradicting outcomes which did not relate to the country's restrictions and lockdowns, rather it was in line with various socio-demographics, the respondent's awareness of food waste generation, and their buying habits (Burlea-Schiopoiu et al., 2021; Cequea et al., 2021; Cosgrove et al., 2021; Filimonau et al., 2022; Rodgers et al., 2021).

Chapter Three

Research Methodology

3.1 Overview

3.2 Population and Sample

3.3 Data Collection and Procedures

3.4 Research Hypotheses

3.5 Tools and Statistical Approaches

3.1 Overview

This study is based on previous research conducted in countries located in the Middle East and North Africa (MENA), the survey was derived from the studies conducted in Tunisia and Qatar, since these countries carry cultural similarities with the Kingdom of Bahrain (Ben Hassen et al., 2020; Jribi et al., 2020).

Through the literature review, it was noticed that there were multiple variables concerned with the change in food consumption and food waste generation, these include food purchase behaviour, feelings, financial security, and the implementation of COVID-19 restriction and policies (Cequea et al., 2021; Janssen et al., 2021; Lahath et al., 2021; Ouhsine et al., 2020; Theodoridis & Zacharatos, 2022). These factors will be tested against the consumption of food and generation of food waste to determine if there were significant difference between them through performing Chi-square statistical test.

This study aims to assess the fluctuations in Bahraini residents' food consumption and generation of food waste during the COVID-19 pandemic and the reasons behind it. Through a cross-sectional study, a quantitative approach was established to perform an online self-administered structured survey. The developed survey consisted of 26 questions distributed to three main segments:

1. Participants' demographic characteristics.
2. Participants' food consumption behaviour.
3. Participants' food waste behaviour.

The first section comprised of gender, educational attainment, age group, social status, occupation, monthly family income, nationality, governorates they live in, number of individuals in their household, how

long they lived in Bahrain, whether they opted to postpone loans during the pandemic, if they were affected by income loss, if they worked from home, if they contracted the COVID-19 virus and if they had negative feelings, the latter five questions were related to the COVID-19 pandemic period.

The second section of the survey consisted of food consumption behaviour during the pandemic, these included rating the change in consumption of different food items to know which food group varied the most during the pandemic, the change in the mode of purchasing food, whether they bought discounted food products as well as if they prepared shopping lists and stockpiled food during the pandemic.

The third section measured food waste behaviour, these involved the awareness of the food waste problem in the Kingdom of Bahrain, whether they tried to control food wastage during the pandemic, the final use of food leftover, the change in food waste compared to the period before the pandemic, the ratio of thrown foods per food purchased and the main reason they throw leftovers during the COVID-19 pandemic.

The various sociodemographic characteristics present in the first segment were tested against questions in the second and third segments to find out if there were significant difference between them and also to test the hypotheses mentioned in this chapter.

3.2 Population and Sample

The type of sampling conducted in this study was convenience sampling which depends on sending the survey to a group of people and then forwarding it to another group of their contacts and so on (Dornyei, 2007). The target sample size was determined through the Cochran formula, and the margin of error was ± 5 , with a 95% confidence level, thus the sample size was calculated to be $N \approx 384$ (Cochran, 1977).

The study pool is estimated to be just above 1.13 million individuals as the study targeted all the residents in the Kingdom of Bahrain which include Bahraini citizens and non-citizens living in the four governorates, also it targets participants who are above 18 years old and those who have been living in the kingdom for at least the past two years. According to the latest statistics regarding Bahrain's population, it is reported that there were 1,504,365 individuals living in Bahrain in the year 2021. The population that was excluded from this study were individuals below the year 18 which were less than 279,759 individuals, accurate numbers are not available as the published census age groups are under 10 years, 10 to 19 years old. From the study pool, the males are estimated to be above 735,235 individuals whereas the females were above 396,414 individuals. Moreover, the Bahraini individuals included in the study pool were above 439,574 individuals (38.8%) and the non-Bahraini individuals are predicted to be above 692,074 individuals (61.1%) (IGA, 2022).

3.3 Data Collection and Procedures

In this research, convenience sampling which is a type of non-probability sampling was selected as it helps to reach a higher number of respondents as well as has a high response rate in a short period (Baltar & Brunet, 2012; Benfield & Szlemko, 2006). Following the approval of the content of the survey by the Deanship of Graduate Studies & Scientific Research and prior to distributing the survey, a pilot test was performed to 30 individuals to ensure that all the questions were clear and precise and the feedbacks were noted.

The sampling in this study was performed from 10 February to 6 March 2022, it was conducted by sending messages on different social media platforms (WhatsApp, Instagram, and Twitter) to maximize the

number of participants. The online distribution of the survey was selected due to the rapid spread of the virus during the period of submitting the survey as 90,440 newly reported cases in Bahrain were announced thus utilizing the online platforms helped in limiting the spread of the virus (WHO, 2022).

After the responses were collected, the dichotomous categorical variables were coded 1 and 2, for example: for the gender- female = 1 and male = 2, for work from home- yes = 1 and no = 2. Furthermore, the responses from the multi-choice questions such as age range, occupation, and family income were coded, for example: for selecting the educational level:

- Less than secondary certificate = coded as 1
- Secondary certificate degree = coded as 2
- Diploma or bachelor's degree = coded as 3
- Master or Doctorate degree = coded as 4;

this was done for the other questions in the same manner, as the number of choices varied from three choices to seven choices, and thus the coding also varied from three to seven.

3.4 Research Hypotheses

In this research, five hypotheses were tested and these are:

Hypothesis 1 (**H1**): Presence of a significant difference between contracting the COVID-19 virus and the consumption of healthy meals.

Hypothesis 2 (**H2**): The majority of the respondents did not stockpile food during the pandemic.

Hypothesis 3 (**H3**): Utilizing online shopping platforms increased during the pandemic.

Hypothesis 4 (**H4**): The majority of the households increased food waste during the pandemic.

Hypothesis 5 (**H5**): There is a significant difference between nationality and food waste during the pandemic.

3.5 Tools and Statistical Approaches

This study depended on three main tools, first is the survey which was an online self-administered survey and consisted of 26 structured questions. Later, the results of the survey were coded with the help of Microsoft Excel and the analysis was conducted by using various statistical tests in SPSS Statistics for Windows Version 26.0 software (IBM Corp., Armonk, NY, USA).

After the survey results were obtained, the coded data were entered into SPSS. For the first section of the survey, frequencies, and percentages of each question were calculated using the software as well as bar graphs were obtained from these data using Microsoft excel. For the second and third sections, percentages of each question were measured using the SPSS software followed by bar graphs with the help of Microsoft excel.

The measurement variables in this study were nominal and ordinal. Due to this reason, the chi-square test of independence was selected as the statistical test performed to identify if there was independence between different questions and the socio-demographic variables of the participants. This test was selected as it helps to identify if there was significant independence between two variables as the statistically significant independence was selected when the p-value was below 0.05 (p-value < 0.05) (Kothari, 2004).

Regarding the hypotheses testing, it was conducted with the help of SPSS software. For the first hypothesis, the chi-square test was selected to measure if there was a significant difference between contracting the COVID-19 virus and the consumption of healthy meals. Likewise, the fifth hypothesis followed the same procedure as chi-square was used to test if there was a significant difference between nationality and food waste during the pandemic.

For the second, third and fourth hypotheses, the testing was conducted by examining the results related to the questions of the habit of stockpiling, utilizing online shopping platforms, and the amount of household food waste.

Chapter Four

Results

4.1 Overview

4.2 Results

4.1 Overview

The survey was completed by 394 participants and the valid participants who are 18 years old or above and living in the Kingdom of Bahrain two years prior to the pandemic were 98.9% of the participants and thus four responses were removed as they did not meet these criteria.

The results revealed minor changes in food consumption in most food groups and mode of purchasing food, while consuming unhealthy meals and snacks, as well as buying food items using online shopping and food delivery services increased during the pandemic. A positive awareness was noticed among the respondents of this study since the majority did not stockpile food and 44.6% of the respondents always prepared a shopping list before buying food items.

A summary of the relation of different socio-demographic to the change in consumption of food groups is presented in Figure 4.1. The specific categories that led to the increase and decrease of each food group are displayed in the figure, for instance; one of the socio-demographics that is significant in consuming meat was age group, the respondents younger than 41 had higher increase while the that are 41 and elder had higher percentage of decrease. Similarly, increased consumption of dairy products was noticed among respondents who opted to postpone loan payments. A detailed analysis is presented in the following section.

The most common method to treat the leftover food was eating it the following day and majority of the respondents were aware of the problem of food waste and tried to control it during the pandemic. Close to 50% of the respondents did not change the amount of food waste generated during the pandemic, and the groups that showed higher increases compared to their counterparts were females, low-income families, young individuals,

single respondents, Bahraini participants, and those experiencing negative feelings. The increase in consumption of most of the food groups and increased shopping resulted in the increased generation of food waste.

The reasons for change in food waste generation are displayed in Figure 4.2, the increased generation of food waste seen amongst various categories like female respondents, respondents between 18 to 30 years, those who increased food shopping, those who endured negative feelings during the pandemic etc. Whereas, the groups that minimized the generation of food waste compared to their counterparts were male respondents, those between 41 to 60 years, married respondents etc.

Three of the five hypotheses were accepted as the majority of the respondents did not stockpile food during the pandemic, an increased utilization of online shopping platforms was noticed, and it was found that there was a significant difference between nationality and food waste generation during the pandemic.

Increase	Food group	Decrease
-Below 41 years	Meats	- 41 years and above - Affected by income loss
-Between 18 to 30 years -Bahraini residents	Unhealthy meals	
-Opt to postpone loan payments	Dairy	
-Between 18 to 40 years -Single -Married -Had negative feelings	Baked products	
-Between 18 to 30 years -Single -Bahraini -Did not lose their income	Snacks	
-Between 18 to 30 years -Single -Married -Students -Bahraini	Frozen foods	-‘Other’ social status -Non-Bahraini respondents -Opt to postpone loan payments
-Unemployed individuals -Capital governorate residents -Had negative feelings	Canned foods	-Between 51 to 60 years -‘Other’ social status -Non-Bahraini -Opt to postpone loan payments -Did not endure negative feelings

Figure (4.1): Socio-demographic relation to change in consumption of food groups

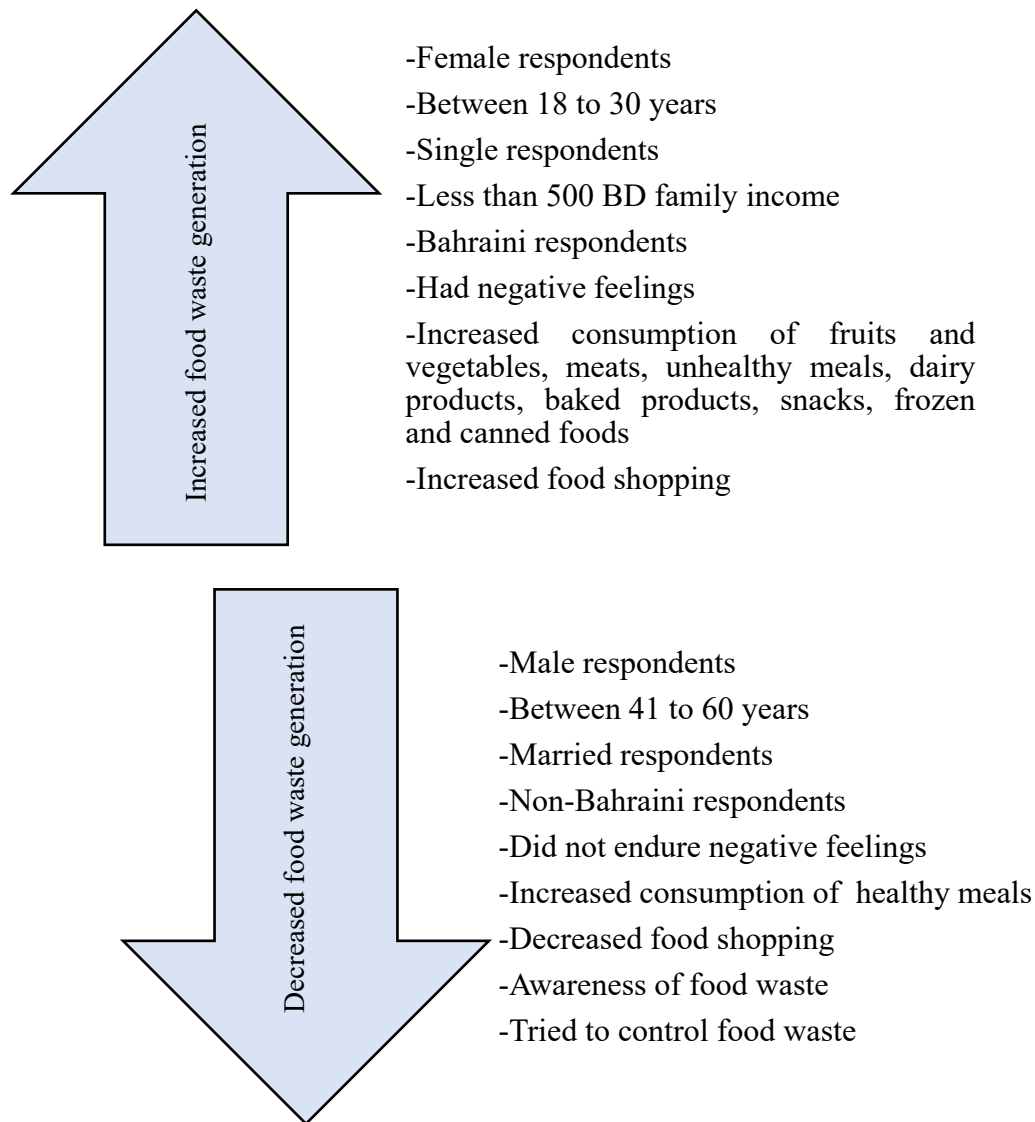


Figure (4.2): Reasons for change in food waste generation

4.2 Results

This section consists of the following sub-sections:

1. Participants' demographic characteristics.
2. Participants' food consumption behaviour.
3. Participants' food waste behaviour.

4.2.1 Participants' Sociodemographic Characteristics

Through the online survey, the demographic characteristics were collected and are summarized in Table 4.1 & 4.2. The Tables show the socio-demographic along with their categories, number of respondents and their percentages.

Close percentages were obtained between females and males, 50.3% and 49.7% respectively. While the occupation was divided as employers in the governmental sector (45.1%), followed by students (20.3%), employees in the private sector (16.9%), retired respondents and the housewives were the least category that participated in the survey. More than 65% of the responses were from participants holding a Diploma or Bachelor's degree followed by Secondary certificate holders (17.4%) and Master's or Doctorate holders (14.6%).

The participants' residences were almost close in three of the four governorates, with Muharraq governorate participants being the highest contributors (28.5%) followed closely by the Northern governorate respondents and the Southern governorate, 27.7% and 25.9% respectively, and finally, the Capital governorate participants were close to 18%. The highest age group that completed the survey was between 18-30 years with 49.2%, just above 22% were between 31-40 years, followed by respondents in the age group 41-50 years (16.9%) and only 1% of the participants were 61 years or above. The social statues is the last socio-demographic in Table 4.1, majority of the respondents are married (55.4%) while 42% were single and 2.6% were in the 'others' category.

Table 4.2 shows that the survey was mostly filled by Bahraini participants (87.2%) while only 12.8% were non-Bahraini respondents. The most common family income range was between 500 to 999 Bahraini

Dinar (BD) (43.3%), while the families who had an income exceeding 1000 BD were 39.5% and 17.2% were low income families.

The most common count of individuals in the household were three to five individuals (47.9%) followed by six to eight individuals (32.8%). Moreover, only 7.7% of the respondents live in households with two or fewer individuals, and 11.5% of respondents live in households with more than 8 individuals. Of the 390 participants, 49.2% did not have any loans while 50.8% had loans during the pandemic, half of whom opted to postpone loan payments while the other half continued paying their loans during that period. Furthermore, more than 75% were not affected by the loss of income during this period.

Since the start of the pandemic outbreak, 63.6% of the participants worked/studied from home while the rest kept on working onsite. Lastly, the participants who contracted the COVID-19 virus before filling the survey were found to be 41% of the respondents. Out of the four negative feelings, the participants mostly felt worried and bored, 30.8% and 30% respectively while 18.7% did not have any negative feelings. This is depicted in Figure 4.3.

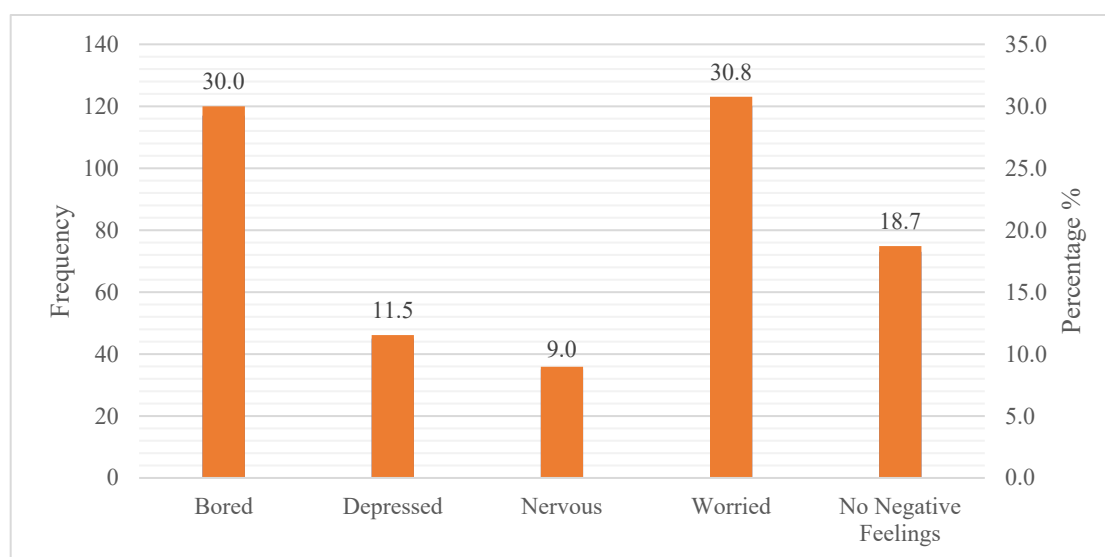


Figure (4.3): Participant's feelings during the pandemic

Table (4.1): Demographic characteristics of the participants' N = 390

Socio-demographic	Categories	Number (Percentage%)
Gender	Female	196 (50.3%)
	Male	194 (49.7%)
Occupation	Employed in Governmental Sector	176 (45.1%)
	Student	79 (20.3%)
	Employed in Private Sector	66 (16.9%)
	Retired	30 (7.7%)
	Unemployed	23 (5.9%)
	Freelance	10 (2.6%)
	Housewife	6 (1.5%)
Educational Level	Less than Secondary Certificate	1 (0.3%)
	Secondary Certificate	68 (17.4%)
	Diploma or Bachelor	264 (67.7%)
	Master or Doctorate	57 (14.6%)
Governorate	Muharraq Governorate	111 (28.5%)
	Northern Governorate	108 (27.7%)
	Southern Governorate	101 (25.9%)
	Capital Governorate	70 (17.9%)
Age (Years)	18 – 30	192 (49.2%)
	31 – 40	86 (22.1%)
	41 – 50	66 (16.9%)
	51 – 60	42 (10.8%)
	61 or more	4 (1.0%)
Social Status	Married	216 (55.4%)
	Single	164 (42.0%)
	Others	10 (2.6%)

Table (4.2): Demographic characteristics of the participants' N = 390

Socio-demographic	Categories	Number (Percentage%)
Nationality	Bahraini	340 (87.2%)
	Non- Bahraini	50 (12.8%)
Family Income	Less than 500 BD	67 (17.2%)
	500 to 999 BD	169 (43.3%)
	1000 to 1499 BD	70 (17.9%)
	1500 to 1999 BD	35 (9.0%)
	2000 to 2499 BD	18 (4.6%)
	2500 to 2999 BD	14 (3.6%)
	≥ 3000 BD	17 (4.4%)
Individuals in the Households	2 or less individuals	30 (7.7%)
	3 - 5 individuals	187 (48.0%)
	6 - 8 individuals	128 (32.8%)
	More than 8 individuals	45 (11.5%)
Opt to postpone loan payments	Yes	99 (25.4%)
	No	99 (25.4%)
	Do not have loans	192 (49.2%)
Affected by income loss due to the pandemic	Yes	90 (23.1%)
	No	300 (76.9%)
Work/Stay at Home	Yes	248 (63.6%)
	No	142 (36.4%)
Contract COVID-19	Yes	160 (41.0%)
	No	230 (59.0%)

4.2.2 Participants' Food Consumption during the Pandemic

The change in consumption of each food group during the COVID-19 pandemic was measured through the survey and the percentage of each scale was calculated as shown in Table 4.3. The most common response in all the food groups was no change in consumption and there were close percentages between no change and increase in two food items namely unhealthy meals (fast food) and snacks. The change in the mode of purchasing food items during the pandemic was determined through the responses and it can be observed in Table 4.4. The majority of the individuals did not change their purchase of local foods, similarly, the mode of purchasing food did not change in both the large and small supermarkets, 43.1% and 46.2% respectively. Utilizing online shopping platforms and food delivery services increased drastically during the pandemic by 58% and 67.2% while it decreased by 10% and 9.7% respectively.

Table (4.3): Change in food consumption of each food group during the COVID-19 pandemic.

Food group	Change in consumption - Number (Percentage%)				
	Much less	Slightly less	No change	Slightly more	Much more
Fruits and Vegetables	17 (4.4%)	32 (8.2%)	190 (48.7%)	108 (27.7%)	43 (11.0%)
Meats	17 (4.4%)	55 (14.1%)	247 (63.3%)	55 (14.1%)	16 (4.1%)
Healthy meals	30 (7.7%)	38 (9.7%)	174 (44.6%)	110 (28.2%)	38 (9.7%)
Unhealthy meals	56 (14.4%)	56 (14.4%)	107 (27.4%)	100 (25.6%)	71 (18.2%)
Water	14 (3.6%)	31 (7.9%)	174 (44.6%)	107 (27.4%)	64 (16.4%)
Dairy products	19 (4.9%)	38 (9.7%)	235 (60.3%)	75 (19.2%)	23 (5.9%)
Baked foods	7 (1.8%)	35 (9.0%)	235 (60.3%)	89 (22.8%)	24 (6.2%)
Snacks	23 (5.9%)	39 (10.0%)	143 (36.7%)	110 (28.2%)	75 (19.2%)
Frozen foods	32 (8.2%)	41 (10.5%)	186 (47.7%)	93 (23.8%)	38 (9.7%)
Canned foods	35 (9.0%)	39 (10.0%)	232 (59.5%)	58 (14.9%)	26 (6.7%)

Table (4.4): Change in mode of purchasing food during the COVID-19 pandemic.

Mode of purchasing food	Change in mode of purchasing food - Number (Percentage%)				
	Much less	Slightly less	No change	Slightly more	Much more
Buying local food	9 (2.3%)	31 (7.9%)	220 (56.4%)	96 (24.6%)	34 (8.7%)
In person large supermarket shopping	38 (9.7%)	72 (18.5%)	168 (43.1%)	80 (20.5%)	32 (8.2%)
In person small supermarket shopping	28 (7.2%)	64 (16.4%)	180 (46.2%)	88 (22.6%)	30 (7.7%)
Online shopping	24 (6.2%)	15 (3.8%)	125 (32.1%)	120 (30.8%)	106 (27.2%)
Food delivery services	18 (4.6%)	20 (5.1%)	90 (23.1%)	105 (26.9%)	157 (40.3%)

A positive awareness was seen in the food shopping behaviour as most participants did not buy discounted food items always and 44.6% of the respondents prepared a shopping list before buying food items. Stockpiling food was only seen by 39% of the participants, Table 4.5 summarizes the food shopping behaviour.

Table (4.5): Food shopping behaviour during the COVID-19 pandemic.

	Response	Number (Percentage%)
Buy discounted food items	Yes	136 (34.9%)
	No	56 (14.4%)
	Sometimes	198 (50.8%)
Prepare shopping list	Yes	174 (44.6%)
	No	91 (23.3%)
	Sometimes	125 (32.1%)
Stockpile food	Yes	152 (39.0%)
	No	142 (61.0%)

The effect of the respondents' demographics on consuming different food items was measured through the Chi-square test and the difference between them is presented in Table 4.6 and Table 4.7. The values displayed correspond to the Pearson Chi-Square values and the (*) sign indicates which category has a significant difference with consuming each food group (i.e. $p\text{-value} < 0.05$). The reason why changes in the consumption of fruits and vegetables, healthy meals, and drinking water are not displayed in Tables 4.6 and 4.7 is due to the absence of a significant difference between them and the different socio-demographics.

From Tables 4.6 and 4.7, it can be observed that gender, educational attainment, family income, individuals in the household, working from

home, and contracting the COVID-19 virus did not have a significant difference with the change in consumption of any food group. The sociodemographic which influenced the food groups the most was the age group, as it is significant in six out of ten food groups, these were: consuming meats, unhealthy meals, baked foods, snacks, frozen foods, and canned foods.

When comparing the difference in the increase and decrease of meat consumption, 22.3% of the participants below the age of 41 years increased their consumption compared to a 12.9% decrease in the same age group and the rest did not change their consumption, whereas, only 7.4% of the ones who were 41 years increased meat consumption and 31.4% of them decreased it. Another socio-demographic that showed a significant difference with meat consumption was income loss, majority of them did not experience a change in consumption, but when comparing the changes, those who lost part of their income tended to minimize meat consumption (21%), while 15.5% increased meat consumption.

High percentages of increased consumption of unhealthy meals (fast foods) were seen among two groups of respondents, specifically the ones between 18 - 30 years and the Bahraini individuals 55% and 47% respectively. The next food group is consuming dairy products, opting for loan postponements showed that it had a higher percentage of increase in comparison to not postponing, 35.3% and 21.6% respectively.

Even though the majority of the participants did not change their consumption of baked products, it was noticed that 78.7% of the ones who increased their consumption were in the age group 18 to 40 years. All of the respondents who increased consuming baked foods were single and married individuals, moreover, 32.1% of those who endured negative feelings have increased consuming baked products.

The socio-demographics that contributed to the increase in snacking during the pandemic were respondents between the ages of 18 - 30 years, this age group resembled 57.2% of the increase among all age groups. Furthermore, the respondents whose social status was single (57.3%), 49.7% of the Bahraini nationals, and 47.6% of those who did not lose at least part of their income contributed to the increased habit of snacking.

The next food group that showed a significant difference with multiple socio-demographics was consuming frozen food items. An increase was noticed among 40.1% of respondents from the 18 to 30 age group, 33.3% of married ones, 35.3% of single participants, 41.7% of students, and 36.1% of Bahraini respondents. On the contrary, the categories that showed a decrease in consuming frozen foods were 50% of the respondents whose social status was 'other', 36% of the non-Bahraini respondents, and 28% of the respondents who opted to postpone loan payments.

Lastly, the food group with the highest significant difference was canned food items. About 52% of the unemployed individuals, 32.8% of the capital governorate residents, and a quarter of those suffering from negative feelings increased consuming canned foods. On the other hand, multiple categories reported a decrease in consuming canned foods, these include, participants from the age group 51 to 60 (42%), 'others' social status (70%), non-Bahraini respondents (34%), those who opted to postpone loan payments (30.3%), and 23.2% of respondents who did not experience negative feeling during the pandemic.

Table (4.6): Sociodemographic effects on consumption of different food groups during the COVID-19 pandemic.

Food group	Pearson Chi-Square values							
	Gender	Age group	Education attainment	Social status	Occupation	Family income	Nationality	Governorate
Meats	4.199	36.079*	5.700	13.113	31.447	18.195	5.037	15.342
Unhealthy meals	3.357	49.34*	13.082	12.628	34.910	10.478	13.228*	8.990
Dairy products	3.187	14.182	3.173	9.255	19.228	32.435	7.906	6.657
Baked foods	5.219	40.72*	8.080	28.048*	22.029	29.815	5.991	6.457
Snacks	8.762	52.366*	6.327	24.552*	22.774	21.623	25.799*	6.247
Frozen foods	8.034	58.017*	10.011	19.34*	44.526*	22.362	16.227*	5.341
Canned foods	4.660	40.256*	11.153	30.121*	37.106*	24.176	10.641*	23.124*

** p-value < 0.05 (significant difference)*

Table (4.7): Sociodemographic effects on consumption of different food groups during the COVID-19 pandemic.

Food group	Pearson Chi-Square values					
	Individuals in the household	Loan postponement	Income loss	Work/Stay at Home	Contract COVID-19	Negative feelings
Meats	8.751	4.378	12.972*	1.157	0.281	9.394
Unhealthy meals	12.142	6.057	2.577	3.179	3.134	8.728
Dairy products	15.378	10.919*	2.828	0.492	1.842	.980
Baked foods	5.236	2.081	6.744	0.229	6.658	14.354*
Snacks	14.963	4.156	10.03*	1.225	8.956	8.163
Frozen foods	7.600	11.228*	2.292	3.169	5.284	7.029
Canned foods	10.050	11.514*	9.249	2.064	5.320	17.862*

** p-value < 0.05 (significant difference)*

The sociodemographic effects on food behavioural change and mode of purchasing food during the COVID-19 pandemic were also measured using the Chi-Square test, the results are summarized in Table 4.8 and Table 4.9, the values displayed correspond to the Pearson Chi-Square values and the (*) sign indicates which category has a significant difference in consuming each food group (i.e. $p\text{-value} < 0.05$). The different food shopping behaviours analysed were buying from the local food markets, in-person small and large supermarket shopping, online food shopping, food delivery services, buying discounted food, and stockpiling food.

It is observed that the family income, the individuals in the household, working from home, and contracting the COVID-19 virus did not have a significant difference with the respondents' food purchasing behaviour. The Pearson Chi-Square values are interpreted in the same manner as the previous 2 tables, where the (*) sign indicates which socio-demographic has a significant difference with food shopping behaviours.

Buying local foods showed the lowest rate of change, 43.6%, it was also found to have a significant difference with the gender of the participants as 15% of the males minimized buying local foods compared to a 5% decrease amongst females. The age groups that showed increased dependence on local foods were the age groups between 31-40 years with a 41.8% increase, respondents between 41-50 years with a 33.3% increase, ages between 51-60 years showed a 42.8% increase and finally, three of the four respondents above 61 years have increased purchasing local foods, while the young respondents (between 18 and 30 years) increased their purchase of local foods by 26.5%.

Social status also had a significant difference with purchasing local foods. An increase was reported among 41.2% of married individuals compared to 23.1% of the single respondents and 30% of the other status

groups, moreover, the majority of the two latter groups did not change their purchase compared to 48.6% of the married individuals.

The nationality of the individuals was significant in buying local food, more Bahraini respondents, 34.4% increased their dependence on these foods compared to a 24% increase amongst non-Bahraini participants, moreover, the same percentage of the latter group decreased their consumption of local foods compared to 8.2% of the Bahrain respondents. Finances were also found to be significantly associated, 42.2% of those who experienced income loss increased consumption of local foods in comparison to 30.6% of those who did not lose part of their income. Furthermore, 49.4% of those who postponed loan payments bought locally grown foods, while an increase in 27.8% of the respondents who did not postpone loan payments. The final socio-demographic significant to buying local foods was experiencing negative feelings, 35% who had negative feelings increased their purchase of local foods in comparison to 26% of those who did not.

The next buying habit that was examined was buying groceries from small supermarkets, 40.9% of the age group 41 to 50 years increased the utilization of small supermarkets to buy their food products. Even though a significant factor was not found between small supermarket shopping and nationality, the percentage of increased dependence on them amongst Bahrainis was twice that of non-Bahrainis, 32.3% and 16% respectively. A 42.4% increase was noticed among those who opted to postpone loan payments in comparison to 26.1% who did not.

The significant differences with online shopping and which increased its utilization include female respondents with an increase of 63.2% of them, while 52.5% of the male respondents increased their dependence on them. Another significant difference was the age group, 63.3% of the

respondents between 18 and 40 years increased their use of these platforms. The nationality of the respondents was one of the significant differences with online shopping along with educational attainment, more than 60% of the Bahraini respondents increased their utilization of these platforms compared to an increase among 40% of non-Bahraini respondents.

The fourth mode of shopping that was further analysed through Pearson Chi-square was the dependence on food delivery services to meet their nutritional needs. Again, gender had a significant difference with it and a large variation in increase of these services was obtained between female and male respondents, 75.5% and 58.7% respectively. The age group also influenced the increased demand for these services as an increase was obtained among 70.9% of the respondents between 18 and 50 years. Single respondents had a higher dependence compared to married respondents, 71.3% and 64.3% respectively. A huge variation in the increased order of food delivery services was noticed among the nationality of the respondents, 71.7% of the Bahraini respondents increased their order through these platforms while an increase among 36% of the non-Bahraini was reported by the respondents. Finally, it was noticed that the respondents who experienced negative feelings had a higher increase in utilizing food delivery services compared to those who did not experience them, 69.4% and 57.5% respectively.

Buying discounted items was found to have a significant difference with social status as 60% of those whose social status is considered as others (widowed and divorced) did not buy any discounted items during the pandemic. Another shopping habit that was examined was the preparation of a shopping list before visiting the grocery shops, a significant difference was found among five socio-demographics. Firstly, 50% of the females prepared shopping lists while 39% of the male

respondents did so, whereas, the age group between 18 and 30 years had the highest percentage of not preparing those lists which included 31% of them. The third socio-demographic was social status, 51.8% of the married respondents and 50% of the others (widowed and divorced) in comparison to 34.7% of the single participants prepared those lists frequently. The occupation of the respondents was also significant to the preparation of the shopping list, the three major groups which always did so were the unemployed (56.5%), retired (56.6%), and housewives (83.3%). Lastly, the place of residence was found to be significant in preparing a shopping list, the two governorates with the highest percentages for the preparation of shopping lists were Northern governorate residents at 48.1% and Muharraq governorate residents at 47.7%.

The final purchasing behaviour that was analysed is stockpiling food, an increase in adopting this habit was absent in 65.2% of the respondents whose social status is single compared to 56.4% of the married individuals. The other significant difference was the occupation of the respondents, 50% of the retired individuals and 65% of the unemployed respondents stockpiled food whereas 62.5% of the governmental employees, 90% of the freelancers and 83.3% of the housewives did not stockpile food. The third significant difference was negative feelings, 42.9% of those who experienced negative feelings have stockpiled food whereas, 78% of those who did not suffer from negative feeling did not stockpile food.

Table (4.8): Sociodemographic effects on mode of purchasing during the COVID-19 pandemic.

Food purchasing behaviour	Pearson Chi-Square values						
	Gender	Age group	Education attainment	Social status	Occupation	Family income	Nationality
Buying local food	15.062*	32.839*	12.456	23.657*	31.571	36.016	13.232*
In person large supermarket shopping	2.819	15.524	24.201*	8.777	30.569	31.886	8.206
In person small supermarket shopping	2.826	27.493*	23.743*	18.325*	32.307	33.684	8.728
Online shopping	20.98*	27.649*	31.784*	6.347	29.680	17.186	17.396*
Food delivery services	20.116*	74.751*	25.336*	19.454*	24.571	23.107	34.024*
Buy discounted food	0.272	13.755	7.991	18.246*	17.387	8.061	5.632
Prepare Shopping list	8.046*	24.816*	5.881	36.539*	26.15*	17.670	5.135
Stockpile Food	0.016	4.703	2.095	6.632*	13.558*	3.718	0.023

** p-value < 0.05 (significant difference)*

Table (4.9): Sociodemographic effects on mode of purchasing during the COVID-19 pandemic.

Food purchasing behaviour	Pearson Chi-Square values						
	Governorate	Individuals in the household	Loan postponement	Income loss	Work/Stay at Home	Contract COVID-19	Negative feelings
Buying local food	10.888	10.938	16.06*	12.838*	5.411	5.082	11.590*
In person large supermarket shopping	12.703	11.391	8.319	11.832*	3.181	3.982	6.788
In person small supermarket shopping	19.712	10.526	14.242*	7.600	1.031	0.980	3.882
Online shopping	10.628	14.172	8.121	4.375	7.436	6.614	2.123
Food delivery services	5.833	17.483	4.483	6.047	1.434	0.999	5.305
Buy discounted food	9.088	4.478	3.355	3.246	2.539	0.763	3.880
Prepare Shopping list	6.558*	15.665	4.287	0.314	0.636	0.673	.395
Stockpile Food	2.548	0.891	0.010	0.225	0.128	0.847	10.985*

** p-value < 0.05 (significant difference)*

4.2.3 Participants' Food waste

The final use of leftover food was measured through the survey, close to half of them ate the food the next day while few of them fed it to the domestic animals or donated it, 19% and 14.6%, a more detailed data is present in Figure 4.4.

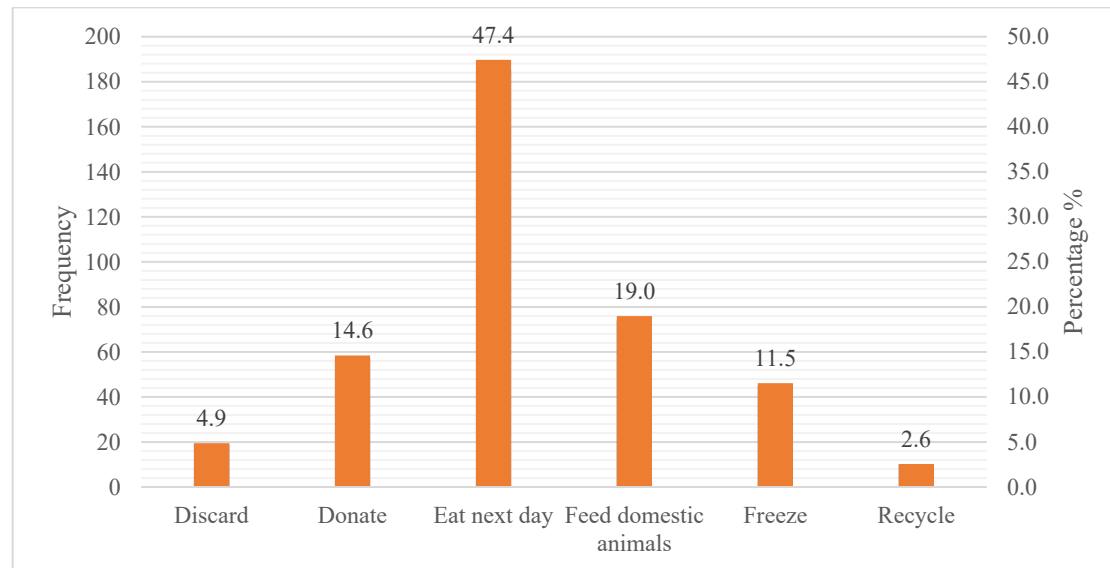


Figure (4.4): Final use of leftover food.

The testing for the presence of a significant difference between eating the leftover food the next day and various socio-demographics, shopping habits, and change in food waste was examined thoroughly. Four factors were found to be significant to eating leftover food the next day, Table 4.10 displays these factors. The groups that reported eating leftover food during the pandemic were households with five individuals or less (54.3%), respondents that increased the consumption of frozen foods (51.1%), stockpiled food (53.9%) and those who minimized food waste during the pandemic (56.2%). On the contrary, the individuals that stated not eating leftover food during the pandemic were from households with individuals more than five (61.2%), respondents who decreased consumption of frozen

foods (52%), participants that did not stockpile food (56.7%), and those who increased their food waste during the pandemic (66%).

Table (4.10): Factors significant to eating leftover food the next day during the COVID-19 pandemic (Chi-Square test).

Factors	Pearson Chi-Square value
Individuals in the Household	11.284*
Eating Frozen Foods	10.325*
Stockpile Food	4.235*
Change in Food Waste	12.417*

** p-value < 0.05 (significant difference)*

A summary of the reasons to throw away food is present in Figure 4.5. More than a quarter of the participants saw that it was due to it passing its expiration date (26.4%), while 22.3% threw away food since they cooked large amounts, and 20.3% did throw away food due to the long storage period.

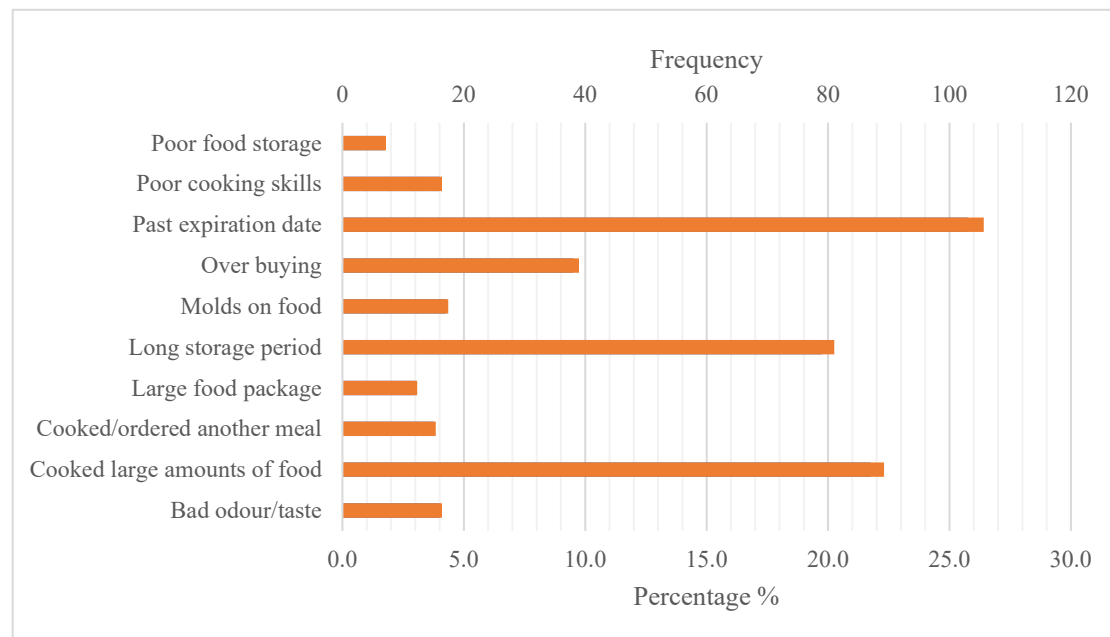


Figure (4.5): Reason to throw away food during the COVID-19 pandemic.

The awareness of the problem of food waste was taken into consideration, 58.7% were aware of the problem while 30.8% did not see it and the rest did not cast their opinion on this issue. Moreover, 70% of the participants tried to control their food waste and 16.4% did not attempt to do so, Table 4.11 gives more insight into the past two questions.

Table (4.11): Awareness and controlling food waste during the COVID-19 pandemic.

	Response	Number (Percentage%)
Aware of food waste problem	Yes	229 (58.7%)
	No	120 (30.8%)
	No opinion	198 (10.5%)
Try to control food waste	Yes	273 (70.0%)
	No	64 (16.4%)
	No opinion	53 (13.6%)

The responses for the awareness of the issue of food waste in the Kingdom of Bahrain during the COVID-19 pandemic were further analysed using the Pearson Chi-Square test against the socio-demographics, eating and shopping habits, and change in food waste of the respondents, the significant differences are presented in Table 4.12. The sociodemographic groups that were found to be aware of the problem of food waste in the Kingdom of Bahrain were male respondents (66.4%), those who have degrees above secondary certificates (61.9%), married respondents (65.2%), higher percentage of non-Bahrain participants who were aware of the problem of food waste in the Kingdom as compared to Bahraini participants, 72% and 56.7% respectively, respondents living in Muharraq and Capital Governorate, 63.9% and 70% respectively and respondents that worked/studied from home (62.5%).

The eating and shopping habits that had a significant difference with awareness of the problem of food waste in Bahrain were those who increased consumption of healthy meals (66.8%), and canned foods (65.4%), participants that minimized shopping in small supermarkets (68.4%), bought discounted items (69.1%), prepared shopping list (64.3%), and the respondents that decreased their food waste during the pandemic (73.9%). On the other hand, the individuals that were not aware of food waste in Bahrain were female respondents (48.9%), respondents with secondary certificates or less (58.2%), those who did not buy discounted items (64.2%), and participants who did not prepare a shopping list before shopping (52.7%).

Table (4.12): Factors significant to awareness of the problem of food waste during the COVID-19 pandemic (Chi-Square test).

Factors	Pearson Chi-Square value
Gender	9.631*
Education Attainment	10.005*
Social Status	9.084*
Nationality	4.174*
Governorate	8.874*
Work/Stay at Home	4.019*
Eating Healthy Meals	9.997*
Eating Canned Foods	15.134*
In person shopping (small supermarket)	9.861*
Buy Discounted Items	18.326*
Prepare Shopping List	7.238*
Change in Food Waste	16.487*

** p-value < 0.05 (significant difference)*

Controlling food waste during the COVID-19 pandemic in the Kingdom of Bahrain was tested against the socio-demographics, eating and shopping habits, and change in food waste of the respondents using the Pearson Chi-Square test, the significant differences are presented in Table 4.13.

Trying to control food waste during the pandemic was noticed amongst male respondents (76.2%) when compared to females (63.7%), 80% of respondents between 41 and 50 years, 92.8% of respondents between 51 and 60 years, married participants (80.5%), more non-Bahrain participants tried to control food waste as compared to Bahraini participants, 88% and 67.3% respectively, respondents living in Muharraq and Capital Governorate, 78.3% and 78.5% respectively and households with less than six individuals (75.5%).

The eating and shopping habits that are significant to trying to control food waste are also presented in Table 4.13. Trying to control food waste was noticed amongst those who increased consumption of healthy meals (82.4%), respondents that decreased consumption of unhealthy meals (82.1%), those who drank more water (76%), participants that decreased consumption of snacks (79%). Furthermore, shopping habits that could minimize food waste through trying to control it were from respondents that minimized shopping in small supermarkets (79.3%), respondents that bought discounted items (79.4%), participants that prepared shopping list (76.4%), those who stockpiled food (78.2%). Lastly, it was noticed that 88.5% respondents that minimized food waste have tried to control food waste during the pandemic.

Table (4.13): Factors significant to trying to control food waste during the COVID-19 pandemic (Chi-Square test).

Factors	Pearson Chi-Square value
Gender	7.270*
Age Group	29.826*
Social Status	26.554*
Nationality	8.849*
Governorate	13.185*
Individuals in the Household	11.694*
Eating Healthy Meals	20.636*
Eating Unhealthy Meals	18.256*
Drinking Water	10.364*
Eating Snacks	11.931*
In person shopping (small supermarket)	11.611*
Buy Discounted Items	10.899*
Prepare Shopping List	13.493*
Stockpile Food	8.150*
Change in Food Waste	25.690*

** p-value < 0.05 (significant difference)*

The participants were also asked to rate the percentage of food group wasted per food bought as presented in Table 4.14. The majority of the participants saw that they wasted less than 2% of the food bought in the following food groups: vegetables, fruits, dairy products, meats, pulses, and cereals, the only exception was baked food as the majority wasted more than 2% of the baked goods they bought. The food group that was least wasted was meats followed by dairy products, pulses and cereals.

Table (4.14): Percentage of food group wasted per food bought during the COVID-19 pandemic.

Food group	Percentage of food group wasted per food bought - Number (Percentage %)				
	Less than 2 %	Between 3 to 5 %	Between 6 to 10 %	Between 11 to 20 %	More 20 %
Vegetables	210 (53.8%)	91 (23.3%)	57 (14.6%)	19 (4.9%)	13 (3.3%)
Fruits	221 (56.7%)	93 (23.8%)	49 (12.6%)	13 (3.3%)	14 (3.6%)
Dairy	263 (67.4%)	68 (17.4%)	35 (9.0%)	16 (4.1%)	8 (2.1%)
Meats	270 (69.2%)	58 (14.9%)	38 (9.7%)	12 (3.1%)	12 (3.1%)
Baked foods	166 (42.6%)	121 (31.0%)	59 (15.1%)	25 (6.4%)	19 (4.9%)
Pulses	255 (65.4%)	79 (20.3%)	39 (10.0%)	10 (2.6%)	7 (1.8%)
Cereals	253 (64.9%)	72 (18.5%)	44 (11.3%)	12 (3.1%)	9 (2.3%)

When asked to rate the change in food waste during the pandemic compared to the period before it, close to the majority felt there was no change in their food waste (49.7%), and the ratio of an increase or decrease was close to each other, more details are present in Figure 4.6.

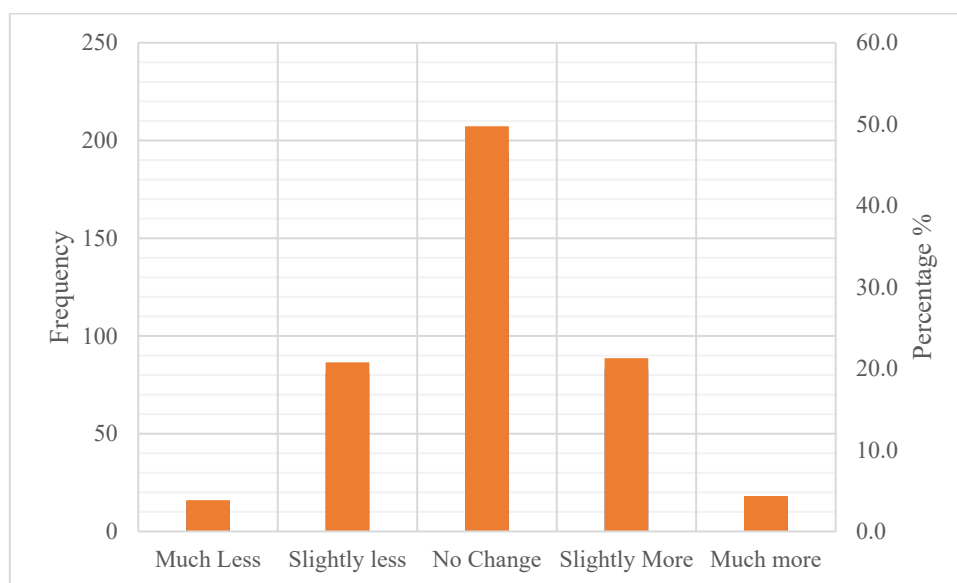


Figure (4.6): Change in food waste during the COVID-19 pandemic.

4.2.4 Factors Affecting Food waste

A summary of the socio-demographics that were significant in generating food waste is provided in Table 4.15. By conducting the Chi-square test, the significant socio-demographics were found to be gender, age group, social status, family income, nationality, loan postponement, and negative feelings. The values displayed are the Pearson Chi-Square value and the (*) sign indicates which socio-demographic has a significant difference with the amount of food waste generated. Increased food waste was noticed among female respondents (30.1%), the age group of 18 to 30 years (35.4%), and the respondents whose social status was single (30.4%), families with income less than 500 BD (32.8%), Bahraini respondents (27.9%) and those who experienced negative feeling during the pandemic

(29.6%). Whereas, a decrease in food waste was detected among the male respondents (30.9%), the respondents between the ages 41 to 60 years (38.9%), the married individuals (29.6%), the non-Bahraini residents (40%), and the respondents who did not experience negative feelings (27.3%). The other factors were mentioned in Tables 4.12 and 4.13.

Table (4.15): Socio-demographic factors significant to food waste

Socio-demographics	Pearson Chi-Square value
Gender	11.495*
Age Group	41.444*
Social Status	21.187*
Family Income	39.108*
Nationality	11.457*
Loan Postponement	12.730*
Negative Feelings	15.441*

** p-value < 0.05 (significant difference)*

The following test was performed between the change in food waste and the consumption of the ten food groups during the pandemic, the Pearson Chi-Square values are presented in Table 4.16.

It is noticed that the only food group that was not significant to the change in food waste was drinking water. The increase in consumption of the food groups in Table 4.16 led to the increase in the generation of food waste, the only exception being the consumption of healthy meals, where its increase did not trigger the increase in food waste. Moreover, a direct difference was noticed between the decrease in consumption of the food groups in Table 4.16 and decreased food waste. Once more, the only exception was consuming healthy meals, where the increase in consumption of it triggered the decrease in the amounts of food waste.

Table (4.16): Change in consumption of food groups significant to food waste

Food groups	Pearson Chi-Square value
Fruits and Vegetables	38.893*
Meats	81.288*
Healthy Meals	44.008*
Unhealthy Meals	78.250*
Dairy Products	30.353*
Baked Foods	37.449*
Snacks	56.670*
Frozen Foods	49.124*
Canned Foods	57.692*

** p-value < 0.05 (significant difference)*

The food shopping behaviour was also examined closely to find whether there is a significant difference with change in food waste and the results are displayed in Table 4.17. The results showed that the increase in shopping tends to generate more food waste and vice versa.

The majority of those who did not stockpile food (54.6%), did not change the generation of food waste, while 57.8% of those who stockpiled food changed the amount of food waste generated, whether it was an increase (29.6%) or decrease (28.2%). Other factors, such as being aware of the problem of food waste in Bahrain and trying to control food waste were mentioned in Tables 4.12 and 4.13 respectively.

Table (4.17): Food shopping behaviour significant to food waste

Food shopping behaviour	Pearson Chi-Square value
Buying Local Foods	35.290*
In Person Large Supermarket Shopping	28.988*
In Person Small Supermarket Shopping	46.051*
Online Shopping	30.048*
Food Delivery Services	49.318*
Stockpile Food	11.483*

** p -value < 0.05 (significant difference)*

4.2.5 Hypotheses Testing

The hypotheses displayed in Section 2.3 were tested, Table 4.18 summarizes the results. Chi-Square test was conducted to H1, the test did not show a significant difference between contracting the COVID-19 virus and consumption of healthy meals, similar to it, H4 was rejected as Figure 4.6 showed that 74.3% of the respondents did not report an increase in food waste during the pandemic.

The hypotheses that were not rejected are H2, H3, and H5. Regarding stockpiling food, the results from the survey which are presented in Table 4.5 revealed that only 39% of the respondents were stockpiling food during the pandemic. The utilization of online platforms increased among the majority (57.2%) of the respondents which resulted in not rejecting H3. The fifth hypothesis was not rejected since nationality was one of the socio-demographics that had a significant difference with food waste.

Table (4.18): Research hypotheses verdict.

Hypotheses		Verdict
H1	Presence of a significant difference between contracting the COVID-19 virus and the consumption of healthy meals.	Rejected
H2	Majority of the respondents did not stockpile food during the pandemic.	Not rejected
H3	Utilizing online shopping platforms increased during the pandemic.	Not rejected
H4	Majority of the households increased food waste during the pandemic.	Rejected
H5	Presence of a significant difference between nationality and food waste during the pandemic.	Not rejected

Chapter Five

Discussion, Conclusion and Recommendation

5.1 Overview

5.2 Discussion

5.3 Conclusion

5.4 Recommendations

5.1 Overview

Accomplishing food security and minimizing food waste is a major step to achieving SDGs 2 and 12, it was important to investigate and assess the fluctuations in Bahraini residents' food behaviour during the pandemic and it was vital to analyse how the people living in the Kingdom of Bahrain reacted and adapted during the COVID-19 pandemic. The results showed few changes in food consumption and waste generation, shopping pattern as well as the presence of a significant difference between food consumption and waste generation with various socio-demographics. This is discussed in detail in the following section.

5.2 Discussion

The first section of the result was the socio-demographics of the respondents who completed the survey. A close number of female and male respondents were obtained, 50.3% and 49.7%, respectively, the study pool included all the individuals in the Kingdom who were 18 or above and those residing in Bahrain prior to the pandemic. The employed individuals were just above 60% and the students accounted for 20%. The youth were the ones with the highest percentage of responses (49.2%) similar to studies conducted in the US and Italy (Rodgers et al., 2021). Whereas the representation of the elder respondents (51 years and above) in this study was low, 11.8%, this issue was found in several studies (Li et al., 2022; Sassi et al., 2016; Silvennoinen et al., 2014).

Comparing the percentage of the nationalities of the respondents in the study with the population of Bahrain, varying results were obtained through the survey as 87.2% of the respondents were Bahraini citizens while only 12.8% were non-Bahrain respondents, these percentages hugely differ from the latest statistics published the study pool showed that the

study targeted 39.9% Bahraini individuals and 61.1% non-Bahraini individuals from the 1.13 million residents (IGA, 2022). The reason for this variation may be due to the type of sampling, convenience sampling, which shows that the survey was mainly circulated among Bahraini citizens. About 82.3% of the respondents had Diploma certificates or higher degrees which indicates that the survey was filled by respondents having high educational attainment.

One of the gaps that this study aimed to fill was to find out the influence of financial constraints on the consumption of food and generating food waste. The percentage of those affected by income loss was found to be 23.1% which is less than respondents from Kenya, Nigeria, and Senegal, whereas it was more than respondents from Mali and Zambia (Maredia et al., 2022).

5.2.1 Variation in consumption of different food groups

Through the survey, participants were asked to rate the change in consumption of the ten food groups due to the absence of a baseline data regarding their consumption because of lack of studies in this field in the Kingdom of Bahrain. More than 40% of the participants did not change in the consumption of 8 of the 10 food groups, while the highest percentage of change was detected in unhealthy meals (72.6%) and snacks (63.3%), moreover, a relative increase in consumption of unhealthy meals (43.8%) and snacks (47.4%) was noted, these results were in line with studies conducted in an international study and several other studies which shows the negative influence that the pandemic caused to the respondents' diet (Ben Hassen et al., 2020; Chenarides et al., 2021; Lamy et al., 2022). While other studies noticed a decrease in the consumption of unhealthy meals and snacks (Amicarelli & Bux, 2021; Ben Hassen, El Bilali, Allahyari, Berjan, et al., 2021; Ben Hassen et al., 2022; Cheikh Ismail et al., 2020; Di Renzo

et al., 2020). Unhealthy meals, by definition, are a food category do not contribute to one's health as it mainly consists of fats from animal origin and salts as well as being low in vitamins and fiber. These may range from food from fast-food joints to deep fried meals cooked in the household ("Unhealthy food", 2002).

It is important to discuss and analyse the environmental impact caused by the consumption of the previously mentioned food groups. According to the data displayed in Table 4.3, the respondents either not changed or have increased their consumptions of all food groups which shows that they did not decrease their GHGs emissions rather they have stabilized or increased it. The relative increase in fruits and vegetables which was accompanied by an increase in consuming healthy meals minimized the increase in GHGs emissions as compared to diets dependent on meats and its derivatives as cattle farms emit large amounts of methane, while the increase in consumption of dairy products, unhealthy meals and snacks, have contributed to the increase in GHGs emissions as dairy products are considered one of the highest contributors, while ordering unhealthy meals and snacks leads to increasing GHGs emissions as it contains oils and sugars since they utilize large portions of land and withdraws large amounts of fresh water (Poore & Nemecek, 2018).

Through analysing the presence of a significant difference between the ten food groups and the various socio-demographics, the consumption of fruits and vegetables, healthy meals, and drinking water was not influenced by any socio-demographics, i.e. absence of significant difference.

During the pandemic, even though most of the respondents did not change their consumption of meats, an increase was noticed amongst 22% of the respondents below 41 years, whereas, a 31% decrease in the

consumption of meats was noticed among respondents above 40 years, the results of this group are similar to the results obtained from previous researches, indicating that the elder might decrease the consumption of meats during stressful periods (Amicarelli & Bux, 2021; Di Renzo et al., 2020; Ouhsine et al., 2020).

The variation in the consumption of unhealthy meals was reported in different age groups, the majority of the young individuals increased their dependence on them, whereas, the majority of the respondents between the ages of 51 and 60 decreased the consumption of this food group, which demonstrates the willingness of the respondents into either leaving or committing to such unbalanced diets. A significant difference was obtained between the consumption of unhealthy meals and the nationality of the respondents, 47% of the Bahraini respondents increased their consumption while 44% of the non-Bahraini residents decreased the consumption of unhealthy meals. The results concerning the unhealthy meals were similar to two neighbouring GCC countries, Qatar and UAE (Ben Hassen et al., 2020; Cheikh Ismail et al., 2020), while studies performed in Russia and Oman obtained contradicting results (Ben Hassen, El Bilali, Allahyari, Berjan, et al., 2021; Ben Hassen et al., 2022).

The consumption of baked food products did not change amongst 60% of the respondents, this is because the operation of the bakeries in Bahrain was not altered by the pandemic and thus the absence of major change (GOB, 2022). The changes in this study are a bit higher than the results obtained in Denmark, Germany, and Slovenia where low rates of change were noticed (Janssen et al., 2021), while in two studies conducted in Italy, the consumption of baked foods decreased due to the lockdown imposed (Amicarelli & Bux, 2021; Di Renzo et al., 2020).

Consuming snacks was the food group that increased the most among the respondents in Bahrain, 47.4%, the age groups had a significant difference with eating snacks as more than 40% of respondents in the age group between 18 to 40 years contributed to this high increase, in contrary, 41% of respondents above 50 years reduced their consumption of snacks. This is similar to the change in the consumption of unhealthy meals, which shows that young respondents tend to neglect the importance of maintaining a healthy and balanced diet. Moreover, 57.3% of the respondents whose social status was single and 40% of the married individuals at the time of filling out the survey increased the habit of snacking. On further analysing the result, 98.9% of the single individuals and 57.9% of the married participants were below 40 years, this proves that age plays an important role in snack intake, furthermore, a study conducted before the pandemic to respondents below 24 years also reported similar dietary consumptions among individuals eating from home (Laska, Graham, Moe, Lytle, & Fulkerson, 2011).

There was a change in consumption of snacks among 72.3% of those who experienced income loss compared to 60.7% of those who did not suffer from income loss, the percentages of increased consumption of snacks were close between the two groups (above 45%). Having these kinds of meals among people experiencing financial difficulties may contribute to malnourishment (Hughes et al., 2021; Maredia et al., 2022).

The fourth factor which is significantly associated with consuming snacks was the nationality of the respondents, more Bahraini nationals increased their consumption of snacks compared to non-Bahraini respondents, 49.7% and 32% respectively, this difference was also reported in Qatar where a similar variation was found between the citizens and non-Qatari residents (Ben Hassen et al., 2020).

Previous researchers did not investigate the reason for the changes in the consumption of non-perishable foods (frozen and canned foods), rather, they reported the trend of consumption of these items (Ben Hassen et al., 2022; Janssen et al., 2021). In this study, there was a similar association between different sociodemographic and frozen and canned foods. The majority of the participants (59.5%) did not change their consumption of canned food compared to 47% in consuming frozen items as presented in Table 4.3. Frozen items had a higher increase among respondents between the ages of 18 and 50 years, while a higher percentage of elder individuals decreased their dependence on these food items. Similarly, the presence of an increase in consumption of canned foods was among respondents between 18 and 40 years, while the elder respondents decreased their consumption which thus proves the tendency of the young respondents to not commit to a balanced diet with fresh ingredients.

The variation in the consumption of frozen and canned foods across the different social statuses in Bahrain revealed low dependence on these items among the ‘other’ social statuses (widow or divorced), while the majority of the single individuals did not change their consumption of non-perishable foods. Close to 45% of married individuals did not change their consumption of frozen food and 33% of them increased their reliance on them. On the other hand, the majority of the married individuals did not change the consumption of canned food. These results show that during times of insecurity, married individuals tend to secure their freezers with frozen food items.

The occupation of the respondents was also a significant factor in the consumption of frozen and canned foods. Students were between not changing their consumption of frozen foods and increasing the consumption, 48.1% and 41.7% respectively, this can be explained as this

age group reported either an increase or not changing their consumption. Whereas, the retired individuals were split $\approx 33.3\%$ across the decreasing, not changing and increasing their consumption, half of the retired individuals were above 51 years and the other half between 41 and 50 years, this clarifies the reason for the split result as the ones below 51 years tend to either increase or not changing the consumption of frozen items. Consequently, the majority of the unemployed respondents increased the consumption of both frozen and canned foods, this demonstrates the behaviour of this group as most of them stored such items for future consumption as they had longer shelf-life.

Alternatively, the consumption of the former food items was significant for the nationality of the respondents, this was not the case in Qatar, Denmark, Germany, and Slovenia, as a significant difference was not spotted (Ben Hassen et al., 2020; Janssen et al., 2021). Bahraini respondents had higher consumption percentages compared to the non-Bahrain respondents in both frozen and canned foods.

The significant difference between consuming frozen food and opting to postpone loan payments was obtained due to the high rates of change in consumption of frozen foods among respondents who opted to postpone their loan payment, 62.7%, compared to those who did not, 49%. On the other hand, the other non-perishable food, canned foods, showed lower changes in both groups of respondents, who opted and did not opt to postpone loan payments, 50.6% and 37.2%, furthermore, those who decreased their dependence on these items were 30.3% of those who opted to postpone loan payments and 15.1% of who did not choose to postpone loans. The analysis of these results confirms that those who opted to postpone their loans did not depend on consuming frozen and canned foods, thus, did not decrease their quality of food, which indeed shows the

importance of implementing measures to minimize the financial impact of the pandemic on the public. These results are in the lower range of decrease in the quality of food found in five African countries, which ranged between 16% to 60% decrease (Maredia et al., 2022).

5.2.2 Variation in mode of purchasing food

As presented in Tables 4.4, a vast increase in purchasing food was noticed through online stores and apps (58%) as well as food delivery services (67.2%), this increase is down to several reasons, one of them being the development and enhancement of the online platforms during the pandemic, another reason is the closure of dine-in service in the restaurants that led to people depending on various delivery services and pick-up orders through the online websites. These results are in line with the card transactions of the years 2019, 2020, and 2021 that gave a detailed value of the Point of Sale (POS) transactions, where the amount of money paid to supermarkets and restaurants increased by BD 155.2 million and BD 137.3 million respectively (CBB, 2021, 2022; GOB, 2022).

Assessing the relation of the mode of purchasing food and the GHGs emissions is underestimated. In the consumer level, the use of transportation has increased as most of the respondents depended on food delivery services and ordering food items from online stores, this led to the increase in the carbon footprint due to the heavy utilization of vehicles rather than depending on small supermarkets and groceries available close to the household. Furthermore, a third of the respondents minimized their GHGs emissions by depending on local food rather than imported foods since the latter is transported from thousands of kilometres (Poore & Nemecek, 2018).

Purchasing local foods habit did not change among 56.4% of the respondents, whereas an increase was noticed among 33.3%, this percentage is higher than the study conducted in UAE and similar to the one reported in Qatar, this dependence on locally grown may be due to its supply being uninterrupted during the pandemic unlike other exported food items which stopped or was under price increase (Ben Hassen et al., 2020; Cheikh Ismail et al., 2020).

Further investigations were not conducted in the previous studies to know which socio-demographic characteristic was the reason behind the increase in purchasing local food. As mentioned in the Table 4.8, and 4.9, the analysis of the results through Chi-square shows the significant differences between the mode of purchasing food and the socio-demographics, 40% of respondents above the age of 30 years increased the purchase of these items. These results imply that the elder respondent tends to depend on local foods during times of distress.

Other groups of respondents that were found to have increased the purchase of local foods were married respondents, 41.2% of them, 34.4% of the Bahraini respondents, 42.2% of those who lost part of their income during the pandemic, and 35% who experienced negative feelings. One of the reasons that could be put forward to explain why those experiencing income loss increased their dependence on local foods is the need for small quantities of food, while those who experienced negative feelings could be afraid of importing food from other countries and depend on the local ones.

The visits to both the large and small supermarkets did not change among 43.1% and 46.2% respectively, this is in line with respondents from Denmark and Germany which did not significantly change their supermarket visits, while respondents from Slovenia decreased their visits to supermarkets due to the strict restrictions imposed (Janssen et al., 2021).

Furthermore, the reason for not changing the number of visits to the supermarkets in Bahrain is due to measures undertaken by the National Medical Taskforce for Combatting the Coronavirus (Covid-19) where supermarkets were allowed to operate as usual since they were listed as one of the 17 essential sectors to remain throughout the pandemic (GOB, 2022).

The visits to the large supermarkets increased among 28.7% of the respondents while the visits to the small ones increased among 30.3% of the respondents. The results obtained in this study are in line with the statistics published by the CBB regarding the increase in the amount of money paid through card transactions, these percentages are lower than that of Italian and Tunisian households which had a high dependence on these food outlets (CBB, 2020, 2021, 2022; Di Renzo et al., 2020; Jribi et al., 2020).

One of the significant differences with buying food from large supermarkets was income loss, 40% of those who lost part or all of their income during the pandemic have increased their dependence on these outlets compared to 25.3% of those who were not financially affected, this outcome shows the shopping practices of the respondents. The other mode of purchasing food that was analysed was buying groceries from small supermarkets, the elder and married individuals preferred this kind of grocery shopping. The age groups and social status that were found to be significant to buying groceries from small supermarkets were 40.9% of individuals between 41 to 50 years, along with them, 33.3% of the married respondents increased their grocery shopping from small supermarkets.

One of the major changes that occurred during the pandemic is the dependence on online platforms to purchase groceries which increased among 58% of the respondents and thus accepting the third hypothesis H3. The reliance on food delivery services also increased among 67.2% of the

respondents. These high percentages were not reported in any former study, including in countries that imposed lockdown measures, this could be due to reducing their visits to the supermarkets and grocery shops to maintain social distancing and lower the probability of catching the virus in Bahrain and also due to the high number of internet users in the Kingdom since 100% of the population are internet users per statistics published by the World Bank in 2021 (AlTarrah et al., 2021; Baker et al., 2020; Ben Hassen et al., 2020, 2022; Cheikh Ismail et al., 2020; Di Renzo et al., 2020; Filho et al., 2021; Jribi et al., 2020; Lamy et al., 2022; The World Bank, 2021).

The groups that were significantly associated with the increase in purchasing grocery food items through online platforms were the female respondents, 63.2% of them, as compared to 52.5% of the male respondents, these percentages are higher than the ones acquired in Portugal, as it was found that there was no relation between gender and online grocery shopping (Gomes & Lopes, 2022). Further analysis of this result suggests that this high dependence was contributed to the higher percentage of female respondents staying at home or working from home during the pandemic compared to their male counterparts, as 71.7% of the females who increased online shopping, worked/stayed at home whereas only 55.8% of the males did so.

The second significant difference with online shopping was the age group as 63.3% of the respondents between 18 to 40 years had increased this type of shopping, the reason for this increase among this group could be due to them using online platforms frequently and this has increased during the pandemic. This result is in line with a study conducted during the pandemic in Qatar and Michigan (US), where it was found that the young respondents had increased their dependence on online platforms to

purchase their groceries and they had a positive experience (Hadler et al., 2021). The third significant difference with online shopping was the nationality of the respondents, 60.5% of the Bahraini participants had increased their dependence on online shopping to buy their groceries as compared to 40% of the Non-Bahrain residents, this result is similar to the one obtained in Qatar (Ben Hassen et al., 2020).

The next shopping behaviour that was examined was ordering food through food delivery services. Female participants had a noticeable increase in ordering from such platforms, 75.5% of them, compared to an increase among 58.7% of the male participants, this variation is larger than the one obtained in online shopping. The reason for it was again found to be working/studying from home during the pandemic, as 68.2% of the female participants who increased their dependence on food delivery services were working/studying remotely as compared to 58.7% of the male participants. The age group that utilized the food delivery services are the ones between 18 and 50 years where 70.9% of them increased their dependence on this service. Even before the pandemic, it was noticed that young individuals were the group that depended on such platforms, increased use could be due to the presence of discount offers, busy daily schedule, or even this group being technologically literate (Ray et al., 2019)

Another significant difference with utilizing food delivery services was social status. A higher proportion of respondents whose social status was single (71.3%) increased their utilization compared to an increase among 64.3% of the married participants. A huge difference was noticed in the nationality of the respondents and the increase in the use of food delivery services, more Bahraini respondents increased ordering food through food delivery services as compared to the non-Bahraini

respondents, 71.7% and 36% respectively. Reasons for such variation could be familiarity with food delivery applications, knowing the available restaurants, or maintain social distancing.

The last significant difference with food delivery services concerns exhibiting negative feelings during the pandemic. The presence of such emotions was reported to have two contradicting outcomes, it could increase or decrease the use of this platform, and another study showed that the participants tried to maintain social distancing and thus order through delivery services (Chenarides et al., 2021; Evers et al., 2018). Here, almost 70% of those who experienced negative feelings increased their utilization of this platform compared to 57.5% of those who did not experience any negative feelings.

The next shopping behaviour that was analysed is the purchase of discounted food items, this practice was noticed among 34.9% of the respondents, which was found to be lower than respondents from Greece, where the majority of the households bought such items (Theodoridis & Zacharatos, 2022). The single socio-demographic that was found to be significant to it was the social status of the respondents, 60% of the others (widowed and divorced) did not purchase such items, on further examination of the result, it was found that all of them did not stockpile food which shows a positive behaviour.

Another shopping behaviour was preparing a shopping list, this behaviour was important to analyse as it could indicate the individuals that plan meals before cooking or those who minimize excessive buying or minimize waste (van Geffen et al., 2020). The socio-demographic groups that prepared such lists were the female respondents, married and 'other' social status (widowed and divorced), unemployed, retired and housewives, and respondents living in Northern and Muharraq

governorate. According to Theodoridis & Zacharatos (2022), preparing a shopping list gives an indicator of food waste, so it was important to point out which group of individuals did so. Conversely, 31% of the young respondents, between 18 and 30 years, did not prepare such lists which points out this group might not be the one responsible for buying household groceries, unlike the young respondents from Italy who were more organized as they prepared shopping list and planned meals (Principato et al., 2022).

The last purchasing behaviour that was examined was stockpiling food. Only 39% of the respondents were involved in buying and storing large quantities of food, this is less than respondents from the US, Canada, 12 countries in Sub-Saharan Africa, Lebanon, and UAE, while the percentage of stockpiling food was more than participants from Russia, Arizona and Michigan, Greece, UK, and Oman. The groups that increased stockpiling food were married respondents, retired, unemployed and close to 43% of the respondents who had negative feelings during the pandemic increased stockpiling food, furthermore, three of the four groups prepared a shopping list. This result shows that there was an association between feeling insecure and buying and storing large quantities of food as the unemployed and respondents experiencing negative feelings have contributed to this increase. Finally, the second hypothesis H2 was accepted as the percentage of respondents who stockpiled food was below 50% (Amuakwa-Mensah et al., 2022; Baker et al., 2020; Ben Hassen, El Bilali, Allahyari, Berjan, et al., 2021; Ben Hassen, El Bilali, Allahyari, & Charbel, 2021; Ben Hassen et al., 2022; Cheikh Ismail et al., 2020; Chenarides et al., 2021; Cosgrove et al., 2021; Everitt et al., 2022; Filimonau et al., 2022).

5.2.3 Managing Food waste

In 2021, Bahrain was considered one of the countries with the highest average household food waste (kg/capita/year), it was important to assess and examine the amounts of food waste as well as the variables influencing the generation of food waste in the Kingdom (UNEP, 2021). Furthermore, additional variables concerned with the COVID-19 pandemic were introduced to the study to compare the status of Bahrain to other countries.

The first factor analysed was the final use of leftover food during the pandemic. The respondents showed positive practices towards the final use of the leftover food, the most popular final use was eating the leftovers the next day (47.4%) followed by feeding it to domestic animals (19%) and donating them (14.6%). A similar result was reported among Peruvians as they ate the leftover food the following day (46%) and lower than the Brazilian respondents (60%) (Cequea et al., 2021). The management of leftover food to minimize food waste was similar to respondents from Türkiye who shared leftover food to decrease the generation of avoidable food waste (Yetkin Özbük et al., 2022). It is important to note that recycling food was the least preferred method of using leftovers with only 2.6% of the respondents adopting it, this environmentally safe method was also seen to be the least preferred method of treating non-hazardous waste in Bahrain in the year 2020 (GCC-STAT, 2022).

In this study, there were four factors significant to eating the leftover food the next day, these include the number of individuals in the household, consumption of frozen foods, stockpiling food, and change in the amount of food waste during the pandemic. Eating leftover food was noticed in small households, five individuals or less, this might be due to the low number of individuals which contributes to better tracking of their food and leftovers. Cooked foods require to be refrigerated for them to be safely

consumed, this may explain why those who increased the consumption of frozen foods had no issue with eating leftovers the next day, this explanation could also be put forward to why 53% of the ones who stockpiled food ate leftovers the next day as they were used to storing food. The last group of individuals that were significantly associated with eating leftovers were the ones who minimized the amount of food wasted during the pandemic, this association was also found in New York (US) which further enhances the need to adopt such practices to minimize food waste (Babbitt et al., 2021).

The three main reasons for throwing away food during the pandemic were due to passing the expiration date (26.4%), cooking large quantities (22.3%), and storing food for long periods (20.3%). These reasons were identical to a comparative study performed in Brazil and Peru, two other studies reported overcooking as one of the reasons for throwing away food during the pandemic (Cequea et al., 2021; Filimonau et al., 2022; Jribi et al., 2020). While prior to the pandemic, Silvennoinen et al. (2014) stated the reason for food waste was due to food spoilage.

It was important to know if the respondents were aware of the problem of food waste in the Kingdom as awareness could be one of the first steps to tackling this problem. It was stated that 58.7% of the respondents were aware of it, which is lower than respondents from Tunisia, as 89% of the respondents claimed they knew about food waste (Jribi et al., 2020). Unlike the young respondents in Romania who showed high awareness of food waste, the young respondents in Bahrain were less aware of this problem when compared to the elder age groups as 52% of the young ones, between 18 and 30 years, compared to 64.4% of the elder respondents, above 30 years, which emphasizes on the need for more education to the younger public in Bahrain (Burlea-Schiopoiu et al., 2021).

Other demographical groups that had higher awareness of the problem of food waste were male respondents, married individuals, non-Bahraini respondents, participants with college degrees or higher, the governorate residence of the participants, and those who worked or studied from home. Even though the Kingdom is a small country, there was a difference in the awareness of the problem of food waste, respondents from Muharraq and Capital governorates were more aware when compared to the Northern and Southern governorates, respondents living in Muharraq governorate were previously found to have high awareness to this problem and tried to manage waste (Abbas et al., 2020).

Being aware of the food waste problem in Bahrain was also tested against the eating and shopping behaviour of the respondents, the factors that were significantly associated with it were increased consumption of healthy meals and canned foods, minimized in-person shopping at small supermarkets, buying discounted items, and preparing shopping lists. The last significant difference with awareness was the generation of food waste, 73.9% of those who decreased food waste generation were found to be aware of the problem of food waste in Bahrain, this association was also found among Romanian university students, where the students had high awareness about food waste and minimized its generation (Burlea-Schiopoiu et al., 2021).

Another factor that was closely examined was controlling food waste, 70% of the participants tried to control food waste during the pandemic, and this positive behaviour was also noticed in an international study (Lamy et al., 2022). Multiple factors were found to be significant in trying to control food waste, it was found that respondents who were aware of food waste were the ones who tried to control it, these include males, married participants, non-Bahrain participants, and respondents living in

Muharraq and Capital Governorate. This synergy helps to identify and focus on other groups who need more education and awareness campaigns on food waste and how to prevent it. Other demographics who tried to control waste were respondents between the age of 41 and 60 years and households with five individuals or fewer.

Since few researchers examined the factors leading to controlling food waste, further analysis was conducted. It was found that 91.3% of the married respondents who tried to control food were in the age group 41 and 60 years, while the non-Bahraini respondents that had an effort to decrease food waste were found to experience negative feelings during the pandemic (81.8%). The reason why controlling food waste was found amongst households with five individuals or less could be due to easier tracking of food waste within the household since this group was involved in eating leftovers as mentioned previously, which thus helped in minimizing the generation of food waste.

The eating habits that had a significant difference with controlling food waste were those that increased the consumption of healthy meals, drank more water, and decreased the consumption of unhealthy meals and snacks. It is clear that controlling food waste is related to adopting healthy habits, this result is consistent with a study performed in Turkish households which found that health-oriented households had the least food waste (Yetkin Özbük et al., 2022).

The respondent's shopping habits significant to trying to control food waste during the pandemic were those who minimized shopping in small supermarkets, respondents that bought discounted items, prepared shopping lists, and those who stockpiled food. Preparing a shopping list and decreasing trips to supermarkets help to control food waste, it could be due to the commitment to such lists help in minimizing buying unwanted

items which could be wasted in the future (Ouhsine et al., 2020; Principato et al., 2022). Finally, those who tried to control food waste were found to minimize its generation.

5.2.4 Variation in the amount of food waste generated during the pandemic

The amount of food waste during the pandemic was found to remain the same among 49.7% of the respondents, this percentage was close to the one obtained in Canada while close percentages were obtained between the increase and decrease in food waste. The percentage of decreasing food waste was higher in Italy, and the US, 49% and 61% respectively, as they were keen on not wasting food due to food scarcity (Laila et al., 2022; Rodgers et al., 2021), whereas in Italian households, there was a low amount of food waste (Amicarelli & Bux, 2021). When comparing our results with studies conducted in MENA region countries, Oman, Qatar, and Tunisia, it was noticed that the amount of waste in Bahrain is higher, even though the government did not impose any lockdowns or restrictions during the pandemic and people could move around freely (Ben Hassen et al., 2020, 2022; Jribi et al., 2020).

The increase in food waste was declared by 25.7% of the respondents, this result is very close to the one obtained among US households, 26.5% increase, and higher than Turkish respondents were only 17.6% increased food waste (Cosgrove et al., 2021; Yetkin Özbük et al., 2022). While Filho et al., (2021) reported an increase in food waste among 45% of the respondents on five continents. About 24.6% of the respondents in this current study claimed they minimized the amount of food wasted, this percentage is higher than the one obtained in Russia (14.5%) (Ben Hassen, El Bilali, Allahyari, Berjan, et al., 2021). Further assessment of the result

exposed that 94 of the 96 respondents who decreased food waste did not discard leftover food, and more than half of them ate the leftovers the following day. Moreover, 88.5% of the respondents that decreased food waste had tried to control food waste during the pandemic. These prove that adopting and maintaining positive practices can lead to minimizing the generation of food waste.

The food group that was the most food wasted per food bought was baked foods, this is mainly due to the short shelf life of this food as it ranges from three days to 14 days, fruits and vegetables were the next food groups in the list, this food group was the most discarded in a study conducted in 23 countries as well as in other studies conducted on Italian and Canadian households (Amicarelli & Bux, 2021; Everitt et al., 2022; Filho et al., 2021). On contrary, the previous studies reported meats and dairy products being one of the most food discarded while in this study it was the least food groups wasted (Cequea et al., 2021). Opposite to our results, Greek households reported high waste of dairy products, whereas, this food group was one of the least food groups wasted (Theodoridis & Zacharatos, 2022).

The socio-demographics that were found to have a significant difference with food waste were gender, age group, social status, family income, nationality, loan postponement, and negative feelings. The female respondents were the ones with higher food waste compared to male respondents, this result is in agreement with a study conducted in India where the increase was due to feeling insecure and low assurance in the availability of food items which therefore led to the tendency to buy more food and thus waste them (Brizi & Biraglia, 2021).

The other group of individuals who increased food waste was the young respondents, the age group of 18 to 30 years, alarmingly, this age group composed 68% of the total percentage of respondents that increased

food waste during the pandemic. On further analysis, it was found that 92.6% of them experienced negative feelings during the pandemic. Respondents whose social status was single also contributed to the increase in food waste, 92% of them were in the age group of 18 to 30 years and 94% of them experienced negative feelings. Additionally, half of the respondents did not change the amount of food waste while 38.3% of the respondents above 41 years generated less food waste during the pandemic, this result is in agreement with the elder German respondents (above 65 years) were the reason for decreased food waste might be because of their conscious and appreciation to food. Family income was found to have a significant difference with food waste, this association was absent among the German respondents (Hermanussen et al., 2022). Unpredictably, families with a low income had a higher ratio of increased food waste rather than decreased, this was seen in households with income lower than 500 BD. It was noticed that 90.9% of the respondents belonging to this income group who increased food waste were experiencing negative feelings during the pandemic.

The nationality of the respondents was also significant to the change in food waste, this result led to accepting the fifth hypothesis H5. It was observed that in this socio-demographic, 40% of the non-Bahraini participants minimized food waste compared to 22.3% of the Bahraini participants, on further examination, 90% of the non-Bahraini respondents were aware of the problem of food waste, this calls to the need for more education and extensive awareness campaigns to the Bahraini citizens.

Financial security played a role in changing the amount of food waste, those who postponed loan payments had more change in food waste compared to those who did not, 64.4% and 54.6% respectively, moreover, due to postponing the loans, 33.3% decreased the generation of food waste

this behaviour is parallel with the behaviour of the university students in Romania as they tried to decrease food waste due to lack of financial insecurity (Burlea-Schiopoiu et al., 2021). Concurrently, 31.3% of those who postponed loan payments increased food waste which could be due to the improper utilization of the excess money received due to postponing loan payments.

Another significant difference with food waste was the presence of negative feelings during the pandemic, 29.6% of those who experienced negative feelings increased food waste, whereas, 27.3% of those who did not experience negative feelings minimized the generation of food waste. These results show a relation between experiencing negative feelings and food waste generation which is dissimilar to a study conducted on university students in Romania, where those with fears and worries had better management of their food resources, whereas, other studies conducted in Malaysia and China, did not find an association between negative feelings and food waste (Lahath et al., 2021; Li et al., 2022).

In general, the different food groups showed a significant difference between their consumption and food waste, the increase in consumption of these food groups led to an increase in food waste, the only exception being the increased consumption of healthy meals. These differences were not recorded in previous studies, and these results emphasize the need to decrease or not change the consumption of food in order to minimize food waste generation.

The final section regarding food waste was its association with food shopping, the increased frequency of shopping generated more food waste and vice versa, with stockpiling being the exception to this rule. Various studies confirmed this association, where New Yorkers showed an association between food waste and increased food purchases (Babbitt et

al., 2021), additionally, positive practices concerning food preservation led to decreased food waste. In the UK, the increased utilization of food deliveries and takeaways led to increased food waste (Filimonau et al., 2022). However, decreasing trips to grocery stores led to minimized food waste in US and Italy (Rodgers et al., 2021). Conversely, Silvennoinen et al. (2014) reported the absence of a relation between the rate at which the participants shopped for food and food waste. This could be due to the change in variables due to the absence of the pandemic at the time and thus the absence of restrictions.

Stockpiling food reported a 57.8% change in food waste, compared to change amongst 45.3% of those who did not stockpile food, this was down to the presence of negative feelings which was higher amongst those who stockpiled food compared to the ones who did not, 92% and 82.4% respectively. Furthermore, 29.6% of those who stockpiled food increased their food waste while 28.2% decreased it. A previous study conducted in the US by Cosgrove et al. (2021), identified stockpiling food as an early predictor of increased food waste.

5.3 Conclusion

In this study, the changes in food consumption and generation of food waste caused by the pandemic were assessed thoroughly. The objective of this research was to measure and examine the variations in food consumption and waste in the Kingdom of Bahrain since it was one of the few countries that did not impose and lockdown throughout the pandemic. Moreover, it inspected the behavioural changes concerned with buying food and handling food waste.

A quantitative method was selected in this study through a survey that was distributed via different social media platforms, the accepted responses

were 390 respondents as those who did not meet the criteria were either under 18 years or did not live in Bahrain two years before filling out the survey. The results revealed minor changes in food consumption in most food groups, with unhealthy meals and snacks showing major changes and a high increase. The mode of purchasing food also displayed small changes whereas online shopping and food delivery services increased drastically. A positive awareness was noticed among the respondents of this study since the majority of them did not stockpile food and did not always buy discounted food items. Moreover, 44.6% of the respondents always prepared a shopping list before buying food items which showed their preparedness prior to visiting grocery shops.

This study was also performed to find if there was an association between various socio-demographics and changes in food consumption. This was conducted through the use of the IBM SPSS 21 version, in particular, the Chi-square test was used to assess these differences. The test for significant difference revealed age group had a significant difference with the consumption of most food groups with the respondents between 18 and 30 years displaying a high increase in consumption during the pandemic. Furthermore, the socio-demographic that was repeatedly found to have a significant difference with the different food purchasing behaviours was social status. More female respondents depended on online shopping and food delivery services compared to male respondents.

The results in the food waste section exposed several positive behaviours among the respondents. It was noticed that the most common method to treat the leftover food was eating it the following day, 58.7% of the respondents were aware of the problem of food waste in the Kingdom of Bahrain, simultaneously, 70% of the respondents tried to control it during the pandemic. On the other hand, the three main reasons for

throwing away food were due to it passing its expiration date, cooking large amounts of food, and storing food for long periods.

Close to 50% of the respondents did not change the amount of food waste generated during the pandemic, and the groups that showed higher increases compared to their counterparts were females, low-income families, young individuals, single respondents, Bahraini participants, and those experiencing negative feelings. The increase in consumption of most of the food groups and increased shopping resulted in the increased generation of food waste. The food group that resulted in the highest increase in food waste was baked foods, while positive behaviours such as eating leftovers, being aware of food waste, and trying to control food waste have all contributed to minimizing food waste.

Three of the five hypotheses were accepted as the majority of the respondents did not stockpile food during the pandemic, an increased utilization of online shopping platforms was noticed, and it was found that there was a significant difference between nationality and food waste generation during the pandemic.

This study carried a few limitations, one was due to the convenience sampling which led to most responses being from university degree holders and Bahraini citizens, this was also noticed as the survey was mostly sent to this group and it contributed to higher response compared to non-Bahrain respondents, a similar conclusion was observed in a previous study where this kind of impact was deemed as positive rather than a limitation (Wu et al., 2022). Another limitation was the absence of benchmark as no data was available regarding the exact amounts of food the respondents ate and wasted before the pandemic since the respondents were comparing their change in consumption and waste generation before the pandemic to the period during it, this limitation could be dealt with by maintaining food

diaries to collect accurate information from the participants in future studies.

5.4 Recommendations

The main recommendations proposed are to carry out further studies to shed light on the results of this study, this could be conducted by weighing the amount of household food waste and knowing its composition. Secondly, increase educational campaigns on the environmental consequences and GHGs emissions concerned with the increased food consumption and food waste generation as well as the importance of preparing lists prior to going grocery shopping to minimize panic buying and thus food waste. Thirdly, the need to minimize the amount of food consumed and the number of trips to food outlets since it increased the amount of food waste. Another recommendation is to plan for a weekly or monthly food menu in order to prepare an accurate shopping list before visiting grocery shops as preparing such lists showed its potential to minimizing food waste. Finally, the results of the study emphasized the importance of providing more assurance from the government and private sector employers along with the need for the society and non-profit organizations to support vulnerable individuals during times of distress as it was noticed that having negative feelings triggered the increase in food waste.

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Appendices

Appendix (1) Copy of the survey

Assessing Food Consumption and Waste during the COVID-19 pandemic in the Kingdom of Bahrain

Food waste is a major environmental issue in the Kingdom of Bahrain. The UNEP Food Waste Index Report 2021 shows Bahrain generating high amounts household food waste (kg/capita/year) compared to other countries in West Asia and the World. The study aims at assessing food consumption and waste during the COVID-19 pandemic in the Kingdom of Bahrain. This study is a requirement for master's degree thesis in the Environment and Sustainable Development program at the University of Bahrain. Please note that all answers will be kept confidential and used for research purposes only. The results of this study might be published in a later stage. Note: Please refer to the person responsible of purchasing food and the one who knows the components of food waste in your household.

تقييم استهلاك وهدر الطعام خلال جائحة كوفيد-19 في مملكة البحرين

تعتبر مخلفات الطعام قضية بيئية في مملكة البحرين. يظهر تقرير مؤشر نفايات الطعام لبرنامج الأمم المتحدة للبيئة 2021 أن البحرين بها نسبة عالية من نفايات الطعام المنزلية (كجم / فرد / سنة) مقارنة بالدول الأخرى في غرب آسيا والعالم. تهدف الدراسة إلى تقييم استهلاك الطعام وهدره خلال جائحة COVID-19 في مملكة البحرين. هذه الدراسة هي من متطلبات أطروحة الماجستير في برنامج البيئة والتنمية المستدامة في جامعة البحرين. يرجى ملاحظة أن جميع الإجابات ستبقى سرية وستستخدم لأغراض البحث فقط. قد تنشر نتائج هذه الدراسة في مرحلة لاحقة.

ملحوظة: يرجى الرجوع إلى الشخص المسؤول عن شراء المأكولات والشخص الذي يعرف مكونات مخلفات الطعام في منزلك.

Section 1- Socio-Demographic information

الجزء الأول- المعلومات الديموغرافية الاجتماعية

1. Gender (الجنس)
 - Male (ذكر)
 - Female (انثى)
2. Please select your age group (يرجى تحدد الفئة العمرية التي تنتمي إليها)
 - Below 18 years (أقل من 18 سنة)
 - 18-30 years (بين 18 و 30 سنة)
 - 31-40 years (بين 31 و 40 سنة)
 - 41-50 years (بين 41 و 50 سنة)
 - 51-60 years (بين 51 و 60 سنة)
 - 61 years or above (61 سنة وأكثر)

3. Please select your highest level of education (يرجى تحديد أعلى تحصيل تعليمي لديك)
- Less than secondary certificate (أقل من المرحلة الثانوية)
 - Secondary certificate degree (المرحلة الثانوية)
 - Diploma or bachelor's degree (شهادة الدبلوم أو البكالوريوس)
 - Master or Doctorate degree (شهادة ماجستير أو الدكتوراه)
4. Marital status
- Single (أعزب)
 - Married (متزوج)
 - Others (أخرى)
5. What is your occupation? (ما هي مهنتك؟)
- Student (طالب)
 - Unemployed (عاطل عن العمل)
 - Employed – Governmental sector (موظف في القطاع الحكومي)
 - Employed - Private Sector (موظف في القطاع الخاص)
 - Housewife (ربة منزل)
 - Free-lance (أعمال حرة)
 - Retired (متقاعد)
6. Monthly Family income (دخل الأسرة الشهري)
- < 500 BD (أقل من 500 د ب)
 - 500 – 999 BD (بين 500 – 999 د ب)
 - 1000 – 1499 BD (بين 1000 - 1499 د ب)
 - 1500 – 1999 BD (بين 1500 - 1999 د ب)
 - 2000 – 2499 BD (بين 2000 - 2499 د ب)
 - 2500 – 2999 BD (بين 2500 - 2999 د ب)
 - ≥ 3000 BD (3000 د ب فأكثر)
7. Nationality (الجنسية)
- Bahraini (بحريني)
 - Non-Bahraini (غير بحريني)
8. How long have you been living in Bahrain? (منذ متى وأنت ساكن في البحرين؟)
- Less than two years (أقل من سنتين)
 - More than two years (أكثر من سنتين)
9. In which Governorate do you currently live? (في أي محافظة تعيش حالياً؟)
- Muharraq Governorate (محافظة المحرق)
 - Capital Governorate (محافظة العاصمة)
 - Northern Governorate (المحافظة الشمالية)
 - Southern Governorate (المحافظة الجنوبية)
10. Number of individuals living in your household. (عدد الافراد في مسكنك)
- 2 or less individuals (شخصان أو اقل)

- 3 و 5 أشخاص (3 - 5 individuals)
- 6 و 8 أشخاص (6 - 8 individuals)
- أكثر من 8 أشخاص (More than 8 individuals)

11. Did you opt to postpone your loan payments during the pandemic (هل اخترت)
(تأجيل سداد قروضك أثناء الوباء ؟)

- Yes, I postponed loan repayment (نعم، لقد أجلت سداد القرض)
- No, I did not postpone loan repayment (لا، لم أوجل سداد القرض)
- I do not have any loans (ليس لدي أي قروض)

12. Were you affected by income loss due to the pandemic? (هل تأثرت بفقدان مصدر)
(دخل بسبب الوباء؟)

- Yes, I was affected with income loss (نعم ، لقد تأثرت بخسارة مصدر دخل)
- No, I was not affected with income loss (لا، لم اتأثر بخسارة مصدر دخل)

13. Did you work from home during the pandemic? (هل عملت من المنزل أثناء الجائحة؟)

- Yes (نعم)
- No (لا)

14. Did you contract COVID-19 in the past 2 years? (هل اصبت بفيروس كورونا خلال)
(العامين الماضيين؟)

- Yes (نعم)
- No (لا)

15. Have you experienced any negative feelings during the pandemic (هل مررت)
(بأي مشاعر سلبية أثناء الجائحة)

- Nervous/Worried (متوتر)
- Worried (قلق)
- Depressed (مكتئب)
- Bored (الشعور بالضجر/الملل)
- No negative feelings (لم تكن هناك أي مشاعر سلبية)

Section 2- Food consumption pattern during COVID-19 pandemic.

الجزء الثاني- نمط استهلاك الطعام خلال جائحة كوفيد-19

16. Rate the change of consumption of the following food and drinks items during the pandemic as compared to the period before it (قيم التغير في استهلاك الأطعمة)
(والمشروبات التالية أثناء الجائحة مقارنة بالفترة التي سبقتها)

	Much less انخفض كثيرا	Slightly less انخفض قليلا	Did not change لم يتغير	Moderately more زاد قليلا	Much more زاد كثيرا
Fruits and Vegetables الفواكه والخضراوات					
Meats اللحوم					
Healthy meals وجبات صحية					
Unhealthy meals (Fast food) وجبات غير صحية (وجبات سريعة)					
Water الماء					
Dairy products منتجات الألبان					
Baked foods المخبوزات					
Snacks وجبات خفيفة (سناك)					
Frozen food وجبات مثلجة (مفرزات)					
Canned food وجبات معلبة					

17. Rate the following food purchasing methods during the pandemic (قم بتقييم طرق)
(شراء الطعام أثناء الجائحة)

	Much less انخفض كثيرا	Slightly less انخفض قليلا	Did not change لم يتغير	Moderately more زاد قليلا	Much more زاد كثيرا
Buying local food شراء الطعام المحلي					
Buying food in person from a large supermarket شراء الطعام شخصياً من سوبر ماركت كبير					
Buying food in person from a small supermarket or grocery store شراء الطعام شخصياً من سوبر ماركت صغير أو محل بقالة					
Online grocery shopping شراء الأطعمة عبر الانترنت					
Ordering Food delivery services طلب الأطعمة عبر خدمات التوصيل					

18. Did you buy discounted food products? (هل اشتريت منتجات غذائية بأسعار مخفضة؟)

- ☐ Yes (نعم)
- ☐ Sometimes (أحياناً)
- ☐ No (لا)

19. Did you prepare a shopping list before buying the grocery items? (هل قمت بإعداد قائمة التسوق قبل شراء مواد البقالة؟)

قائمة التسوق قبل شراء مواد البقالة؟

- ☐ Yes (نعم)
- ☐ Sometimes (أحياناً)
- ☐ No (لا)

20. Did you stock up food during the pandemic? (هل قمت بتخزين الطعام أثناء الجائحة؟)

- ☐ Yes (نعم)
- ☐ No (لا)

Section 3- Food waste generation during COVID-19 pandemic.

الجزء الثالث- انتاج مخلفات الطعام خلال جائحة كوفيد-19

21. Are you aware of the food waste problem in the Kingdom of Bahrain? (هل أنت

على علم بمشكلة هدر الطعام في مملكة البحرين؟)

- ☐ Yes (نعم)
- ☐ No (لا)
- ☐ No opinion (ليس لدي رأي)

22. Did you try to control food wastage during the pandemic? (هل حاولت السيطرة

على الهدر الغذائي أثناء الجائحة؟)

- ☐ Yes (نعم)
- ☐ No (لا)
- ☐ No opinion (ليس لدي رأي)

23. Current final use of leftovers? (ما هو الاستخدام النهائي حالياً لبقايا الطعام؟)

- ☐ Eating it the next day (تناوله في اليوم التالي)
- ☐ Feed domestic animals (تغذية الحيوانات الأليفة)
- ☐ Freezing it and eating it later (تجميدها واكلها في يوم اخر)
- ☐ Donating it (التبرع بها)
- ☐ Recycling it (إعادة تدويرها)
- ☐ Discarding it (رميها)

24. Select the food waste change during the COVID-19 pandemic compared to the period before it. (حدد التغير في هدر الطعام خلال جائحة كوفيد-19 مقارنة بالفترة التي سبقتها)

- ☐ It has become much less (انخفض كثيراً)
- ☐ It has decreased (انخفضت)
- ☐ Has not changed (لم يتغير)
- ☐ It has increased (زادت)
- ☐ Much more (زادت كثيراً)

25. Select the ratio of thrown foods per food purchased during COVID-19 pandemic

(حدد نسبة الأطعمة التي تم إلقاؤها لكل طعام تم شراؤه أثناء جائحة كوفيد-19)

	Less than 2%	3 to 5%	6 to 10%	11 to 20%	More than 20%
Vegetables الخضراوات					
Fruits الفواكه					
Dairy products منتجات الألبان					
Meats اللحوم					
Baked foods المخبوزات					
Pulses البقوليات					

Cereals (Pasta, couscous) الحبوب (المعكرونة والكسكس)					
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26. Main reason for throwing leftover food during the pandemic. (السبب الرئيسي)
(لرمي بقايا الطعام أثناء الجائحة)

- Poor cooking skills (مهارات طبخ سيئة)
- Past expiration date (فوات تاريخ الانتهاء)
- Bad odour / taste (طعم / رائحة كريهة)
- Cooked / ordered another meal (طبخت / طلبت طبق آخر)
- Cooking large amounts of food (طبخ كميات كبيرة من الطعام)
- Storing food for a long period in the fridge (تخزين الطعام لفترة طويلة في الثلاجة)
- Over buying (الإفراط في الشراء)
- Poor food storage (سوء تخزين المواد الغذائية)
- Molds growing on the food (وجود العفن على الطعام)
- Too large food package (عبوة الطعام كبيرة جدًا)

سعادة الأستاذ الدكتور محمد الحلو المحترم
عميد كلية العلوم والقائم بإعمال عميد كلية العلوم الصحية

الموضوع: استبانة الطالب محمود علي جامع العقل

فبالإشارة الي طلبكم الموافقة على الاستبانة الخاصة بطلبة الدراسات العليا وتعهداتهم الالتزام بأنظمه جامعه البحرين وبالتالي الالتزام باستمارة الطالب والمشراف التي وافقت عليها عمادة الدراسات العليا وتم توقيعكم الكريم.

فانه يطيب لي افادتكم علما بانه ليس لدى اللجنة مانع من اجراء العمل على الاستبانة وتوزيعها للطالب محمود علي جامع العقل مع الالتزام بما هو منصوص في الاستمارة الخاصة باستبانة الطالب والمشراف.

هذا ما لزم وتفضلوا سعادتكم بقبول وافر الشكر والتقدير


الدكتور محمد الانصاري
نائب الرئيس لخدمة
المجتمع وشؤون الخريجين
التوقيع


الدكتور محمد رضا
عميد الدراسات العليا
والبحث العلمي
التوقيع

م ح 168/ 2021/ خ 16
التاريخ: 16 نوفمبر 2021م

الأخ الفاضل الدكتور محمد الأنصاري المحترم
نائب الرئيس لخدمة المجتمع وشئون الخريجين
وقائم بأعمال عميد القبول والتسجيل

الموضوع: الموافقة على استبيان الطالب محمود علي جامع العقل (20135601) الطالب في برنامج ماجستير
البيئة والتنمية المستدامة

تحية طيبة وبعد،،،،

أرجو إعلامكم بأن مجلس كلية العلوم في اجتماعه رقم 2021/16 بتاريخ 11 نوفمبر 2021م، قد ناقش استبيان طالب الماجستير في برنامج البيئة والتنمية المستدامة محمود علي جامع العقل (20135601)، وذلك بناءً على توصية اللجنة الإدارية لبرنامجي دكتوراه وماجستير البيئة والتنمية المستدامة بتاريخ 2021/11/1م، وبعد الإطلاع على موضوع الاستبانة فإن المجلس يوصي بالتالي:

توصية رقم (2021/122):

يوصي مجلس الكلية في جلسته رقم (2021/16) المنعقدة بتاريخ 11 نوفمبر 2021م بالموافقة على استبيان الطالب محمود علي جامع العقل (20135601)، وذلك وفقاً للتالي:

اسم الطالب :	محمود علي جامع العقل	الرقم الجامعي:	20135601
اسم المشرف:	د. مريم المناعي (أستاذ مساعد في قسم الرياضيات) د. سميرة يوسف حسن (أستاذ مساعد في كلية الدراسات العليا – جامعة الخليج العربي)		
عنوان الأطروحة:	Assessing Food Consumption and Waste during the COVID-19 pandemic in the Kingdom of Bahrain		
عناوين الاستبيان:	Assessing Food Consumption and Waste during the COVID-19 pandemic in the Kingdom of Bahrain		

وتفضلوا بقبول خالص التحية والتقدير،،،

أ.د. محمد مصطفى الحلو
عميد كلية العلوم القائم بأعمال
عميد كلية العلوم الصحية
والرياضية

نسخة: للدكتور محمد رضا قادر (عميد الدراسات العليا)

التاريخ: 2 نوفمبر 2021

من: رئيس لجنة إدارة برنامجي دكتوراه وماجستير البيئة والتنمية المستدامة، أ. د. محمد الحلو

إلى: مجلس كلية العلوم

الموضوع: توصية بالموافقة على استبيان الطالب محمود علي جامع العقل (20135601) في برنامج ماجستير البيئة والتنمية المستدامة

تحية طيبة،

نحيطكم علماً بأن لجنة إدارة برنامجي دكتوراه وماجستير البيئة والتنمية المستدامة في اجتماعها الحادي عشر لعام 2021 المنعقد في 1 نوفمبر 2021، ناقشت الاستبيان المقدم من طالب ماجستير البيئة والتنمية المستدامة محمود علي جامع العقل (20135601) وتوصي اللجنة بالموافقة على الاستبيان وفقاً للمعلومات التالية:

اسم الطالب	محمود علي جامع العقل	الرقم الجامعي	20135601
اسم المشرف	د. مريم المناعي (أستاذ مساعد في قسم الرياضيات) د. سميرة يوسف حسن (أستاذ مساعد في كلية الدراسات العليا - جامعة الخليج العربي)		
عنوان الأطروحة	Assessing Food Consumption and Waste during the COVID-19 pandemic in the Kingdom of Bahrain		
عناوين الاستبيان:	Assessing Food Consumption and Waste during the COVID-19 pandemic in the Kingdom of Bahrain		
رقم توصية اجتماع لجنة إدارة برنامجي دكتوراه وماجستير البيئة والتنمية المستدامة	2021/11/2		

المرفقات:

- الاستبيان
- استمارة طلب الموافقة على صيغة استبيان
- إقرار وتعهد
- قرار الموافقة على عنوان الأطروحة
- مقترح الأطروحة

Arabic Abstract

المخلص

على الصعيد العالمي، كانت هناك تغييرات في استهلاك الغذاء وتوليد مخلفات الطعام خلال جائحة كوفيد-19، وتهدف هذه الدراسة إلى تقييم هذه التغييرات والأسباب الكامنة وراءها في مملكة البحرين. تم اختيار نهج كمي ومن خلال دراسة مقطعية، تم توزيع استبيان خلال أشهر فبراير ومارس 2022 نتج عنه قبول 390 استجابة، وتم حذف الاستجابات المرفوضة بسبب ملئها من قبل المستجيبين الذين تقل أعمارهم عن 18 عامًا أو المستجيبين الذين لم يعيشوا في البحرين قبل عامين من ملء الاستبانة. كشفت النتائج عن ثبات في استهلاك أربع مجموعات غذائية وزيادة استهلاك كبيرة للوجبات غير الصحية والوجبات الخفيفة (سناك). علاوة على ذلك، كانت هناك تغييرات قليلة في طريقة شراء الطعام بينما ارتفع الطلب على شراء الطعام من المتاجر عبر الإنترنت وخدمات توصيل الطعام بشكل كبير. ولوحظ وعي إيجابي بين المشاركين حيث أن غالبيتهم لم يخزنوا مواد غذائية و 44.6٪ منهم أعدوا قائمة التسوق قبل زيارة محلات البقالة. أظهرت النتائج في قسم هدر الطعام أن الطريقة الأكثر شيوعًا لمعالجة بقايا الطعام كانت تناولها في اليوم التالي وحاول غالبية المستجيبين التحكم في هدر الطعام وكانوا على دراية بمشكلة هدر الطعام في مملكة البحرين، ووجد أنهم قللوا من تولد مخلفات الطعام. قرابة 50٪ من المستجيبين لم يغيروا كمية مخلفات الطعام المتولدة أثناء الجائحة، ويعزى التوليد المتزايد لهدر الطعام إلى زيادة استهلاك معظم مجموعات الطعام وزيادة التسوق من محلات بيع الأغذية (سوبر ماركت). القيود الموجودة في هذا البحث هي وجود التحيز لأن معظم الردود كانت من حاملي الشهادات الجامعية والمواطنين البحرينيين، وغياب البيانات والإحصائيات المتعلقة باستهلاك وهدر الطعام. التوصيات الرئيسية المقترحة هي إجراء مزيد من الدراسات من خلال وزن كمية نفايات الطعام المنزلية وإيجاد مكوناتها، وزيادة الحملات التوعوية حول الحاجة إلى تقليل كمية الطعام المستهلك وعدد الرحلات إلى منافذ الطعام، وضرورة إعداد قوائم التسوق قبل زيارة منافذ بيع الأغذية، وأخيرًا، تقديم الدعم للأفراد المتضررين في أوقات الأزمات.

الكلمات المفتاحية: استهلاك الطعام، هدر الطعام، جائحة كوفيد -19، مملكة البحرين.



تقييم استهلاك وهدر الطعام في مملكة البحرين أثناء جائحة كوفيد -19

تم تقديم الأطروحة للإستيفاء الجزئي لمتطلبات درجة الماجستير في البيئة والتنمية المستدامة

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