







## Article

# Healthy and Sustainable Diets in Times of Crisis: A Longitudinal, Mixed-Methods Study of Risk Factors and Coping Mechanisms in UK Parents During the COVID-19 Pandemic

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## Abstract

To develop interventions and policies to promote healthy and sustainable diets during times of crisis, it is important to understand how populations respond to such situations based on real-life examples. Using the recent COVID-19 pandemic as a case study to identify risk and protective factors for such situations, we implemented the first longitudinal mixed-methods approach of this topic to date. Data were collected from a sample of UK parents (stratified for gender and socioeconomic status) through two surveys and a set of focus groups during the pandemic. The focus groups identified multifaceted drivers of change linked to capability (e.g., shielding), opportunity (e.g., time, food access and availability), and motivation (e.g., reflective motivation, stress and mental health challenges) barriers. High levels of COVID-19 stress were linked with less healthy and sustainable diets in the survey results, while higher social cohesion, reflective motivation to consume healthy foods, and positive coping scores were protective, and linked to healthier and more sustainable diets. A range of coping strategies were identified, including home cooking and meal planning, which could provide a basis for future intervention development to reduce stress, maintain wellbeing, and improve dietary outcomes in future crisis situations.

**Keywords:** COVID-19; COM-B; food security; dietary behavior; emotional eating; coping strategies; sustainable diets



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## 1. Introduction

Understanding the impact of crises such as the COVID-19 pandemic on both the food system and people's behavior is important in ensuring the resilience of public health as well as environmental sustainability. A healthy diet is characterized by a balance of essential nutrients, including a variety of fruits, vegetables, whole grains, and lean proteins, while

limiting processed foods, added sugars, and unhealthy fats; such diets are fundamental in preventing chronic diseases like obesity, diabetes, and cardiovascular disease, and in promoting mental health, quality of life, and wellbeing [1,2].

A sustainable diet, on the other hand, extends beyond individual health to include environmental, economic, and social considerations. It emphasizes the consumption of foods that have a low environmental impact, are culturally acceptable, nutritious, and economically fair. This typically involves prioritizing whole plant-based foods, reducing meat consumption, and minimizing food waste, all of which contribute to reducing the carbon footprint of our diets—such diets are often both healthier and more sustainable than the average Western diet [2], and as such are important to meeting both environmental and public health goals. During events like pandemics, economic downturns, or natural disasters, people's food choices may shift dramatically due to altered availability of foods, economic constraints, and psychological stress. By studying these dynamics, we can better prepare for future crises and promote diets that are both healthy and sustainable, ensuring resilience in our food systems and public health.

The COVID-19 pandemic and associated lockdowns and quarantines were a period of high stress for individuals [3], with lockdown measures linked to increases in general psychological distress [4], anxiety, and depression [5]. The pandemic and its wider societal impacts also resulted in changes to food systems with widespread labor shortages, fragmented supply chains, shop closures, and panic buying [1,6], leading to alterations in the availability and accessibility of food [7]. Food insecurity intensified during the pandemic due to financial insecurity and job losses [8]. Food insecurity in UK adults quadrupled in the first weeks of COVID-19 [9] and particularly impacted vulnerable groups such as those on low incomes, and people with young children [10,11].

Due to the widespread social changes, individuals faced challenges in maintaining a healthy and sustainable diet. Indeed, eating patterns changed during the pandemic [12]. For some, these dietary changes led to diets becoming healthier, with increases in fruit and vegetables and fish reported [13–15] and increased overall diet quality [16]. However, for many, the changes resulted in less healthy diets with increased consumption of snack foods, carbohydrates [13–15,17], and other ultra-processed foods, as well as more frequent alcohol consumption [18], and more frequent meals [13,19]. Moreover, for those that experienced positive shifts in diet and activity, these were often short-lived, with later phases of the pandemic marked by increased stress, reduced physical activity, and declining diet quality [20]. Such dietary changes may have impacted on weight status in the population [14], with reports of increased weight [13]. Although negative dietary changes were widespread [17], they were most often noted in people with negative mood, and those with higher levels of depression and anxiety [21].

Dietary changes occurred during the COVID-19 pandemic for a variety of reasons.

Some people made positive changes, such as eating more fruit and vegetables, to help protect themselves against COVID-19, with early evidence indicating that dietary choices could help to protect against the virus [22]. Other dietary changes were the result of alterations in food access and affordability, with an increased usage of food delivery services, changes in food supply chains, and changes to employment status [23]. Changes in diet were also driven by the fear and anxiety experienced [24], with increases in emotional and comfort eating [25]. Many people used food as a coping mechanism to the stresses of the pandemic [20], leading to increases in unhealthy eating habits [26]. Emotional eating was particularly common among younger adults and those facing prolonged social restrictions [27].

Food insecurity was also a risk factor for negative dietary changes, with research suggesting that those who experienced food insecurity were likely to have altered their diets more considerably [28].

The widespread negative dietary changes, such as reductions in fruit and vegetable consumption, that were seen during the COVID-19 pandemic are concerning given that such changes are both less healthy and less sustainable [2]. It is therefore important from both a public health and environmental perspective to understand dietary changes, their causes, and mitigating factors, so that targeted interventions can be developed to better cope with future crises.

In the present study, we aimed to extend the understanding of risk and protective factors for maintaining a healthy and sustainable diet during times of crisis using the COM-B framework. The COM-B framework [29] proposes that capability (C) (both physical and psychological), opportunity (O) (both physical and social), and motivation (M) (both reflective and automatic), need to be considered when looking to understand why certain behaviors (B), such as the dietary changes seen during the COVID-19 pandemic, occur. This framework was selected as it provides a useful lens through which to examine behavior change in response to complex, real-world contexts such as the COVID-19 pandemic. COM-B has been widely used in public health and behavioral research, including exploring individual health behavior relating to the COVID-19 crisis.

During the COVID-19 pandemic, individuals experienced different opportunities to deal with stressors such as physical and social barriers to exercising or eating healthily, had different capabilities that resulted in physical and psychological barriers to being active or accessing healthy food, and/or had different motivations which resulted in intrinsic and automatic emotional barriers that we hypothesize led to different dietary choices and physical activities, and in turn, varying abilities to cope.

The COM-B framework does not focus extensively on emotional factors as cause of behavior but rather considers these as integrated within the model components, notably automatic motivation. Given the stressful nature of the COVID-19 pandemic, we extended the analysis to include an in-depth assessment of both stressors and drivers of resilience, which is the ability to adapt and remain functionally stable during stressful situations [30,31]. There are various factors that contribute to resilience. Adaptive emotion regulation may act as a protective factor against burnout during the pandemic, while maladaptive emotion regulation heightens the risk of burnout [32]. Adaptive emotion regulation encompasses functional reactions to emotional events such as accepting them or being able to see them in a calm or positive way, whereas maladaptive strategies are often marked by (escalating) negative thoughts [33]. However, resilience is also supported by activities that directly induce positive states such as physical activity or experiences of social connection [34]. Previous research has also emphasized the positive effects of being in nature [35], and it is plausible that, given the already established link between greenspace and reduced stress levels [36], and the restrictions on movement during lockdown periods, the environment in which people lived may have played an important role in how people coped during the pandemic.

This study has two aims: first to examine how the COVID-19 pandemic impacted dietary choices and behaviors amongst parents of children under 18 years of age in the UK with a focus on risk and protective factors, and second, to examine factors that either increased stress and lowered wellbeing or mitigated against negative impacts of the pandemic on health and wellbeing, promoting resilience. To explore these aims, we implemented online surveys at two different times in the pandemic in the same group of parents in the UK allowing us to perform longitudinal analyses across the two time points; and conducted a series of focus groups with a subset of the same parent sample. Parents were chosen as

the population of interest due to the potentially great impact of changes in childcare and schooling during the pandemic and the resulting stress and upheaval [10].

We stratified gender and socioeconomic status during recruitment to allow us to gather insights into different groups of respondents. The questions posed during the surveys and focus groups were informed by the COM-B framework [29] such that we sought to explore capabilities (physical and psychological), opportunities (physical and social), and motivations (reflective and automatic) in relation to dietary choices, physical activities, and wellbeing, in order to gain a better understanding of what drives changes to people's diet and wellbeing and what factors may promote resilience. The insights garnered from this study hold significance for future crisis management strategies and for individuals presently grappling with stress.

This study offers several novel contributions to the literature on dietary behavior and resilience during crises. First, to the authors' knowledge, it is the first study to take a longitudinal mixed-methods approach, collecting data at multiple time points during the COVID-19 pandemic to examine changes in dietary behavior, coping strategies, and stress in the same group of individuals. Second, the study applies the COM-B framework to understand how capability, opportunity, and motivation influence diet and coping behaviors in a real-world crisis setting, extending its utility beyond individual-level health interventions to broader societal disruptions. Third, we developed and applied an Integrated Health and Sustainability Score, building on work by Strid et al., [37] to evaluate individual dietary patterns based on both health and environmental criteria, offering a holistic assessment aligned with global goals for sustainable nutrition. Finally, by stratifying participants by gender and socioeconomic status, and combining survey results with in-depth focus groups, we were able to surface nuanced insights into how stress, emotional regulation, and coping mechanisms interact with food behaviors during times of elevated uncertainty. These contributions provide an evidence base for designing tailored interventions to support dietary resilience during future pandemics, economic downturns, or climate-related disruptions.

## 2. Materials and Methods

Data were collected through three instruments: two online surveys and a series of online focus groups (see Figure 1 for a timeline of data collection). Survey 1 was conducted between the 19 and 25 March 2021, towards the end of the winter/spring COVID-19 lockdowns in the UK. During this period, travel restrictions remained in place, but students were beginning their return to schools [38–41]. A second survey was undertaken from 21 to 30 September 2021, at which point most legal limits on contact had been removed in England since July 19th of that year [38].

Lockdowns in	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar <sup>1</sup>	Apr	May	Jun <sup>2</sup>	Jul	Aug	Sep <sup>3</sup>
	2020										2021								
England																			
Scotland																			
Northern Ireland																			
Wales																			

**Figure 1.** Timeline of surveys and focus groups (1—Survey 1 was conducted in March 2021; 2—focus groups took place in June 2021; 3—Survey 2 was conducted in September 2021).

This study was guided by a set of exploratory research questions rather than formal a priori hypotheses. Given the complexity and evolving nature of the COVID-19 pandemic, the study was designed to examine associations and emerging patterns across dietary behavior, perceived stress, and coping strategies using both quantitative and qualitative data. The analysis was theoretically informed by the COM-B framework [29], which

structured our investigation into how capability, opportunity, and motivation influenced participants' behaviors over time.

Survey data are reported following CHERRIES guidelines [42]. All data collection questions were optional due to the potentially distressing nature of the questions, and the voluntary participation of those taking part. As a result, the number of responses reported varies between questions, and does not always equal the total number of respondents in each survey.

Focus groups were hosted in June 2021, 5 weeks after Survey 1. All respondents to Survey 1 were invited to take part. Those that agreed to take part were grouped based on self-reported sex and their coping/stress score derived from the online survey.

## 2.1. Survey 1 (March 2021)

### 2.1.1. Sampling Procedures

Survey 1 was advertised on Prolific, a survey recruitment platform [43], and participants self-selected to take part. Adults who were living in the UK and had children (under 18 years) living with them during the pandemic were eligible to take part. Participants were redirected to Qualtrics, which provided information about the study and enabled participants to provide consent before taking part in the survey. The survey was self-reported and took approximately 15 min to complete. One question was presented per page. Backwards navigation was not enabled. Participants could withdraw from the survey at any point. Participants received GBP 1.88 as compensation for completing the survey, which was equivalent to GBP 7.52/hour, with the survey sample maximized within funding restrictions.

Using Prolific Academic's demographic screening to provide a balanced sample, participants were recruited based on sex and self-reported socioeconomic groups (in Prolific participants select the ladder rung from 1 to 10 which best represents their socioeconomic status, from the best off to the worst off in society).

### 2.1.2. Materials

Survey 1 was developed to examine food behavior before and during the COVID-19 pandemic and to gather information regarding a range of risk and protective factors for maintaining a healthy, sustainable diet. All data collected were self-reported. The online survey was developed in Qualtrics. First, the survey asked questions about the participants' diet to create a combined health and sustainability score, described in more detail below. Hereafter, we asked questions to understand factors that might represent risk or mitigating factors for participants' ability to sustain or switch to a healthy and sustainable diet. These were inspired by the COM-B model, and on emotional and wellbeing-related factors highlighted in the literature. We used the U.S. Adult Food Security Survey Module: Six-Item Short Form to measure food security [44] to assign a food security classification to respondents of either food secure (0–1), low food security (2–4), or very low food security (5–6). We also measured aspects of reflective motivation to eat healthily. As motivation is impacted not only by the value people place on an activity but also their perception of how easy or difficult it is to perform [45], we used two questions asking participants how motivated they felt and how difficult they found it to eat healthily since the start of the pandemic in March 2020. We also asked participants to indicate how motivated the pandemic made them to eat more healthily, more sustainably, and to be more physically active in the future. Both questions used a five-point Likert scale (1 = not at all; 5 = very much).

A series of questions explored factors affecting diet, stress, and coping behaviors throughout the COVID-19 pandemic. To this end, we used three subscales from the COVID-



19 Pandemic Mental Health Questionnaire (CoPaQ) [46]. Specifically, we used seven items from the COVID-19-specific stressors impact subscale asking participants to rate a variety of stressors. We did not use items that might not have applied to all participants such as “being in home office”. The implemented items asked participants to rate on a 5-point Likert scale the stress or burden felt in the past 14 days by worries about their health, about not being able to get medical care, increased conflicts with people close to them, childcare, financial concerns, and uncertainties about work/study.

Reliability analyses indicated adequate reliability in both surveys (Cronbach’s  $\alpha$ Survey 1 = 0.858; Cronbach’s  $\alpha$ Survey 2 = 0.831). We also presented participants with the three items of the subscale measuring social cohesion, asking them to describe their subjective impression of it at that point in time. For instance, participants were asked whether they had the feeling that “our nation is growing closer over the past 14 days” on a 5-point Likert scale (Cronbach’s  $\alpha$ Survey 1 = 0.832; Cronbach’s  $\alpha$ Survey 2 = 0.836). To measure how participants coped by themselves and in interaction with others, we then asked them to fill out 13 items that comprised the scale measuring positive coping. This evaluated whether participants maintained a daily routine, had social contact but also privacy, and used inner strength (e.g., “I changed my attitudes about what is important to me in my life”) and one item of the interpersonal conflict scale, as before these items were answered on a 5-point Likert scale (Cronbach’s  $\alpha$ Survey 1 = 0.702; Cronbach’s  $\alpha$ Survey 2 = 0.691).

We used three additional questions to measure emotional eating/drinking adapted from Burgess et al. [47]. The questions asked participants to indicate on a 5-point Likert scale (1 = never; 5 = always) how often they ate or drank unhealthy/unsustainable foods and drinks (sweets, fast foods, sugary drinks) to forget their problems, to cheer them up, or to be sociable (Cronbach’s  $\alpha$ Survey 1 = 0.694; Cronbach’s  $\alpha$ Survey 2 = 0.734). We then presented them with 20 tickable items that represented (mal-)adaptive emotional functioning such as “I am able to meet my emotional needs” or “I feel sad often”.

In addition, participants were asked to provide the first four digits of their postcode, to enable location-specific insights to be ascertained, and to opt-in to take part in a subsequent focus group. Finally, the survey included questions about demographic factors including age, sex, number of children, and location, as well as childcare/caring responsibilities.

All questions in the survey included a “not applicable”, “I don’t know”, or “prefer not to say” option. See Supplementary S1 for the complete survey. The survey was piloted with a sample of 10 parents in England prior to being administered to the population sample to test the usability, comprehensibility, and technical functionality of the survey. The pilot led to minor changes in the wording of questions for clarity and to remove minor errors, but no questions were removed or substantially changed.

### 2.1.3. Development of an Integrated Health and Sustainability Score

Using data from Strid et al. [37] on combined nutritional and environmental food evaluation, an Integrated Health and Sustainability Score (ISS) was developed for use alongside the survey. A detailed breakdown of the ISS components and scoring criteria, including food group classifications and point allocations, is provided in Supplementary S2.

For each food group included in the survey’s consumption questions (fruit, vegetables, unbattered fish, whole red meat, processed red meat, crisps), an average ISS was calculated based on individual food category combined nutritional and environmental scores from Strid et al. [37]. Vegetables (score of 1) and fruits (1.43) had the lowest ISS scores while processed (5) and whole red meat (5) had the highest, with unbattered fish (3) and crisps (4) coming in between.

The scoring system was developed to reflect public health nutrition priorities in the UK and broader sustainability goals by encouraging plant-based, minimally processed

food intake. Although this scoring system does not take into account all possible variations of food products or agricultural production systems within these categories, it is aligned with literature on combined environmental and health impacts of food, where red meat has been identified as having high impacts in both categories and fruits and vegetables having low impacts in both categories [48] and with the EAT-Lancet’s planetary diet recommendations [2], and provides a snapshot of the health and sustainability of participant diets. This resulted in three point-in-time values and three change-over-time values, as described in Table 1.

**Table 1.** Integrated health and sustainability scores.

ISS Score Type	ISS Score Name	Time Assessed
<i>Point-in-time values:</i> Sum of each participant’s ISS score for each food group. The lower the value, the healthier and more sustainable the person’s diet at that point.	precISS	Prior to March 2020 (based on recall from Survey 1)
	midcISS	March 2021 (Survey 1)
	latecISS	September 2021 (Survey 2)
<i>Change-over-time values:</i> Difference between one point-in-time value and another. Negative scores indicate the person’s diet became healthier and more sustainable over that period.	eISS	Change in diet in the first part of the pandemic (midcISS-precISS)
	mISS	Change in diet in the middle of the pandemic (latecISS-midcISS)
	tISS	Overall change in diet from pre-pandemic to the end of the pandemic (latecISS-precISS)

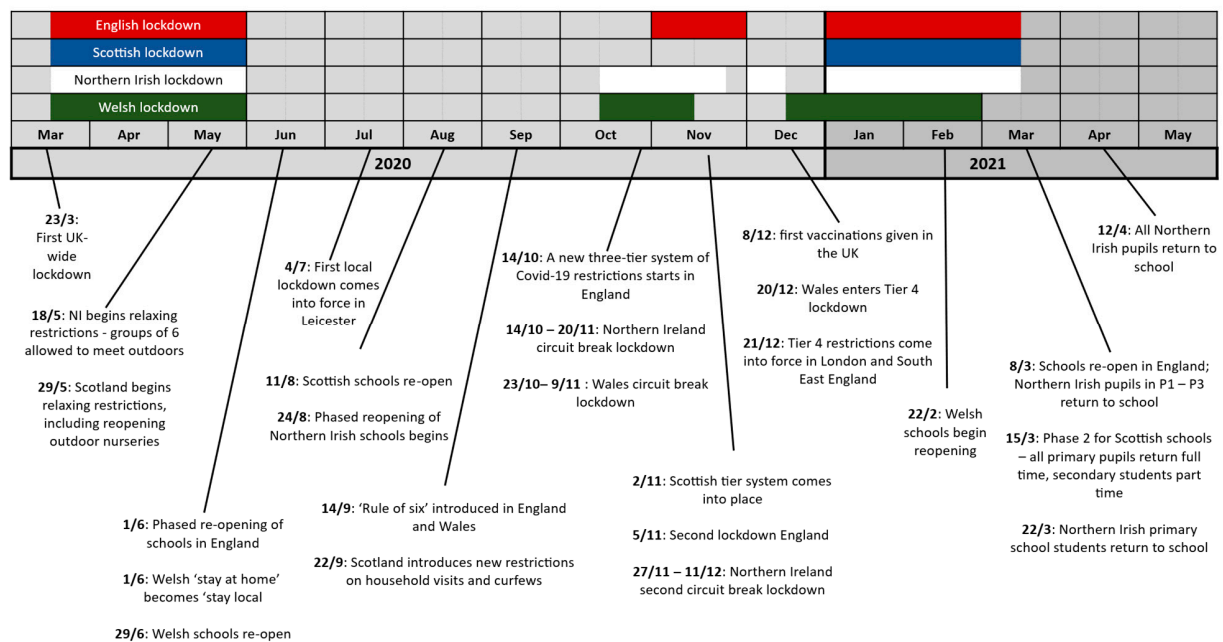
## 2.2. Focus Groups (June 2021, During Lockdown Easing)

Small focus groups, with 2 to 3 participants per group, were hosted online via MS Teams. Participants were assigned a group based on their self-reported sex and their coping/stress score from the surveys: male high stress, male low stress, female high stress, and female low stress. However, only three focus groups were conducted as the high-stress male participants who had signed up did not attend the scheduled focus group and did not respond to a request to reschedule. Group 1 included 3 females, all of whom were coded as low stress based on their coping/stress score from their surveys, Group 2 included 3 males, all of whom were coded as low stress based on their coping/stress score from their surveys, whilst group 3 included 2 females, both of whom were coded as high stress.

A focus group guide was developed (see Supplementary S3) and was piloted online prior to the focus groups, resulting in minor restructuring to reduce the focus group length. During the first part of the focus group, participants discussed changes in their diet, daily routine, and reasons for change during the COVID-19 pandemic. In the second part of the focus group, participants drew the trajectory of change in their diet and lifestyle over the course of the pandemic using Google Slides as a tool to encourage in-depth discussion. The participants were given a generic timeline as a discussion prompt (see Figure 2), depicting milestones such as initiation of lockdowns, closure and opening of schools, and restrictions around physical activity.

After drawing the trajectories, all participants were asked to describe their drawings to the group, highlighting any changes that were made to diet or lifestyle, reasons for the changes, and whether these changes remained. In the third part of the focus group, participants discussed changes implemented to improve the sustainability of their diet and lifestyle. In the final part of the focus group, participants discussed drivers of change, and co-produced ideas and methods for helping people to cope during times of stress, such as during a pandemic. Informed by the COM-B framework [29], the participants were asked

to discuss opportunities (physical and social), capabilities (physical and psychological), and motivation (reflective and automatic).



**Figure 2.** COVID-19 timeline for all countries in the UK (image used in focus group discussion as a prompt). Colors used represent each country: England = red, Scotland = blue, Northern Ireland = white, Wales = green.

The focus groups lasted between 45 and 90 min. All participants gave written and oral consent to take part before the focus groups commenced. The discussions were audio-recorded and transcribed upon completion. Participants were advised to keep their microphone and video on throughout the session to facilitate dialogue; however, only audio was recorded for analysis.

The audio recordings from the focus groups were transcribed and then analyzed using thematic analysis [49], using the COM-B model as a lens for the analysis. This method facilitated the systematic identification and exploration of recurring themes and patterns within the participants' responses, that could then be grouped according to capability (C), opportunity (O), and motivation (M). Through a process of data familiarization, code generation, theme development, review, and refinement, the study sought to uncover nuanced insights into the reasons behind dietary changes, coping strategies, and perceptions of wellbeing among the participants. This approach ensured a comprehensive and structured examination of the qualitative data, contributing valuable depth and context to the study's findings. The data are presented in the form of adapted pen profiles, to summarize the data and allow for reader interpretation [50].

### 2.3. Survey Data Analysis

The survey data from Survey 1 and 2 were analyzed using IBM SPSS version 25. Food security, ISS, stress, cohesion in society, coping positive, and emotional eating scores were calculated. Descriptive statistics were produced to explore the demographic composition of the sample. We also applied the COM-B model to the data by grouping risk and protective factors to reflect capability, opportunity, and motivation to eat healthily and sustainably. We did not measure all potential factors representing capacity, opportunity, and motivation but focused on variables of significance for the COVID-19 crisis. We therefore primarily focused on opportunity and on motivational factors that include, for instance, stress and emotional eating [51].



### Geospatial Data

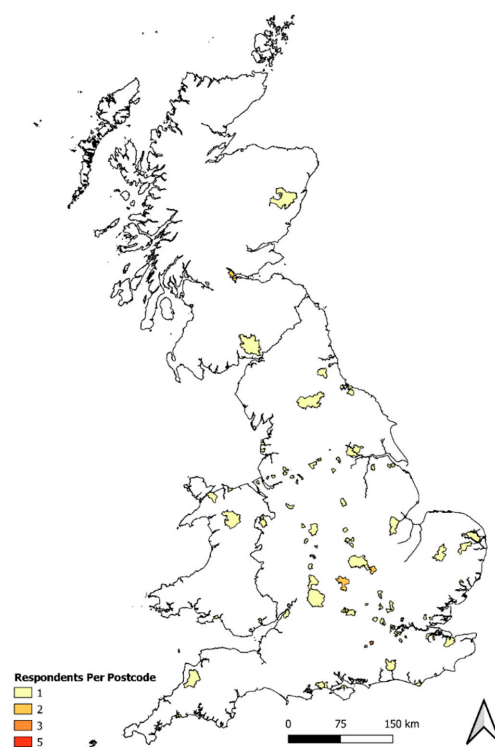
Geospatial analyses were performed in the R programming language and Quantum GIS (QGIS), with all work carried out using the British National Grid CRS (EPSG:27700) [52]. Postcode data from the OS Code Point with Polygon (CPP) [53] dataset were first parsed and grouped by outbound postcodes before clipping to the ONS Coastal Boundary file to remove polygon sections over water that distorted areal analysis—due to the absence of data for Northern Ireland in the CPP dataset, NI responses were excluded from further geographical analysis. Artificial “Vertical Street” postcode polygons hard coded in the CPP source files were dissolved prior to analysis to avoid intersection conflicts between datasets. For situations where Vertical Streets lay directly on the boundary geometry between postcodes, postcode and Vertical Street polygons were merged in QGIS based on the largest shared common boundary. Greenspace data sourced from the OS Open Greenspace dataset were then aggregated, where applicable, from multi-part to single-part polygons based on shared attribute ID prefixes. Finally, an overlap analysis in QGIS was performed to determine the proportion of greenspace present in each postcode polygon. This final greenspace proportion was then used to assess potential postcode-level correlations between access to greenspace and the various dietary /behavioral measures.

## 3. Results

### 3.1. Participants

#### 3.1.1. Survey 1

A total of 312 responses to the first survey were submitted. Of these, 28 were excluded due to survey completion rates below 10%. Two participants submitted the survey twice; in each case, the submission with more data was retained and the other deleted (in both cases, the deleted submission was one of the 28 that we excluded). This left a total of 284 responses to Survey 1. Respondents were aged 20–72 years (median 41) from across the UK (see Figure 3, due to limitations in mapping data availability described in the geospatial data section above, this map shows only mainland UK participants (Northern Irish participants are not shown)).



**Figure 3.** Survey 1 respondent location.

A total of 143 women and 139 men took part, with a range of 43–55 responses in the low (F:45; M:50), mid (F:55; M:44), and high (F:43; M: 45) socioeconomic status groups. Most participants ( $n = 213$ ) had one ( $n = 113$ ) or two ( $n = 100$ ) children, with only 24 participants stating they had more than two children. Most participants ( $n = 194$ ) were white British. Many were in full-time employment prior to the COVID-19 pandemic ( $n = 155$ ). Over half of participants had a bachelor's and/or postgraduate degree ( $n = 151$ ). Most respondents were classified as food secure ( $n = 210$ ). However, 26% ( $n = 74$ ) were food insecure. No straightliners were found. More detailed participant information can be found in Supplementary S4.

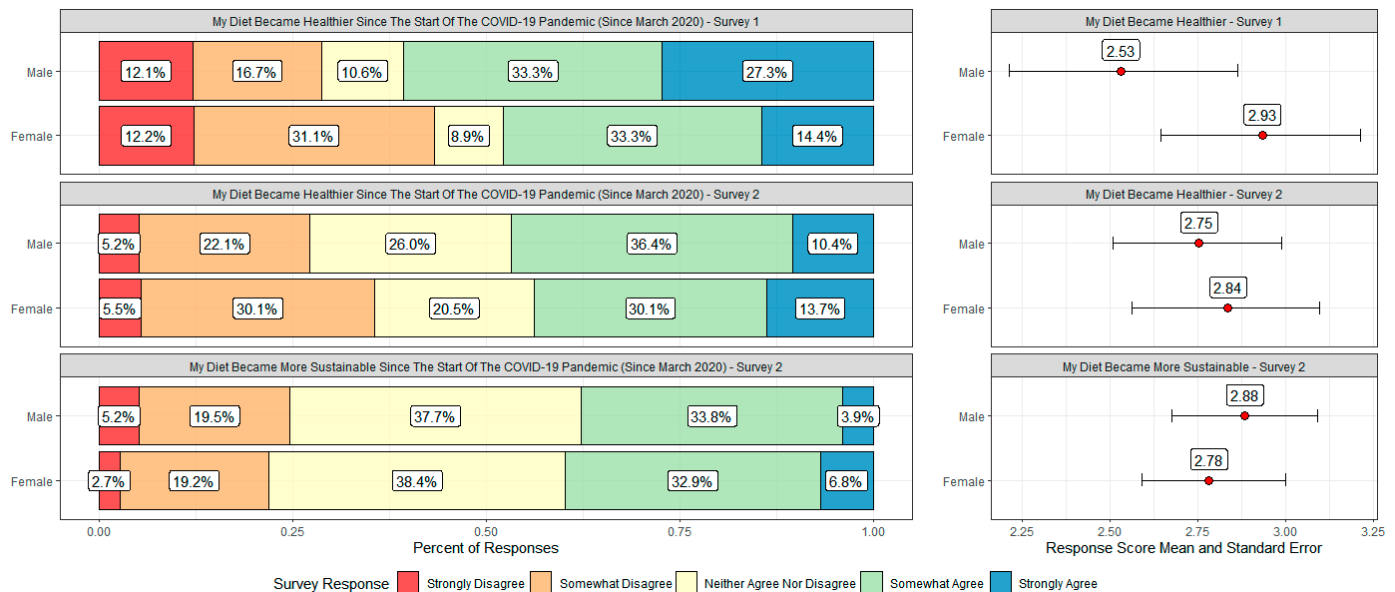
### 3.1.2. Survey 2

All respondents to Survey 1 were invited to take part in Survey 2. A total of 165 responses to Survey 2 were collected, of which 12 responses were excluded from Survey 2 due to low completion rates ( $<10\%$ ). A further two responses were excluded from Survey 2 because the participant had been excluded from Survey 1 due to low completion, leaving a total of 151 responses, which accounts for 61% of those invited. The responses were gathered from participants aged 20–72 (median 42) from across the UK. Again, most respondents had one ( $n = 60$ ) or two ( $n = 54$ ) children, with only 11 having more than two children. Most respondents were white ( $n = 125$ ). The gender split was almost equal, with 73 women and 77 men taking part. Participants were from a range of low (F:20; M:26), mid (F:32; M:26), and high (F:21; M:25) socioeconomic groups. Slightly over half of respondents were in full-time employment prior to the pandemic ( $n = 82$ ) or had a university degree ( $n = 88$ ). Most ( $n = 122$ ) respondents were food secure, whilst 12% ( $n = 18$ ) had low food security, whilst 7% ( $n = 11$ ) had very low food security.

### 3.2. Changes in Food Consumption

Across the two surveys, the absolute change in the six food groups assessed was low (less than 1 unit on average). Whilst not statistically significant, increases were noted in fruit, vegetable, and whole fish consumption and a decrease in whole red meat consumption (though no change was seen in processed red meat or potato crisps [chips] consumption during this period). While some food categories fluctuated between March 2021 and September 2021 (e.g., whole fish consumption increasing in March 2021 and then returning to baseline by September 2021), the changes in food consumption indicate that diets became marginally healthier and more sustainable over time, with increases in fruit and vegetable consumption, a stable level of whole fish consumption, and a decrease in whole red meat, processed red meat, and potato crisp [chip] consumption.

Reflecting the above data, most respondents agreed that their diet became healthier in response to the statement “My diet became healthier since the start of the COVID-19 pandemic” ( $M = 2.77$ ;  $SD = 1.35$ ; note that 1 reflects “strongly agree” and 5 “strongly disagree”). Participants that indicated that their diet became healthier since the start of the pandemic also had a healthier diet at the two relevant ISS timepoint scores at the time of Survey 1 and 2 (midcISS:  $r = 0.392$ ,  $p < 0.001$ ; latecISS:  $r = 0.222$ ,  $p < 0.044$ ). Please note that all reported correlations were checked for visual outliers. Overall perceptions varied between gender and across survey time points, as shown in Figure 4.



**Figure 4.** Self-perceived dietary change in healthiness and sustainability.

### 3.2.1. Capability to Change Behavior

Supporting the COM-B model's assumption that capability is a relevant factor enabling behaviors, participants who reported more difficulty eating healthily also had a less healthy and sustainable diet as determined by the ISS timepoint score at the time of survey 1 (midcISS:  $r = 0.300$ ,  $p < 0.001$ ) and were more likely to have a less sustainable diet at the time of Survey 2 as measured by the later ISS time point measurement (latecISS:  $r = 0.169$ ,  $p < 0.041$ ).

### 3.2.2. Opportunity to Enable the Behavior: Food Security and Demographics

In Survey 1, most respondents were classified as food secure (74%), with 26% classified as being food insecure (18% low; 8% very low). However, in Survey 2 ( $n = 151$ ), the prevalence of food security increased, with 80% of respondents being classified as food secure, and food insecurity decreased to 20% (13% low; 7% very low). A comparison of the level of food security reported by respondents indicated that those who only completed Survey 1 had a higher rate of food insecurity (31%) compared to those who completed both Survey 1 and Survey 2 (Survey 1—22%; Survey 2—20%), indicating that the difference in food security between surveys is due to attrition of those who were food insecure.

No significant difference was found in consumption of different food groups (fruit, vegetables, whole fish, red meat, processed red meat, crisps, takeaway, or alcohol) in an average day/week prior to March 2020 between food secure and food-insecure respondents.

Importantly, comparing consumption patterns prior to March 2020, which participants recalled during the survey, with those from March 2021, respondents who were food secure significantly increased their consumption of vegetables from 2.5 to 3 servings ( $t(108) = -3.49$ ,  $p < 0.001$ ), and fish from 1.4 to 1.7 servings per week ( $t(108) = -4.19$ ,  $p < 0.001$ ), while significantly decreasing consumption of red meat from 2.2 to 1.9 servings per week ( $t(108) = 2.19$ ,  $p = 0.03$ ). Food-insecure respondents, in contrast, showed no significant changes in consumption during this time.

In Survey 2 (September 2021), no significant differences in consumption were found between food secure and food-insecure respondents for most food categories. However, those who were food insecure reported significantly lower alcohol consumption (Levene's  $p = 0.001$ , equal variance not assumed ( $t(114) = 5.06$ ,  $p < 0.001$ )), (per week: secure  $m = 1.85$ ,

insecure  $m = 1.23$ ), and higher consumption of processed meats ( $t(149) = -2.79, p = 0.01$ ) (per week: secure  $m = 1.50$ , insecure  $m = 2.40$ ).

Finally, comparing pre-COVID-19 consumption to consumption reported in Survey 2, food-secure respondents increased fruit consumption from 2.2 to 2.5 servings ( $t(117) = 2.1, p = 0.04$ ) and vegetables from 1.2 to 1.7 daily servings ( $t(117) = 3.41, p = 0.001$ ), and decreased potato crisp (chip) consumption from 2 to 1.5 servings per week ( $t(117) = -2.84, p = 0.005$ ). Food-insecure respondents' consumption patterns did not change significantly, apart from an increase in vegetable consumption from 2.1 to 2.8 servings per day ( $t(29) = 2.16, p = 0.04$ ). However, it is worth noting the low sample size of food-insecure respondents. In sum, there is some support that food security reflects an important opportunity impacting people's ability to eat healthily and sustainably.

Sex was also correlated with ISS early in the pandemic, as women's diets became less healthy and sustainable while men's diets improved (Spearman's  $\rho = 0.207, p = 0.01$ ). Interestingly, average ISS scores for the two sexes were much more similar in March 2021 than either before the pandemic or in September 2021, suggesting some dietary convergence during the lockdown period. This could reflect men profiting from more opportunities to eat healthily (e.g., opportunity to prepare or to eat home-cooked food).

### 3.2.3. Motivation to Perform the Behavior

The COM-B model describes both reflective motivations and automatic motivational processes including emotional processes such as emotional eating [51], as drivers of behavior. We extended the model to include a wider range of emotional predictors as suggested by recent studies [54]. Supporting these assumptions, we found that the reflective motivation to eat healthily following the onset of the pandemic score was associated with an improved diet at the two relevant ISS timepoint scores (midcISS:  $r = -0.322, p < 0.001$ ; latecISS:  $-0.161, p = 0.05$ ).

Similarly, respondents' answers to the question (as asked in Survey 1) "The COVID-19 pandemic and resultant lockdowns have made me more motivated to eat healthily in the future" were associated with a better diet as depicted with their midcISS score ( $r = 0.295, p < 0.001$ ; note that the motivation question was coded from 1 "strongly agree" to 5 "strongly disagree") and also predicted a better diet in their latecISS score as measured in Survey 2 ( $r = 0.169, p = 0.040$ ). In contrast, stress and self-reported emotional eating impaired people's ability to pursue a healthy and sustainable diet. For instance, respondents with higher levels of COVID-19 stress were more likely to have less healthy and sustainable diets, i.e., a higher mean COVID-19 stress score was associated with a worse diet as depicted in the midcISS score ( $r = 0.170, p < 0.04$ ) and it also predicted their diet quality as depicted in the latecISS score measured in survey 2 ( $r = 0.216, p < 0.01$ ).

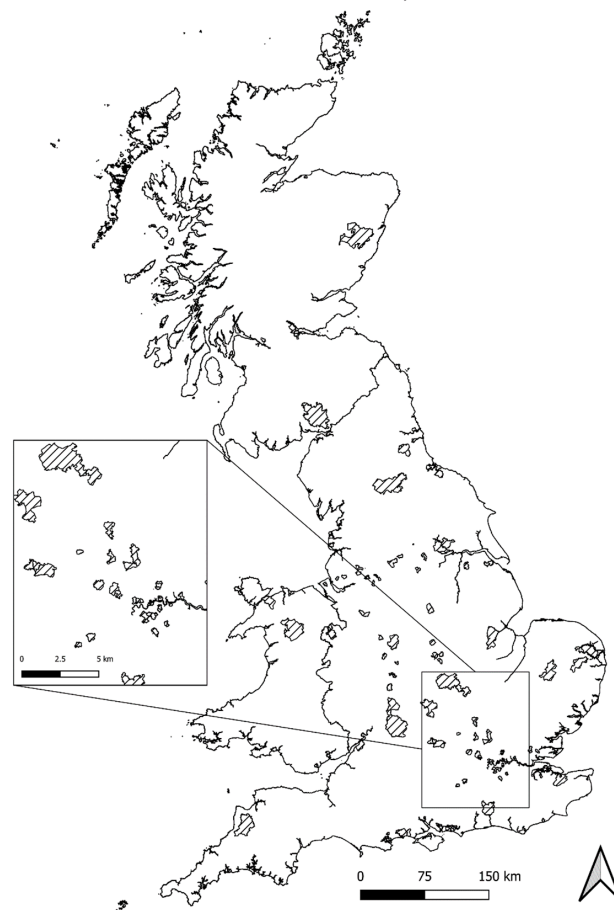
Emotional eating as reported in Survey 1 was associated with a worse diet at that point as depicted in the midcISS score ( $r = 0.210, p < 0.01$ ) but did not predict their latecISS score measured in Survey 2 ( $0.216, p < 0.01$ ). Overall, these findings fit the COM-B model in that having reflective motivation to eat healthily supports healthy and sustainable eating behavior, whereas stress and emotional eating hinder it.

### 3.2.4. Factors Reducing Stress

We also investigated which factors mitigated stress as this could have important implications for interventions. For instance, the score depicting positive coping with the challenges of the pandemic as measured in Survey 1 was associated with less stress at the same time in Survey 1 ( $r = -0.206, p < 0.001$ ) but also predicted less stress later in the second survey ( $r = -0.167, p < 0.05$ ). Similarly, average adaptive emotional functioning as measured in Survey 1 was linked to less stress at the same time ( $r = -0.317, p < 0.001$ )

and predicted less stress in the second survey ( $r = -0.358, p < 0.001$ ). We further observed that food insecurity was associated with higher levels of stress in Survey 1 ( $\tau_b = 0.377, p < 0.001$ ) and Survey 2 ( $\tau_b = 0.238, p < 0.001$ ). Access to the outdoors while at home during the pandemic is also significantly associated with less stress ( $r = -0.167; p < 0.05$ ). Further, more engagement with nature is significantly associated with respondents' mean coping positive scores ( $r = 0.253; p < 0.01$ ).

Percentage greenspace in the four-digit postcode of survey respondents was not found to be linked to the survey scores relating to stress or coping. However, this may be due to the four-digit postcode areas being too large to provide detailed enough information for patterns to be identified—an example of the variability in size of a four digit postcode is shown in Figure 5 with an inset of the South East—and/or the official classification of greenspace in the dataset including only officially designated parks and spaces, leaving out other potentially important natural areas such as farmland or forests. Similarly, living in an area with a larger percentage of greenspace was also linked with worse ISS scores, though this may be due, at least in part, to a lack of precision in this data.

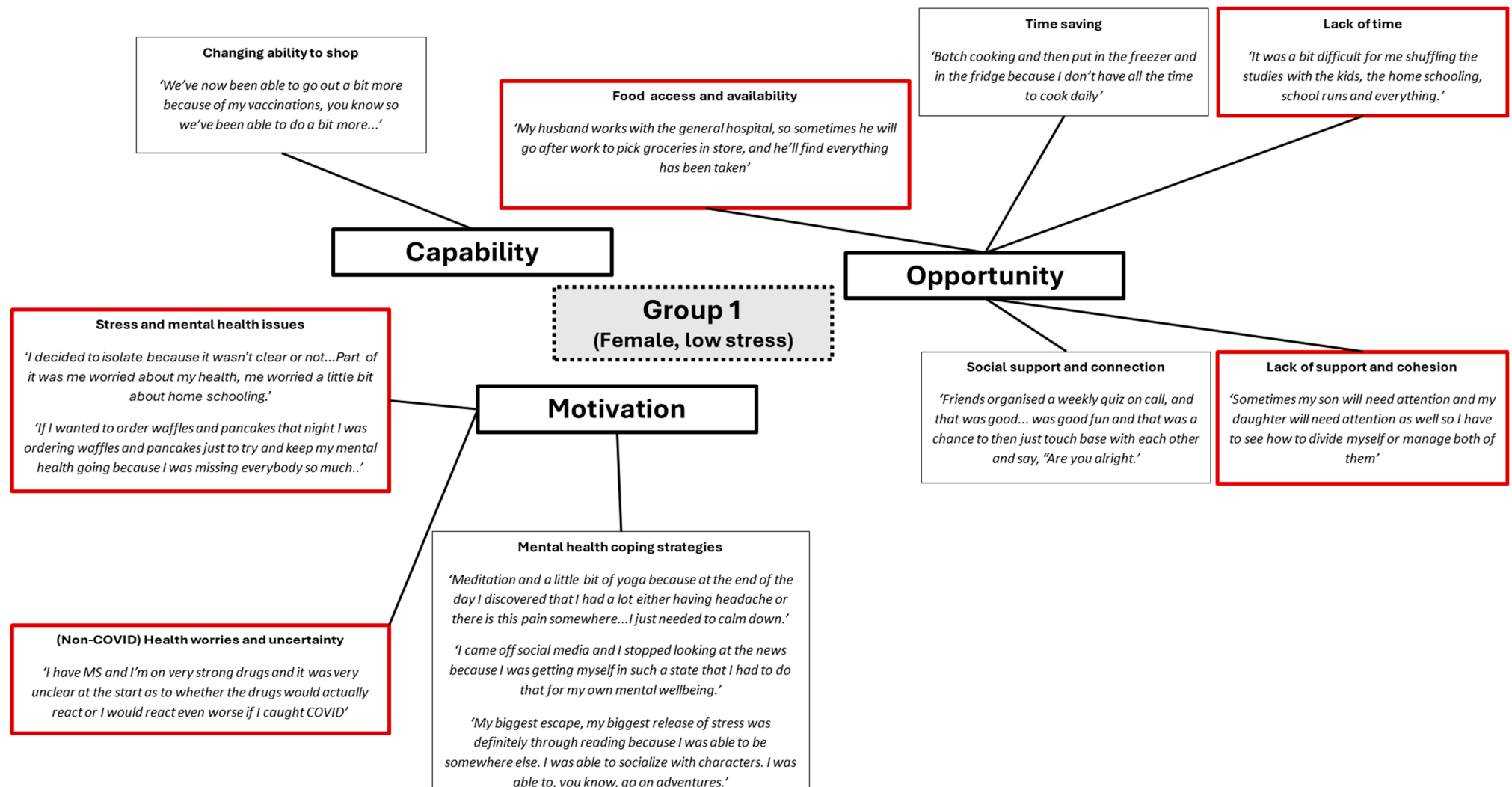


**Figure 5.** Four-digit postcode areas of survey respondents.

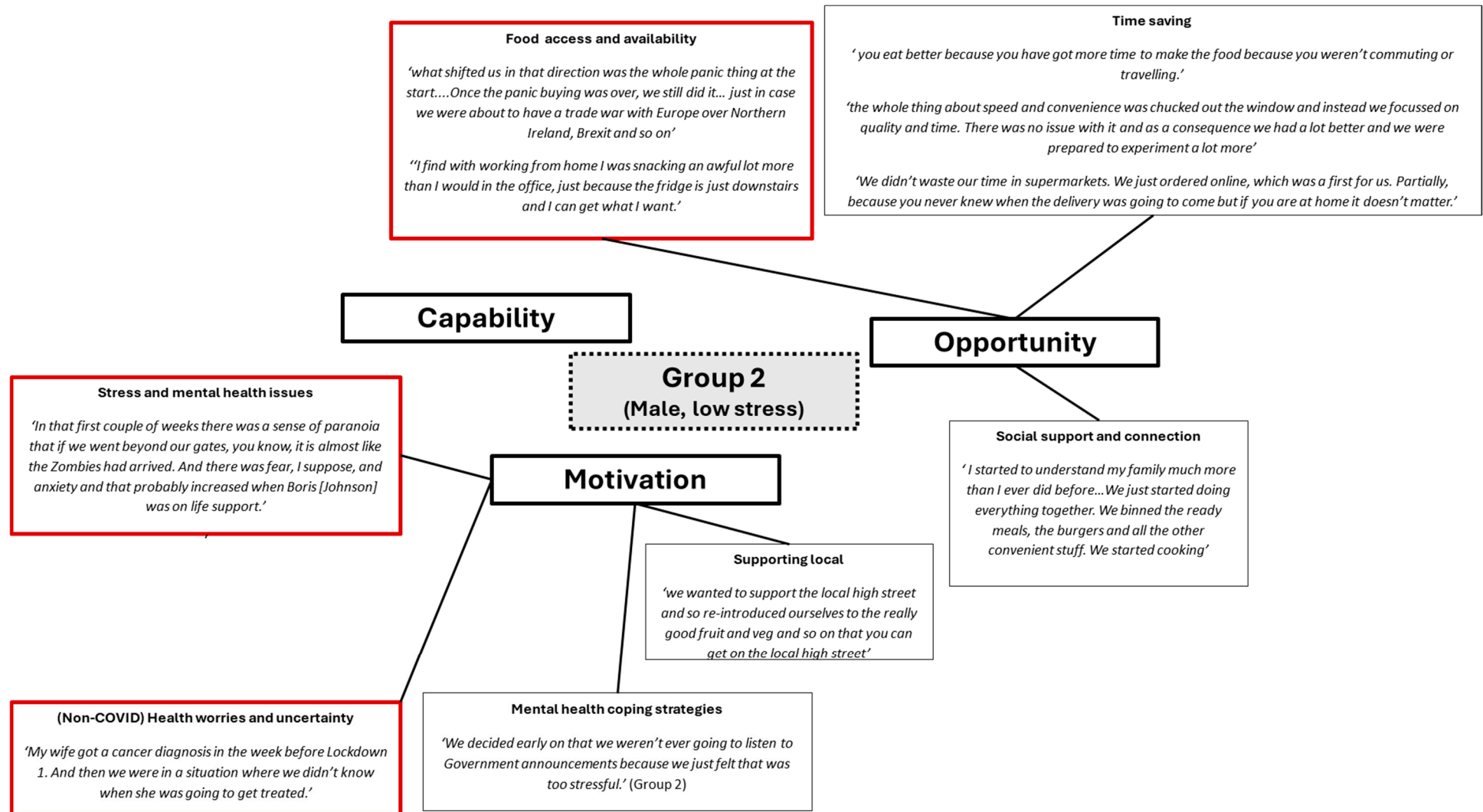
### 3.2.5. Coping Strategies

Pen profiles were developed to summarize and visualize the themes and codes identified from the focus group conversations (see Figures 6–8). Negative behaviors are highlighted in the figures with bold, red boxes. Due to the low number of participants, to preserve anonymity, no information about the participants is presented with the quotes. Diet and wellbeing-related behaviors were discussed during each focus group, adding depth to the insights captured during the surveys.

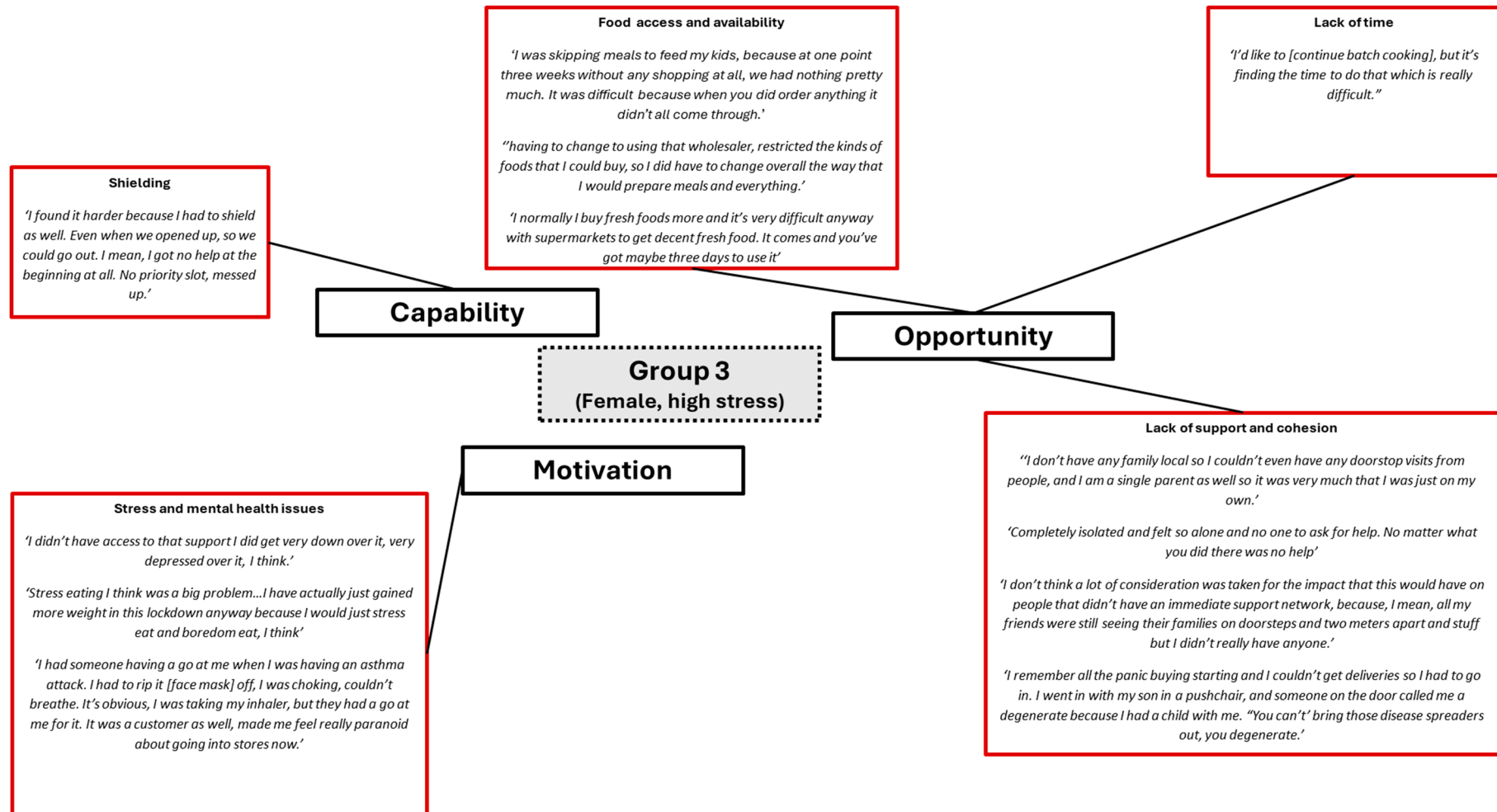




**Figure 6.** Themes and sub themes from focus Group 1—low-stress females. Boxes with a red outline contain negative themes and subthemes, boxes with a black outline contain positive or neutral themes and subthemes.



**Figure 7.** Themes and sub themes from focus Group 2—low-stress males. Boxes with a red outline contain negative themes and subthemes, boxes with a black outline contain positive or neutral themes and subthemes.



**Figure 8.** Themes and sub themes from focus Group 3—high-stress females. Boxes with a red outline contain negative themes and subthemes, boxes with a black outline contain positive or neutral themes and subthemes.

### 3.3. Focus Groups

In Survey 2, a list of coping strategies (identified during the focus groups), were presented to survey respondents. The most frequently reported coping strategy by survey participants was home cooking ( $n = 88$ ), followed by meal planning and/or batch cooking ( $n = 77$ ), and watching more TV/films ( $n = 76$ ). In contrast, only 12 respondents reported using retail therapy or community support groups/networks.

#### 3.3.1. Capability

For those in Group 3, the highest stress group, physical capability to maintain a healthy and sustainable diet was restricted due to shielding requirements and preexisting health conditions, and inability to access grocery deliveries, limiting their ability to shop and deal with the changes associated with lockdowns. Similarly, in Group 1, participants with health issues discussed the positive impact that COVID-19 vaccinations had on their ability to leave home (see Figure 6). In both cases, we class this as a capability barrier, with serious health concerns (and legal requirements) preventing participants from engaging freely in shopping behaviors.

#### 3.3.2. Opportunity

Participants in all three groups discussed how access to food changed during the pandemic, which resulted in dietary changes and stress and uncertainty. Participants in Groups 1 and 3 struggled to access preferred foods, with both reporting limited availability once in supermarkets “he’ll find everything has been taken” (Group 1) and problems with suppliers making accessing any food difficult “three weeks without any shopping at all, we had nothing pretty much. It was difficult because when you did order anything it didn’t all come through” (Group 3). In Group 2, however, discussions highlighted the difficulty of proximity to the kitchen when working from home: “I was snacking an awful lot more than I would in the office, just because the fridge is just downstairs and I can get what I want” and concerns around panic buying and future food system shocks (Figure 7).

All groups highlighted the importance of time. For those in Groups 1 and 3, the lack of time to engage in healthy and sustainable dietary behaviors was a major barrier: “I’d like to [continue batch cooking], but it’s finding the time to do that which is really difficult” (Group 3). In Group 2, discussions centered around the impact of having more time during the pandemic on their food choices: “you eat better because you have got more time to make the food because you weren’t commuting or travelling.” (Group 2).

All groups discussed the importance of social support and cohesion, though the contrast between those with strong social support and those without was stark. In Group 2, for example, the pandemic allowed the strengthening of family bonds: “We just started doing everything together. We binned the ready meals, the burgers and all the other convenient stuff. We started cooking.” While in Group 3, the lack of support was emphasized: “Completely isolated and felt so alone and no one to ask for help. No matter what you did there was no help.”

#### 3.3.3. Motivation

Participants in all three groups stated that their motivation to maintain physical activity and healthy diets changed over the course of the pandemic (see Section 3.3.4).

The low-stress males in Group 2 said that the pandemic, and the shift to more local activities, motivated participants to support local businesses such as fruit and vegetable grocers, and adopt more sustainable behaviors such as growing food at home: “We wanted to support the local high street and so re-introduced ourselves to the really good fruit and veg.” (Group 2).

Participants in all three groups mentioned that anxiety and uncertainty impacted their diets and wellbeing during the COVID-19 pandemic, with issues around stress and mental health being one of the largest themes discussed in the focus groups and intersecting with other health and wellbeing concerns.

Participants in Group 1 experienced uncertainty regarding health conditions and anxiety due to cancelled social events, which impacted their psychological capability: “I have MS... it was very unclear at the start as to whether the drugs would actually react, or I would react even worse if I caught COVID.” (Group 1) For men in Group 2, anxiety and paranoia were prevalent during the early stages of the pandemic, affecting psychological capability, whilst participants in Group 3 (see Figure 8) faced heightened psychological stress due to judgment from others, impacting their mental wellbeing: “I had someone having a go at me when I was having an asthma attack. I had to rip it [face mask] off, I was choking, couldn’t breathe.” (Group 3).

For participants in all three groups, escaping the reality of the COVID-19 pandemic was an important way of dealing with the situation. However, how this was achieved varied between the groups. Participants in Group 1 used escapism through reading: “My biggest escape, my biggest release of stress was definitely through reading because I was able to be somewhere else” and meditation, yoga, and fitness classes (Group 1). Those in Groups 1 and 2 attempted to avoid news and, in some cases, social media, to reduce stress. For low stress males in Group 2, gardening and access to green spaces were crucial in maintaining physical health and family connections. Those in Group 3 also consciously made changes to deal with the challenges of the pandemic, noting that stress eating was a common coping mechanism.

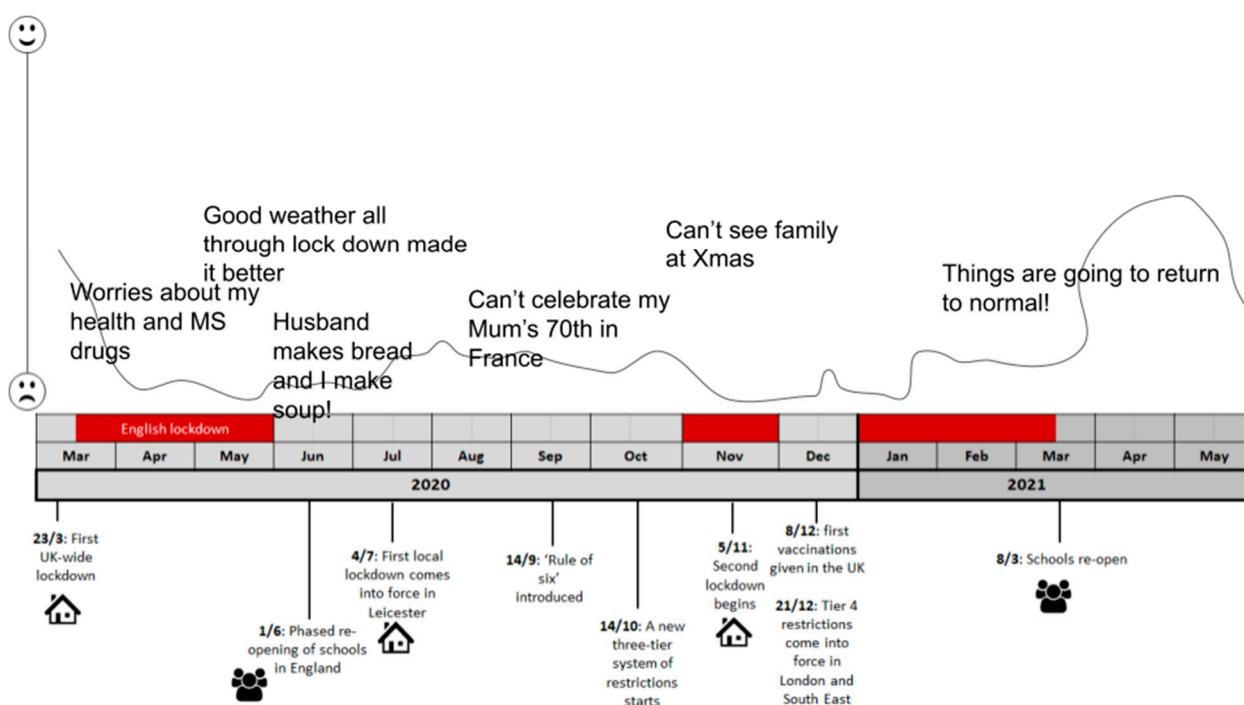
The reduced opportunities for social interactions took their toll on participants in all three groups, and we note the importance of social support and cohesion on mental health, as clearly described by participants in Group 3: “I didn’t have access to that support I did get very down over it, very depressed over it, I think.” However, the impact of this varied, with a strong contrast between the high stress women in Group 3 as compared to the low stress males in Group 2, for whom working from home facilitated social connection to family.

#### 3.3.4. Part 2—Trajectory of Change

In the second part of the three focus groups, participants used a prepared timeline, with key moments such as when lockdowns were initiated or lifted included, to draw out a trajectory of change to summarize how they perceived their diet and lifestyle changed over the course of the pandemic. Participants were asked to indicate negative emotions or negative behavior changes by drawing a dip in their trajectory, whilst positive emotions or behavior changes were indicated by drawing an incline in their trajectory. The trajectories were drawn online using Google Slides (see Figure 9 for an example). The participants were given 10 min to draw their trajectories. Following this, if comfortable, participants were asked to share and describe their drawings with their respective groups, highlighting any changes that were made to diet or lifestyle, reasons for the changes, and whether these changes remained.

All participants included some negative behavioral and emotional changes in their trajectories. Feeling isolated, unable to celebrate milestones such as birthdays, and worries about continued access to healthcare for ongoing or new health conditions were all mentioned and contributed to these declines. Participants indicated that because of the negative changes in their emotions, their dietary choices and cooking practices also changed, and suffered:





**Figure 9.** Example trajectory, image produced by a participant in Group 1—low-stress females.

“Boredom and loneliness. I live alone and I used food to find a pick-me-up, even if just for a moment.”; “Mental health made me feel more lazy and not bothered to cook.”; “Stress and fear played a huge part in my emotional eating.”

Dips in the trajectory were also the result of participants having to make changes to their working habits. For example, one participant noted that they had to change jobs due to redundancies and closures: “Changed jobs to kitchen work and had less time to cook” This, they stated, led to having less time to cook and prepare food, and in turn, impacted their food intake negatively. Changes in working practices also negatively impacted personal finances, which in turn resulted in changes to food behaviors: “We changed our food for financial reasons, we cut down due to a job loss.”

Despite the number of dips in the trajectories, there were several positive moments included. Having more time at home was mentioned as being a contributory factor to the positive changes, with more time to think, or prepare food:

“More time to think about my own health and protecting myself against future disease”; “We have more time to focus on monitoring our plates and what goes on to them.”

Good weather, lockdowns being lifted, and hope relating to “things going back to normal” also strongly contributed to rises in trajectory.

#### 4. Discussion

The COVID-19 pandemic and the associated lockdowns and restrictions impacted individuals worldwide, resulting in a range of adjustments to daily lives, and dynamics at work and in the home. Parents encountered myriad challenges, such as having to homeschool children and dealing with home working arrangements, which may have resulted in greater levels of stress and impacted on their wellbeing. Nonetheless, there exists a dearth of research that explores the multifaceted repercussions of the pandemic on parental wellbeing, dietary patterns, and stress levels.

The aim of this study was first to examine how the COVID-19 pandemic impacted dietary choices and wellbeing amongst parents of children under 18 years of age in the UK, and second, to examine risk factors for impaired diets and increased stress, and identify

coping mechanisms used to mitigate against negative impacts of the pandemic on diet, health, and wellbeing. While the COVID-19 pandemic was used as a case study, we view this as providing useful insights into other high-stress, low-opportunity scenarios, which could come about for a range of different reasons, such as the cost-of-living crisis, periods of civil unrest, or climate catastrophes.

Data captured in the present study suggest that whilst dietary changes during COVID-19 were reported by many participants in the surveys and focus groups, these changes were relatively minor, with averages remaining below 1 unit, e.g., slightly elevating average consumption of fruits (0.3), vegetables (0.7), and fish (0.3), and red meat (0.16) consumption. Conversely, the pandemic prompted an overall reduction in processed meat (0.3) and crisps (0.65) consumption, which contradicts previous research that indicated increases in processed foods, and snack foods [17]. The dietary changes in the current study were minor and may indicate high resilience of participants in maintaining relatively stable dietary patterns [55,56]. The findings also align with some previous research which indicates that there were widespread increases in the consumption of fresh fruit and vegetables [13,57] and homemade meals [58], with reduced consumption of comfort or fast foods [13,58], and alcohol [13] during the pandemic.

Importantly, changes in dietary intake and behaviors were most apparent amongst participants most at risk of food insecurity in both the survey and focus group, with opportunity (e.g., time to cook) mentioned frequently. Although the attrition of those most at risk of food insecurity between surveys 1 and 2 necessitates cautious interpretation, such a finding could indicate the importance of providing targeted support in helping people at risk of food insecurity to deal with changes to food access, as well as changes to their financial stability.

Participants in the survey and focus groups reported that drivers of dietary changes were multifaceted, covering capability (e.g., shielding restricting ability to go shopping), opportunity (e.g., time, food access and availability), and motivation (e.g., health concerns, stress and mental health challenges) related factors. More time to prepare food and cook at home drove dietary change for those used to long commutes, a feature found by other researchers in relation to home cooking during the pandemic [59]. Ability to access food was another core consideration, with the need for grocery delivery slots to be available to those at risk, and the importance of supply chains maintaining availability of healthy, sustainable foods highlighted. Financial considerations also played a role, underscoring the need for affordability-focused interventions. Previous research has noted that financial challenges and being at risk of food insecurity led to alterations in shopping and eating habits [28]. Another driver of change for some participants was to improve personal health, supporting previous research by Marty et al. [16], whilst others stated that they became more conscious of the need to promote environmental sustainability. Meal planning and preparation were key strategies for avoiding waste and making the most of the food available, aligning with personal motivations to promote wellbeing and health.

Significantly, the pandemic appeared to have resulted in a heightened awareness of individual priorities, with more than 60% of respondents saying that COVID-19 had helped them to identify their priorities. This realization reflects the profound impact of the pandemic on individuals' lives and values, influencing their dietary choices and fostering a heightened consciousness of personal wellbeing and priorities. These insights extend beyond the study's scope, inviting further exploration into the intricate relationships between external crises and personal transformations.

Within the realm of protective and positive factors associated with healthier and more sustainable diets, several noteworthy correlations emerge. Participants' mean social cohesion score is linked with healthier dietary choices during the pre-COVID-19 period.

Moreover, heightened motivation to consume healthy foods following the pandemic's onset aligns with healthier and more sustainable dietary patterns at multiple time points. Negative factors related to less healthy and sustainable diets are correlated with increased mean COVID-19 stress scores, underscoring the potential impact of stress on dietary choices during challenging periods. These correlations collectively offer insights into the intricate relationships between psychosocial factors, stress, and dietary behaviors. This supports previous research which highlighted that poor mental health during the COVID-19 pandemic was associated with an increase in unhealthy eating habits [60]. While the inability to establish causal relationships underscores the need for caution, these findings provide a foundation for further investigations that could unveil the complex interdependencies shaping individuals' health and sustainability choices during times of crisis. Emotional functioning emerged in our study as a consistent predictor of stress, with food security likely influential. Such findings underscore the significance of maintaining a health-conscious approach during periods of stress and may provide a rationale for the development of further specific dietary support interventions, particularly during periods of high stress. The findings also highlight the importance of reducing stress by limiting food insecurity.

When looking at the impact of the pandemic on wellbeing, the findings indicate that there may be a potential positive influence of self-reported level of engagement with nature, something that only some of the participants had the opportunity to do during the COVID-19 associated lockdowns. While the available greenspace detail in the present study, constrained by four-digit postcodes due to ethics board restrictions, limits granularity and makes discerning clear patterns difficult, this finding supports previous literature which has highlighted the impact of access to greenspace in influencing health and wellbeing outcomes [61]. This warrants further exploration and a more detailed investigation into its nuances and effects on individuals' experiences and stress levels.

The study's exploration of coping strategies offers a promising avenue for promoting resilience during times of stress. Notably, the most frequently deployed coping strategies from Survey 2 included home cooking, meal planning, watching TV/films, increasing exercise, and engaging in gardening. Data from the focus groups indicated that food was also used as a coping strategy, reflecting the intertwined relationship between emotional states and dietary choices [16], reinforcing the broader literature on stress-related eating patterns [27].

Negative dietary changes were driven by boredom, financial constraints, stress, and loneliness, while positive changes stemmed from increased time for activities like exercise and cooking, alongside the motivation to enhance health. Reducing feelings of stress was an important part of reducing emotional eating. Whilst these strategies could be developed into interventions to support people in times of future stress and change in managing stress and maintaining healthy behaviors, it is important to recognize that these strategies might be skewed towards those who are food secure, given our sample population, and distinct support mechanisms for the food insecure may be necessary.

Beyond the aforementioned points, this study also offers theoretical contributions to the application of behavioral models in crisis contexts. By using the COM-B framework to analyze coping and dietary behavior's during the COVID-19 pandemic, we demonstrate the model's utility beyond structured individual interventions and into real-world, high-stress scenarios. The findings illustrate how changes in physical capability (e.g., shielding), opportunity (e.g., food access, social support), and motivation (e.g., emotional regulation) intersect to shape behavior under pressure. This suggests that behavioral frameworks such as COM-B could usefully inform both the analysis of (mal-)adaptive responses in crises and the design of targeted public health strategies aimed at strengthening behavioral resilience.

### *Limitations of the Research*

Whilst the findings from this research are novel and offer useful insights into other high stress scenarios, the research discussed is not without limitations. These limitations offer insights into the scope and context of the research, allowing for a balanced understanding of its contributions, and also highlight where further research could be conducted.

First, despite achieving an equal participation of males and females, the participant sample's demographic composition may limit the generalizability of the findings. A lack of ethnic diversity and a predominantly food-secure population could affect the extent to which the results can be extrapolated to more diverse socioeconomic and cultural backgrounds. This underlines the need for caution when applying the findings to broader populations.

The study's survey design and analysis methodology also introduce limitations. The sample size, although suitable for the conducted analyses, might restrict the power to detect subtle effects within specific subgroups. The limited diversity within the sample may also hinder the identification of potential nuances in dietary changes and coping mechanisms across different demographic segments. The timing of the survey implementation, conducted during specific periods of the pandemic, might not capture the full spectrum of experiences throughout the crisis. Although it is possible that long recall periods could introduce recall bias, affecting the accuracy of participants' responses and perceptions of their dietary habits and coping strategies, there is research indicating that to the contrary, a longer period may potentially result in more information recalled, and lower bias in that information [62]. The attrition of food-insecure participants between the two survey phases raises concerns about potential bias in the results. This loss to follow-up may impact the representation of individuals who faced heightened challenges during the pandemic, potentially affecting the conclusions drawn from the data. The investigation into greenspace and its association with wellbeing offers preliminary insights, yet a more detailed assessment of this relationship is warranted.

A further limitation relates to the lack of a control or comparison group, such as non-parents. This may limit the generalizability of the findings to the broader population. However, our focus on parents was intentional, as this group faced distinct and heightened challenges during the COVID-19 pandemic, including increased caregiving demands, disrupted routines, and altered access to food. While the results cannot be assumed to apply to all population groups, they provide transferable insights into how individuals in high-stress caregiving roles navigate dietary risks and resilience, offering value for both targeted interventions and future comparative studies.

However, connecting with participants at multiple time points across the pandemic, a gender balanced sample, and the inclusion of focus groups to discuss the experiences of those surveyed in more depth, are strengths in our data. In summary, while the study contributes valuable insights into the impact of the COVID-19 pandemic on dietary behaviors, wellbeing, and coping mechanisms among UK parents, consideration of study context is necessary. Addressing these limitations in future research endeavors will further enhance the depth and breadth of understanding in this complex field.

## **5. Conclusions**

The key messages distilled from this study underscore the pivotal role of stress, particularly for vulnerable groups like those at risk of food insecurity and females. Notably, we found that healthier and more sustainable diets are linked to reflective motivation and higher positive coping scores, suggesting that enhancing coping strategies could yield benefits for both wellbeing and health/sustainability. The deployment of constructive coping strategies by respondents presents a promising avenue for mitigating adverse outcomes. The pandemic's profound impact on individual priorities is acknowledged, albeit

beyond the study's scope. The findings highlight the potential of stress management and practical solutions (such as meal planning support) to alleviate common barriers like time and financial constraints, potentially enhancing individuals' ability to cope effectively during challenging circumstances. For high-stress populations, targeted and comprehensive support remains imperative.

Future studies could build on these findings. Additional longitudinal research could examine how relationships between stress, coping mechanisms, and dietary change are impacted on longer timescales following times of stress/crisis. Second, there is scope to test targeted interventions (e.g., stress-reduction or meal planning support) aimed at promoting dietary resilience among vulnerable groups such as parents, using the COM-B framework's behavior change wheel [29], and the barriers identified in this study as a starting point to design such interventions. Finally, future work could explore these dynamics in diverse populations and settings, including non-parents, lower-income households, and communities experiencing overlapping social and environmental stressors, to support more equitable food system responses.

**Supplementary Materials:** The following supporting information can be downloaded at <https://www.mdpi.com/article/10.3390/su17135878/s1>, Supplementary S1—First survey, Supplementary S2—Integrated Health and Sustainability Score, Supplementary S3—Focus Group Protocol, Supplementary S4—Second Survey, Supplement S5—survey participants, Supplementary S6—Focus group quotes by theme.

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**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki, and approved by Ethics Committee of Lancaster University (FST20153), July 2020.

**Informed Consent Statement:** Informed consent was obtained from all participants involved in the study.

**Data Availability Statement:** Anonymized data are available from the corresponding author on request.

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**Conflicts of Interest:** The authors declare no conflicts of interest.

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