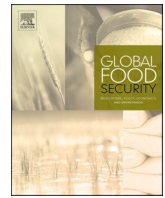




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Research article

Consumer experiences of food environments during the Covid-19 pandemic: Global insights from a rapid online survey of individuals from 119 countries

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ABSTRACT

This study investigates consumer experiences of food environments and food acquisition practices during the Covid-19 pandemic. Our rapid assessment online survey featured a convenience sample of 2015 individuals from 119 countries, spanning Western Europe, North America, Latin America, Asia-Pacific, and Africa. Data collection took place in April 2020 during the second month of the pandemic. Participants were recruited via existing networks of the United Nations System Standing Committee on Nutrition, through social media, and by snowballing. The majority of participants were female (71.9%), from low- and middle-income countries (51.0%), and working in nutrition or healthcare (39.3%). Qualitative thematic analysis and descriptive statistics reveal a series of common global experiences related to food availability and accessibility, food prices and affordability, food acquisition practices, and food preparation and consumption. The importance of community food participation, food sharing, and resource allocation are highlighted, along with increasing awareness of healthy diets and food waste. We identify ten synergistic policy entry points to: 1) build resilient and equitable food environments resistant to stresses and shocks; 2) harness positive dietary-related behaviors manifested during the pandemic; and, 3) mitigate the projected nutrition crisis and promote sustainable healthy diets for all.

1. Introduction

In one year, the Covid-19 pandemic has pushed an additional 320 million people into food insecurity – the equivalent of the previous five years combined (FAO/IFAD/UNICEF/WFP/WHO, 2021) - and another 124 million into extreme poverty (defined as living on < US\$1.90/day) (WorldBank, 2021). If left unchecked, the food security crisis threatens to place millions at higher risk of all forms of malnutrition, including under-nutrition, micronutrient deficiencies and dietary-related non-communicable diseases (FAO/IFAD/UNICEF/WFP/WHO, 2021; Laborde et al., 2021; Osendarp et al., 2021). Given the irreversible effects of early life nutrition (Leroy et al., 2020), the health effects of the pandemic are particularly concerning among nutritionally vulnerable groups such as women and children (Osendarp et al., 2021) as witnessed in previous crises (Brinkman et al., 2010). Further, malnutrition is a co-morbidity factor for Covid-19 infection, worsening risk of severe illness and death (James et al., 2020; Muscogiuri et al., 2020; Wu et al., 2020).

Prior to the pandemic, the world was not on track to meet the 2030 Sustainable Development Goals (SDGs) to eliminate poverty (SDG 1) and malnutrition (SDG 2), and achieve responsible food production and consumption (SDG 12) (FAO/IFAD/UNICEF/WFP/WHO, 2021). The public health nutrition impacts of the pandemic will limit progress on the SDGs, increase pressure on already stretched health systems, lower workforce productivity, increase loss of life, and delay economic recovery (FAO/IFAD/UNICEF/WFP/WHO, 2021; Osendarp et al., 2021; Robertson et al., 2020; Victora et al., 2021).

Food environments have risen to prominence in recent years as a key interface between consumers and the wider food system (Downs et al., 2020; HLPE, 2020; Turner et al., 2019, 2018). At the onset of the pandemic, the United Nations System Standing Committee on Nutrition (UNSCN) mapped the possible impacts of COVID-19 to the food environment conceptual framework by Turner et al. (2018) (UNSCN, 2020) (Fig. 1). This globally applicable framework identifies external and personal food environment dimensions that interact to shape people's

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food acquisition and consumption. External dimensions include food availability, prices, vendor and product properties, and marketing and regulation policies; while the personal domain features dimensions relative to individuals, such as accessibility, affordability, desirability and convenience (Turner et al., 2018).

The Covid-19 pandemic has exposed critical weaknesses of the global food system, reinforcing the need to build food environments that are more resilient to future shocks and stresses (Béné, 2020; De Steenhuijsen Pijters et al., 2021; Webb et al., 2021), and contribute to the progressive realization of the right to food (HLPE, 2020). During the early stages of the pandemic, food acquisition was a prominent global concern with scenes of panic buying and empty shelves in food vendors across the globe (FAO/IFAD/UNICEF/WFP/WHO, 2021). Containment measures and mobility restrictions have since continued to impact food supply chains (Picchioni et al., 2021), whilst stay-at-home orders and the sharpest rise in global poverty in 20-years (Egger et al., 2021; World-Bank, 2021) has impaired physical and economic access to nutritious food (FAO/IFAD/UNICEF/WFP/WHO, 2021).

While there is a range of literature regarding changes in food supply (Chenarides et al., 2020; Priyadarshini and Abhilash, 2021; Tesfaye et al., 2020), food security (Ceballos et al., 2021; Egger et al., 2021; Laborde et al., 2021; Niles et al., 2020b; Picchioni et al., 2021; Sharma et al., 2020), and food consumption (Enriquez-Martinez et al., 2021; Janssen et al., 2021; León and Arguello, 2021; Maredia, 2020; Niles et al., 2021b; Picchioni et al., 2021) during Covid-19, very few studies have assessed the impact of the pandemic on consumer food behaviors through a food environment lens. To our knowledge, there is only one multi-country food environment study that was conducted by the Food and Agricultural Organization (FAO) of the United Nations (UN) (FAO, 2020). The remainder of the food environment studies were undertaken at the national or sub-national level. Of these, nearly half were conducted in the United States of America (USA) (n = 4) (Adams et al., 2020, 2021; Hammons and Robart, 2021; Silva et al., 2021), followed by two in Latin America (Brazil, Mexico) (Gonzalez-Alejo et al., 2020; Horta et al., 2021), and one each in Africa (Zimbabwe) (Murendo et al., 2021), Asia (China) (Ahmed et al., 2020), and the Pacific Islands (Samoa) (Emiliata et al., 2020). The majority of studies reported changes in external food environments, including the natural, built (Ahmed et al., 2020; FAO, 2020) and digital (Horta et al., 2021), home food environments (Adams et al., 2020, 2021; Hammons and Robart, 2021), and household and individual-level food acquisition practices

(Emiliata et al., 2020; Murendo et al., 2021; Silva et al., 2021) since the onset of the pandemic, with differences and similarities observed between level of country development, stringency of pandemic-related mitigation strategies, and socio-economic status. The one multi-country study that has been conducted interviewed urban food system stakeholders such as provincial government officers (FAO, 2020). From the above studies, only three sought to understand the lived experiences of food environment changes during the pandemic using qualitative methodologies (Emiliata et al., 2020; Hammons and Robart, 2021; Silva et al., 2021). No study to date has assessed the impact of Covid-19-related mitigation strategies on food environments at the consumer level across multiple countries or contexts during the early months of the pandemic.

This study aimed to understand the immediate individual-level perceptions and experiences of food environments and food acquisition practices across the globe during the early months of the Covid-19 pandemic using qualitative and quantitative methods. We utilised a short online questionnaire as per rapid assessment survey methods to capture relative changes in food environments and food acquisition practices during the second month of the pandemic (UN Women, 2020a). This approach facilitated the wide scale and timely distribution of the survey via various networks, to collect data from individuals in the safety of their own homes. Findings will inform the development of healthy, sustainable food environments that are more resilient to future shocks.

2. Methods

2.1. Study design

This study was undertaken between 15 and April 30, 2020, one month after the World Health Organization declared Covid-19 a pandemic. By April 30th, 2020, the virus had spread to 96% of countries amounting to 4,350,096 cases (JHU, 2020) and 217,769 deaths (WHO, 2020b) (Fig. 2). The United States of America (USA) and Western Europe were active epicentres, with emerging epidemics in Russia, Latin America, and South Asia. At this time, 95% of countries had deployed strategies to control Covid-19 transmission, with a quarter of countries living under severe lockdown conditions defined as an Oxford Covid-19 Government Response Stringency Index score of ≥ 90 out of 100 (Hale et al., 2021). Countries with severe scores included the Philippines

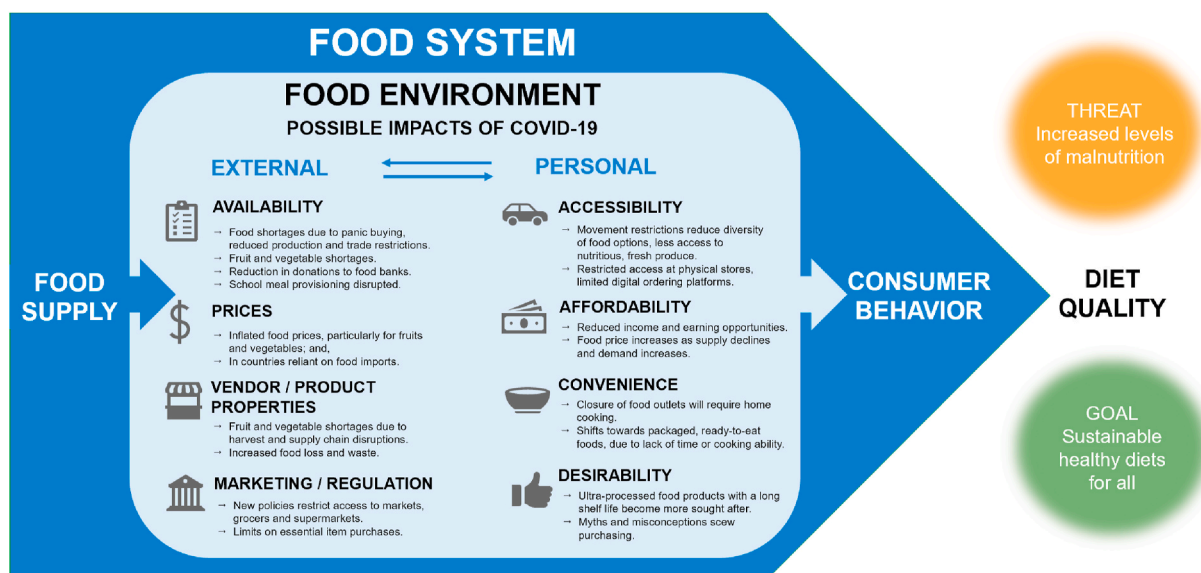


Fig. 1. Possible impacts of the Covid-19 pandemic on food environments as depicted by the United Nations System Standing Committee on Nutrition (UNSCN) (adapted from Turner et al., 2018).

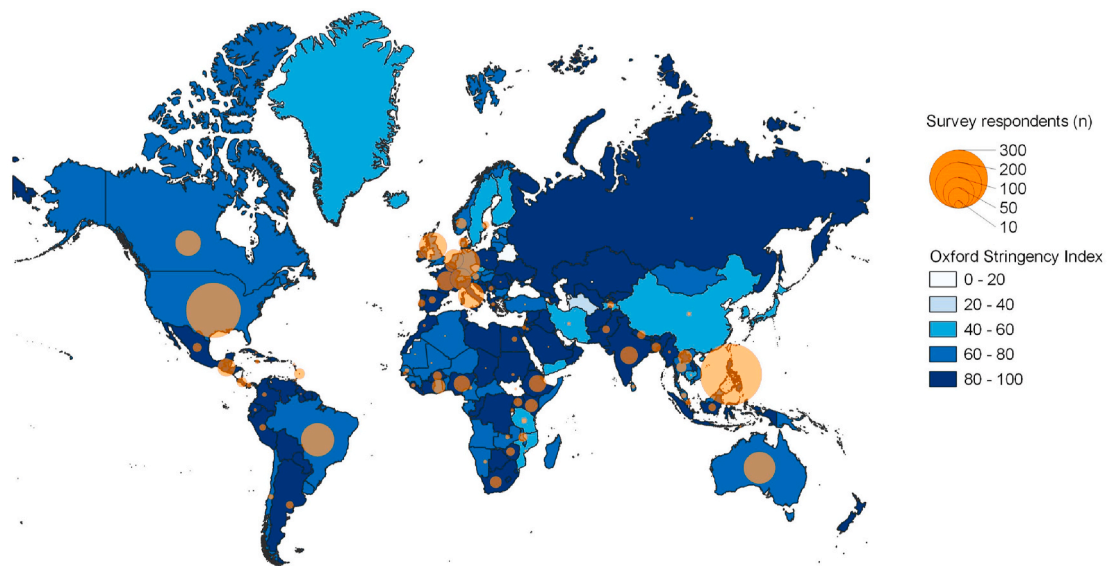


Fig. 2. A world map depicting the Oxford Covid-19 Government Response Stringency Index¹ as of the 30th April 2020 (the last date of primary data collection from the online survey) and the global distribution of survey respondents ($n = 2015$) by country ($n = 119$). The majority of respondents reported from low- and middle-income countries (51.0%) and the following regions: Western Europe, North America and Canada (48.0%), Asia Pacific (25.7%), Africa (12.7%), and Latin America and the Caribbean (12.4%). **Source:** Oxford Covid-19 Government Response Stringency Index (Hale et al., 2021); Authors own.

¹ The Oxford Covid-19 Government Response Stringency Index is a simple additive composite score rescaled to a value between 0 and 100 (strictest) to allow for standardized comparisons of government responses to addressing the spread of the Covid-19 virus; it is based on nine indicators including the closure of schools, workplaces and public transport, stay-at-home orders, restrictions on gathering sizes, and bans on inter- and intra-country travel (Hale et al., 2021).

(100), India (96) and Italy (94).

This study utilised a short anonymized online survey as per rapid assessment methods recommended by the United Nations (UN Women, 2020a), and successfully utilised in other studies (Di Renzo et al., 2020b; Eat Well Tasmania, 2020; FAO, 2020; Maredia, 2020; Niles et al., 2020b). The survey was primarily distributed through the UNSCN networks. Participants were first recruited through an existing contact list (pre pandemic) of individuals that subscribed to receive publications and questionnaires from the UNSCN. The survey was first sent via an e-alert e-mail to the UNSCN publication subscribers ($n = 3052$). The invitation to participate was posted in the following communities of practice and e-discussion platforms hosted by the UNSCN: (i) Agriculture-Nutrition Community of Practice, (ii) Accelerated Reduction Effort on Anaemia Community of Practice, (iii) Nutrition and Noncommunicable Chronic Diseases e-Discussion Forum, and (iv) Nutrition and Climate Change eGroup. In all communications, the invitation to participate in the survey included a request to redistribute the generic survey link to other networks using snowball methods. Lastly, the survey was disseminated through the UNSCN social media channels; website, facebook, and twitter. In total, the e-alert was successfully delivered to 2997 UNSCN subscribers. The total number of opens was 9,850, demonstrating that the original email was redistributed via UNSCN subscriber networks. The link to the questionnaire was clicked 3794 times, giving a completion rate of 53% ($n = 2015$). Adults aged ≥ 18 -years were eligible to participate. Data were collected anonymously via Google Forms.

2.2. Survey development

The food environment framework by Turner et al. (2018) (Fig. 1) informed survey development. The 63-item survey featured structured ($n = 58$) and open-ended ($n = 5$) questions examining changes in food environments, food acquisition practices, food-related behaviors, use of tools and resources, and interest in food and nutrition information (Appendix, Questionnaire). A 5-point Likert scale was used to measure experiences of change, ranging from 1 (decrease) to 5 (increase). Open-ended questions allowed respondents to expand on lived

experience of changes to food-related behaviors since the onset of Covid-19. The UNSCN developed the survey in consultation with experts and was pre-tested.

The questions were developed by the UNSCN based on a published, peer-reviewed, and globally applicable food environment framework (Turner et al., 2018). Given the novelty of the Covid-19 pandemic when the survey was undertaken, no validated questionnaires were available. However, the questionnaire was pilot tested and revised during the development phase with 20 subject context experts at the United Nations (UN) to evaluate the scope, feasibility, and relevance of the questions. Translations from English into French, Spanish, Chinese, Arabic, and Russian, were conducted by professional translators from the Food and Agricultural Organization (FAO) of the UN. The translations in Portuguese and Italian were conducted by UNSCN staff of each mother tongue. All translations were reviewed by a second UN colleague familiar with the terminology and of the same mother tongue to ensure accuracy before distribution. Back translations were conducted in cases where translators indicated a need for further refinement. Discrepancies were minimal and cases were resolved by the official FAO UN translators.

2.3. Data analysis

Descriptive statistics were conducted using SPSS v25 (IBM Statistics). Likert scale responses were recoded into decrease (from 'slight decrease' and 'decrease') and increase (from 'slight increase' and 'increase'). Thematic analysis of the qualitative free text responses ($n = 1151$) identified convergent themes. Responses were first translated into English using Google Translate and each translation was then verified by a person fluent in the language. All responses in the category 'changes to food-related behaviors' ($n = 390$) were translated verbatim for exhaustive coding. The majority of themes and sub-themes reached saturation during this process. All free-text responses were read; however, no further themes emerged. Inductive and deductive coding was undertaken by two independent researchers using a six-step systematic approach (Braun and Clarke, 2006), using Microsoft Excel. The two researchers first familiarized themselves with the free-text responses

before independently identifying and creating codes for emerging sub-themes. Sub-themes were identified based on patterns of meanings present across multiple cases. Because inductive coding is an iterative process, the researchers discussed the coding process and made refinements as necessary (Braun and Clarke, 2006). To unpack any disconfirming evidence, sub-themes were analyzed horizontally across the data and vertically within each case. Any discrepancies were discussed and resolved with the wider team to maximise reliability (Green and Thorogood, 2018). Sub-themes were then deductively coded into overarching themes, guided by the food environment framework (Turner et al., 2018). The majority of sub-themes aligned with dimensions from the conceptual framework, supporting cross-validation of the results. Any sub-themes not captured by the dimensions within the food environment framework were treated as in-vivo themes derived from the data, and were retained to provide contextualised insights (Green and Thorogood, 2018). Mind-mapping techniques aided interpretation. A series of cross-cutting themes considered to be embedded throughout respondents' responses were also identified. Representative quotes were selected and agreed upon by all study authors. Triangulation of data between the descriptive statistics and thematic results showed a high level of consistency, supporting robustness of the study findings (Green and Thorogood, 2018).

2.4. Ethical considerations

This survey was conducted under the UNSCN Strategic Plan 2016–2020 (UNSCN, 2016) and in accordance with the 2000 Declaration of Helsinki. The UNSCN Steering Committee oversees the ethical considerations of the UNSCN Secretariat's activities. Institutional review board approval was not considered a requirement for this rapid assessment online anonymized survey, in line with existing publications utilising this methodology (Di Renzo et al., 2020a, 2020b). Ethical considerations were nevertheless paramount to the study design. All respondents were informed of the ethical considerations related to data use and privacy prior to undertaking the survey. All data was collected anonymously via a generic link. Respondents were informed of their right to refuse to participate without reprisal. Completion and submission of the survey was considered informed voluntary consent. Three UNSCN team members had access to the database and each independently assessed the data outputs to ensure transparency and integrity.

3. Results

3.1. Descriptive statistics

Respondents (n = 2015) spanned 119 countries across six continents (Fig. 2) (Appendix, S1-2). The majority were female (71.9%), from low and middle-income countries (51.0%), from the Western Europe, North America and Canada (48.0%) or Asia-Pacific regions (25.7%), aged 35–54 years old (43.1%), living in small households of 1–2 people (40.7%), in the nutrition or healthcare industry (39.3%), from cities with a population of 300,000 to 3 million (37.3%) (Table 1).

Compared to before the pandemic, the majority of respondents reported decreases in the following food-related behaviors: eating out (91.3%), eating at someone else's place (84.7%), and leaving the house to grocery shop (78.9%) (Fig. 3, A). Conversely, the most prevalent increases were for cooking at home (75.8%) and the use of fruits and vegetables of all types, including fresh (30.2%), frozen (28.9%), and canned (24.4%) (Appendix, S3).

The majority of respondents experienced physical distancing at the point of food acquisition (90.1%), restricted store access (76.6%), physical distancing information (87.8%) and responsible purchasing information (e.g., signage about only purchasing what is needed) (66.5%) in stores (B–C) (Appendix, S4). Most respondents reported stockpiling food (66.9%), increased awareness of food waste (63.1%) (D-E) and bought more food due to fear or anxiety (46.6%) (F-G).

Table 1 Characteristics of respondents (n = 2015) by region (n = 5).

Region	Respondents		Age (years)				Household size (person)				Population size				Occupation				Unemployed/ Retired	Other
	n (%)	Female	≤34	35–54	≥55	1–2	3–4	5+	<10,000	10,000 and 100,000	100,000 and 300,000	300,000 – 3 million	>3 million	Nutrition/ Healthcare	Education	Government	Agriculture/ Food Industry			
Africa	255 (12.7)	119 (5.9)	70 (3.5)	147 (7.3)	38 (1.9)	58 (2.9)	78 (3.9)	119 (5.9)	22 (1.1)	21 (1.1)	28 (1.4)	102 (5.1)	80 (4.0)	122 (6.1)	37 (1.8)	10 (0.5)	35 (1.7)	11 (0.5)	40 (2.0)	
Asia-Pacific	518 (25.7)	356 (17.7)	214 (10.6)	221 (11.0)	83 (4.1)	117 (5.8%)	186 (9.3)	215 (10.7)	43 (2.2)	81 (4.1)	71 (3.6)	209 (10.5)	105 (5.3)	219 (10.9)	43 (2.1)	103 (5.1)	20 (1.0)	17 (0.8)	116 (5.8)	
Eastern Europe	23 (1.1)	15 (0.7)	5 (0.2)	14 (0.7)	4 (0.2)	8 (0.4%)	12 (0.6)	3 (0.1)	4 (0.2)	0 (0.0)	4 (0.2)	10 (0.5)	5 (0.3)	12 (0.6)	4 (0.2)	0 (0.0)	2 (0.1)	0 (0.0)	5 (0.2)	
Latin America	250 (12.4)	192 (9.5)	70 (3.5)	95 (4.7)	85 (4.2)	98 (4.9%)	119 (5.9)	31 (1.5)	21 (1.1)	25 (1.3)	27 (1.4)	75 (3.8)	99 (5.0)	99 (4.9)	17 (0.8)	19 (0.9)	19 (0.9)	37 (1.8)	59 (2.9)	
Western Europe, North America, and Canada	966 (48.0)	764 (38.0)	361 (17.9)	391 (19.4)	214 (10.6)	537 (26.7%)	348 (17.3)	81 (4.0)	131 (6.6)	195 (9.8)	155 (7.8)	345 (17.3)	131 (6.6)	338 (16.8)	187 (9.3)	70 (3.5)	51 (2.5)	78 (3.9)	242 (12.0)	
Missing	3	0	0	0	0	2	0	0	26	322	285 (14.3)	741	420	0	288	202 (10.0)	127 (6.3)	143 (7.1)	462 (23.0)	
Total	2015 (100)	1446 (71.9)	720 (35.8)	868 (43.1)	424 (21.1)	818 (40.7%)	743 (37.0)	449 (22.3)	221 (11.1)	322 (16.2)	285 (14.3)	741 (37.3)	420 (21.1)	790 (39.3)	288 (14.3)	202 (10.0)	127 (6.3)	143 (7.1)	462 (23.0)	

Respondents reported seeking new recipes, especially via websites (36.5%) and a further 13.6% sought nutrition information online (S-T). Of those that had groceries delivered (34.5%), almost a quarter bought from local vendors (24.3%) (J-K). A fifth ordered ready-to-eat meals or food delivered (20.8) (Q-R). When seeking support, a quarter of respondents reached out to friends, family, or neighbors (24.7%) (L-M). Seventeen percent sourced food from home production or from the wild (17.4%) (O-P).

3.2. Key themes

Thematic analysis of the qualitative data identified four primary themes, 10 sub-themes, and five cross-cutting themes (Table 2). Findings related to the primary themes and sub-themes are presented in the sections that follow, whilst the cross-cutting themes are embedded throughout respondent responses.

3.3. Food availability and accessibility

3.3.1. Restricted vendor availability

Respondents described restricted food access due to vendor closures, reduced opening times and physical distancing measures:

“What affected me the most is the [closure of] markets where I usually buy organic and locally produced fresh food. I had to buy such products [at] supermarkets after COVID ...” (F, 25–34 years, Italy, Europe)

“Some concern about [obtaining] healthy food, given long supermarket lines and restrictions on food vendors and opening times.” (F, 65–74 years, Barbados, Latin America)

However, not all respondents experienced the same level of restrictions:

“Not much change overall since access to fresh market nearby is still possible, though frequency of market visits has decreased.” (F, 65–74 years, Thailand, Asia)

3.3.2. Food shortages

Food shortages were described across many settings. Respondents from low- and middle-income countries (LMICs) such as India, Brazil, Philippines, Jordan, and Kenya noted reduced availability of perishable foods, compared to shortages of staple foods in high-income countries (HICs):

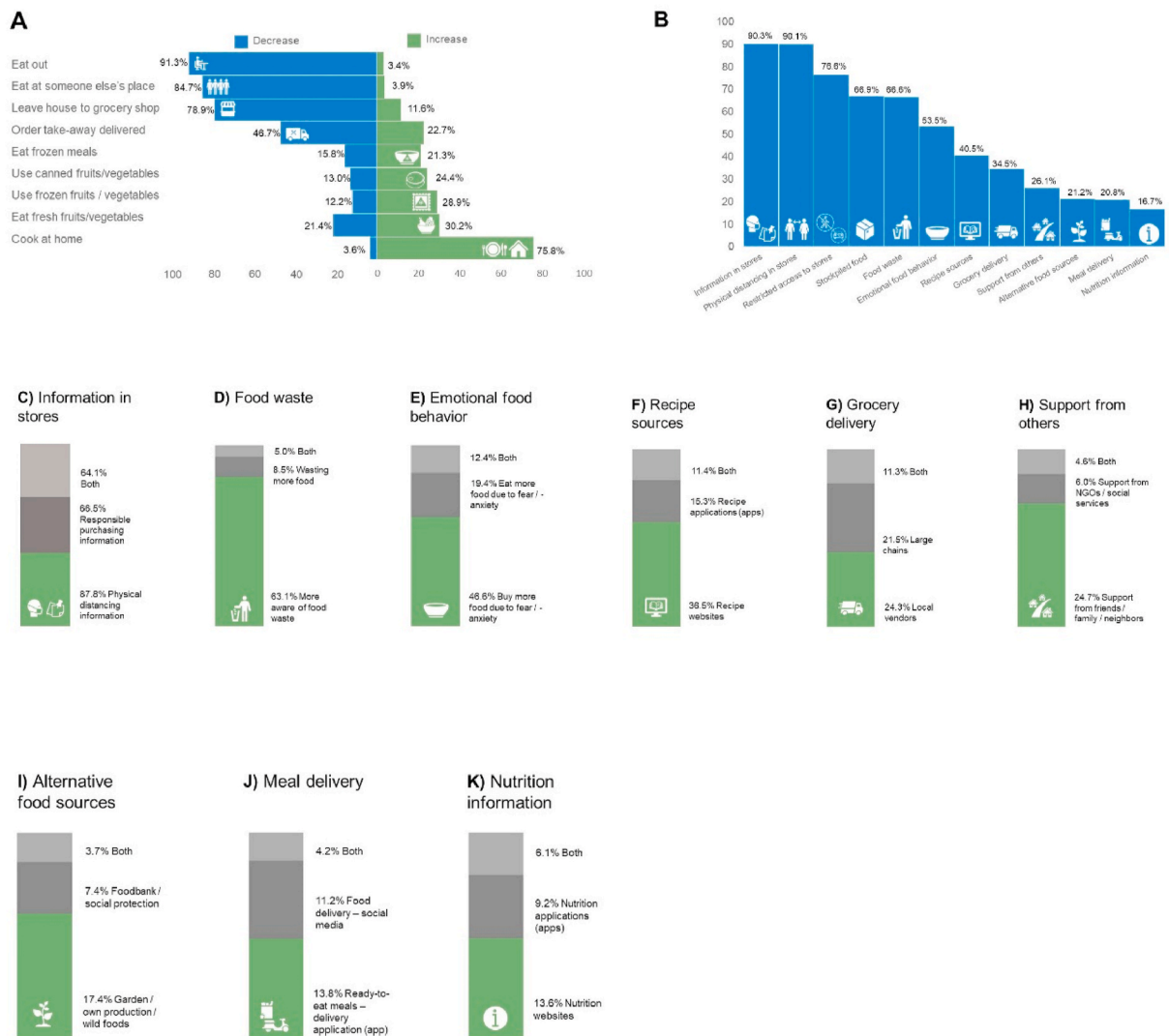


Fig. 3. (A) Reported change (%; increase or decrease) in food related behaviors (note: will not sum to one hundred percent because ‘No change’ responses were omitted for clarity of presentation) (Appendix, S3–S4). (B–K): Reported change (%; yes) in food related behaviors and experiences since the onset of the Covid-19 pandemic. The exploded bar graphs (C–K) present a breakdown of each category from the corresponding columns from (B).

"[Limited availability of] reliable fresh fish and meat has meant greater reliance on vegetarian foods and cooking." (F, 35-44-years, India, Asia)

"... Supermarkets are selling out of all the poor food group items ... white bread, white flour, white rice etc ... the good thing is the alternative stores and health foods are still well stocked and fresh food is readily available." (F, 35-44-years, Australia, Asia-Pacific)

3.3.3. Mobility restrictions

Mobility restrictions were reported to have reduced physical access to food in the majority of countries:

"... curfew in my areas is a strict lockdown, meaning that grocery stores are not open for in-person shopping and we cannot leave the house." (M, 35-44 years, Sri Lanka, South Asia).

"I used to eat a lot more organic food, but because it is not readily available in my neighborhood, and due to movement restrictions, I do not eat it anymore." (F, 45-54-years, Italy, Western Europe)

Several LMIC respondents described how informal mobile vendors helped to mitigate mobility restrictions:

"Fortunately, street vendors bring perishables to our area." (F, 55-64-years, India, Asia)

3.3.4. Home delivery

Narratives around the home delivery of fresh produce were common among respondents from diverse settings:

"... instead of visiting a market frequently, I am purchasing weekly [...] direct from the farm using their home delivery service." (F, 35-44-years, Canada, North America)

"I'm using e-commerce a lot lately to purchase fresh fruits and vegetables ..." (F, 25-34-years, Nepal, Asia)

However, several respondents described limited delivery options, due to lack of services in the Philippines, and waiting lists in Germany, USA, and Uganda. Reliance on social networks to source food was described by the elderly and those quarantining:

"[I] haven't been able to get a delivery slot, but a friend delivered some groceries for me." (F, 65-74-years, USA, North America).

"Our children are food shopping for us." (M, 65-74-years, Switzerland, Western Europe)

One respondent described a civic group bridging the gap between onset of lockdown and formalised food provision:

"Our town [...] established a community help group early in the crisis to deliver food and meals to the elderly and other vulnerable people [...] for a few weeks until local government action was established." (M, 55-64-years, Ireland, Western Europe)

3.4. Prices and affordability

3.4.1. Income and food prices

Participants reported sharp rises in financial insecurity due to reduced employment opportunities, and explained how this had impacted on their ability to purchase food, particularly in LMIC settings:

"There has been a sharp decrease in my household income as it is becoming difficult to get income to support our daily expenses on food, water, electricity." (F, 45-54-years, Nigeria, Africa)

"Due to lock down people are dying due to food shortage, because majority of people are working on daily basis, having no money saved." (M, 45-54-years, Pakistan, Asia)

Some women reported decreased earning potential due to the closure of childcare and schools and the time burden associated with home-schooling and unpaid housework:

"(1) Childcare - teaching/supervising/entertaining children at all times. (2) Cleaning house - time increased (3) Future employment jeopardized: my position is ending, I cannot start a new job while home-schooling." (F, 35-44-years, USA, North America)

Some respondents reported increased food prices, especially in the relatively volatile markets of LMICs across Africa and Asia:

"[The] cost of food has increased drastically." (F, 45-54-years, Sierra Leone, Africa)

"Increase in the prices of food items available in the markets, vegetables, fruits, meat and fish." (F, 45-54-years, Philippines, Asia-Pacific)

In the relatively stable HIC markets, respondents attributed increases in food expenditure to paying a premium for convenience, either by buying at more expensive local stores or due to the costs associated with home delivery services:

"In avoiding large grocery stores, I have been shopping more locally, which means shopping for much more expensive food. I am fortunate to be able to do so, especially as this means supporting local businesses, but it does have a financial impact." (F, 25-34-years, Canada, North America)

"Using delivery services for groceries is more expensive." (F, 65-74-years, USA, North America)

3.5. Food acquisition practices

3.5.1. Shopping behavior

Respondents outlined a series of changes in shopping behavior. Some described changing their choice of vendor type motivated by a willingness to practice physical distancing:

"I have changed the places where food is purchased, I am preferring places with less movement and, also, wider, to avoid close contact with other people." (F, 55-64-years, Brazil, Latin America)

"Opting for open market instead of supermarket - easier to practice social distancing." (M, 25-34-years, Netherlands, Western Europe)

Stockpiling behavior was also reported worldwide in efforts to reduce shopping frequency:

Table 2
Primary themes, sub-themes and cross-cutting themes identified from free-text responses.

Primary themes	Sub-themes	Cross-cutting themes
1. Food availability and accessibility	Restricted vendor availability Food shortages Mobility restrictions Home delivery	Community food participation Food sharing Time and resource allocation
2. Prices and affordability	Income and food prices	Healthy diets awareness
3. Food acquisition practices	Shopping behavior Support for local vendors Alternative food sources	Food waste awareness
4. Food preparation and consumption	Home cooking and food literacy Dietary changes	

“Stocking adequate dry food rations. Increase in quantities of fresh perishables to avoid frequent visits to the market.” (F, 35-44-years, South Sudan, Africa)

“Rationing supplies to minimise visits to grocery shops and exposure.” (F, 45-54-years, Italy, Western Europe).

However, many HIC respondents reported stockpiling in response to panic buying; whereas LMIC respondents bought more for fear that supply chains would fail:

“[I] do more shopping as others buy too much.” (M, 55-64-years, Germany, Western Europe)

“[I] have started to stock up on some food since it is uncertain how long the supply chains will hold out.” (F, 25-34-years, Bangladesh, Asia)

3.5.2. Support for local vendors

Respondents expressed support for local livelihoods, manifested in conscious efforts to procure food from local producers and vendors:

“[I buy] more seafood to support local fishermen.” (F, 35-44-years, France, Western Europe)

“I buy fresh vegetables and fruits directly from farmers (who provide delivery services) so their livelihoods are not impacted negatively.” (F, 55-64-years, Barbados, Latin America)

In some cases, respondents highlighted how this had impacted on the quality of food:

“I have bought more from local sellers even if the quality is lower, partly to support the local economy and partly to not travel further.” (F, 35-44-years, Guatemala, Latin America)

3.5.3. Alternative food sources

Many respondents described a growing sense of community solidarity, which materialised in the gifting of food:

“Sharing more of my own garden produce with my neighbors ...” (F, 45-54-years, Australia, Asia-Pacific)

“I'm buying more food staples to give away to needy people.” (F, 65-74-years, Ecuador, Latin America)

“I have been cooking more at home and sending over food to my family ... It is a way of staying in touch in spite of the physical distancing ...” (F, 35-44-years, Italy, Western Europe)

A number of respondents from LMICs noted their increased reliance on family farms, whilst several HIC respondents had started home gardens to reduce dependence on market-based food sources.

3.6. Food preparation and consumption

3.6.1. Home cooking and food literacy

Due to stay-at-home orders, respondents reported “more time to prepare fresh vegetables and healthy cooking” (F, 55-64-years, Germany, Western Europe) and “learning new recipes to increase variety of home cooked meals” (F, 35-44-years, Bangladesh, Asia).

Motivated to reduce shopping frequency and heightened awareness of food waste, participants demonstrated a willingness to improve cooking skills:

“Preparing and eating meals I might not normally prepare, so I can use ingredients I already have [...] to reduce shopping trips.” (F, 45-55-years, Australia, Asia-Pacific)

3.6.2. Dietary changes

Dietary changes were found to be contrasting among respondents. Whilst some were reportedly “more in the mood for sweet or high-fat foods” (F, 35-44-years, Mexico, Latin America) due to lockdown induced boredom, others described eating less discretionary foods and fresh produce due to mobility restrictions:

“... now with reduced trips to shops, consumption of these [candy, chocolate and beer] have gone down to zero. Sadly, so has the consumption of perishable leafy greens.” (F, 55-64-years, Finland, Western Europe)

Due to increased time at home, some respondents adopted healthier food patterns such as “meeting 5+day of fruit and vegetables” (F, 35-44-years, New Zealand, Asia-Pacific). In one case this had a positive impact on emotional wellbeing:

“I cook more, I have the time to do it while I work. I have coffee, lunch and dinner at the appropriate times and share the table with my family. I am happy.” (F, 35-44-years, Brazil, Latin America)

However, in contrast several respondents from Africa, Asia, and Latin America described moderate to severe food insecurity behaviors:

“Limiting the number of meals eaten per day and portion sizes fearing that food may finish before the lockdown ends and we lay [to] starve.” (F, 25-34-years, Zimbabwe, Africa)

“I am eating less frequently now and lesser amount.” (F, 55-64-years, Philippines, Asia-Pacific)

“I ration how much we eat, so we don't overeat and also don't waste precious food.” (F, 55-64-years, Barbados, Latin America)

4. Discussion

This study aimed to understand the consumer perceptions and experiences of food environments and food acquisition practices across the globe during the early months of the Covid-19 pandemic. Individual insights from 119 countries spanning Western Europe, North America, Latin America, Asia-Pacific, and Africa provide a novel contribution to the literature by complementing existing publications that have typically focused on singular case studies at the national or sub-national scale (Di Renzo et al., 2020b; Eat Well Tasmania, 2020; Maredia, 2020; Niles et al., 2021a). Our results reveal a series of common experiences related to: (i) food availability and accessibility; (ii) food prices and affordability; (iii) food acquisition practices; and (iv) food preparation and consumption. In addition, the five cross-cutting themes found to be embedded throughout respondent narratives highlight the perceived importance of community food participation, food sharing, and time and resource allocation, as well as increasing awareness of healthy diets and food waste in response to the Covid-19 pandemic. Here, we position our findings in relation to the wider literature to identify a series of policy entry points to promote food environment resilience and sustainable healthy diets for all.

4.1. Food availability and accessibility: diversified food sources and decentralized markets

Our findings regarding food availability and accessibility reinforce the global food procurement challenges described elsewhere during the early days of the pandemic (Chenarides et al., 2020; Egger et al., 2021; FAO, 2020; Janssen et al., 2021; León and Arguello, 2021; Maredia, 2020; Niles et al., 2020b; Rozelle et al., 2020; Tesfaye et al., 2020). Despite the exemption of food industries from closures in many settings, strict mobility restrictions (Hale et al., 2021) resulted in labor shortages and disrupted trade flows, impairing food production and distribution, as demonstrated in India (Narayanan and Saha, 2021) and the

Philippines (FAO, 2021). The fresh produce shortages reported by LMIC respondents in our study support evidence from Africa (Egger et al., 2021; FAO, 2020), Asia-Pacific (FAO, 2021; Ferguson et al.,), and South Asia (Mahajan and Tomar, 2021; Maredia, 2020; Narayanan and Saha, 2021; Priyadarshini and Abhilash, 2021). In India, transportation bottlenecks resulted in a 10–20% drop in fresh fruit and vegetable availability (Mahajan and Tomar, 2021), highlighting the fragility of long supply chains in LMICs (Reardon et al., 2020).

Literature supporting the diversification and shortening of food supply chains has been increasingly gaining momentum (Carey et al., 2020; Chenarides et al., 2020; Farrell et al., 2020; Ferguson et al.,; Mahajan and Tomar, 2021; Picchioni et al., 2021; Singh-Peterson and Lawrence, 2015; Smith and Lawrence, 2014). Evidence from this study and the wider literature suggests a need to harness the synergistic effects of both conventional and alternative food sources in food environments (Turner et al., 2018, 2019), to improve food availability and accessibility, stabilise food security and improve environmental preservation (FAO, 2014; Galli and Brunori, 2013; O'Meara et al., 2021; Sonnino and Marsden, 2006), especially given challenges of food distribution through existing long supply chains during shocks (FAO, 2021; Ferguson et al.,; Mahajan and Tomar, 2021; Singh-Peterson and Lawrence, 2015), and the predicted increase in shocks related to population growth, climate change, and zoonotic spill over events (Myers et al., 2017). The heightened consumer demand for locally-produced foods demonstrated in our study may be leveraged to foster stronger producer-to-consumer connections to support livelihoods and improve the resilience of food environments (Carey et al., 2020; Downs et al., 2020; Galli and Brunori, 2013; Picchioni et al., 2021). Evidence from this study also reinforces calls for governments to support the development of e-commerce capacity and skills which will bolster digital retail connectivity and enhance delivery services that may eliminate barriers to nutrient-rich foods during open market closures (FAO, 2020; Hawkes et al., 2020; Priyadarshini and Abhilash, 2021), including solutions to bridge the digital divide to ensure access to the most food insecure (Kaiser et al., 2020). Food distribution initiatives such as decentralized mobile pop-up markets in Peru (FAO, 2020), Philippines (FAO, 2021), and Nigeria (Oni et al., 2020); and cashless farmers markets and fixed price vegetable baskets distributed via community organizations in Jamaica (Oni et al., 2020) provide examples of solutions that may be up-scaled to improve food distribution to all community members.

4.2. Food prices and affordability: price monitoring and financial safety nets

Our findings regarding food prices and affordability support the wider literature demonstrating how the Covid-19 pandemic has resulted in reduced employment opportunities in the face of increasing food prices (Egger et al., 2021; FAO, 2020; Laborde et al., 2021; Picchioni et al., 2021). One study of 30,000 households from nine LMICs found that 67% of respondents experienced income losses during the early phase of the pandemic (Egger et al., 2021), with workers from the informal sector the most vulnerable due to lack of sufficient social safety nets (Maredia, 2020; UN Women, 2020b). A nationally representative study from Bangladesh found that 50% of rural households entered extreme poverty during the first lockdown, with moderate-severe food insecurity jumping from 5% to 26% (Hamadani et al., 2020). Globally, food prices have risen in many cities, although increases have been higher in LMICs than HICs (FAO, 2020), highlighting the disproportionate economic impact of the pandemic on LMICs (Laborde et al., 2021), similar to the 2008-09 Global Financial Crisis (Brinkman et al., 2010). The mean price of maize flour and dry beans rose by 17% and 70% respectively in urban Uganda (Buzigi and Onakuse, 2020), whilst in Nigeria, the mean price of maize and rice increased by 26% and 44% respectively (Adewopo et al., 2021). Similarly, in India, prices increased for lentils, vegetables, fish, and meat across 114 urban centres (Narayanan and Saha, 2021).

As the world grapples with a prolonged recession in the wake of the pandemic, the gap between rich and poor will widen, revealing long-term nutrition consequences (FAO/IFAD/UNICEF/WFP/WHO, 2021; Osendarp et al., 2021; Robertson et al., 2020). The economic fallout has exacerbated the financial vulnerabilities of the casual workforce, land-less rural poor, and low-educated self-employed (Egger et al., 2021; Janssen et al., 2021; Maredia, 2020; Niles et al., 2020a; Picchioni et al., 2021; WorldBank, 2021). Women are particularly vulnerable with 10% worldwide at higher risk of food insecurity compared with men, regardless of location or income (FAO/IFAD/UNICEF/WFP/WHO, 2021), due to increased burden of unpaid care work, disproportional involvement in informal work, and gender pay gaps (UN Women, 2020b). To improve financial access to food, it is imperative that governments monitor food availability and prices (FAO, 2020), such as crowd sourcing detailed, localized, and timely food prices via consumers using digital methods as demonstrated in Nigeria (Adewopo et al., 2021); and provide social security safety nets such as cash transfers and food vouchers, especially for the most vulnerable groups (Egger et al., 2021; FAO/IFAD/UNICEF/WFP/WHO, 2021; León and Arguello, 2021; Picchioni et al., 2021).

4.3. Food acquisition practices: social capital and local community food participation

Our findings related to food acquisition practices demonstrate a series of adaptive behaviors among consumers across the globe. To mitigate the risk of contagion and in response to fear and anxiety, reports of reduced frequency of shopping and stockpiling were common in our study, consistent with a global FAO report (FAO, 2020), and evidence from Asia-Pacific (Eat Well Tasmania, 2020), Europe (Di Renzo et al., 2020b; Janssen et al., 2021), North America (Niles et al., 2020a), and South Asia (Narayanan and Saha, 2021). This finding reveals how survival psychology – the drive to gain control over feelings of fear – triggers consumer behavior change, and echoes findings from historical crises (Loxton et al., 2020). The use of alternative food sources such as own production and food sharing between friends, family and neighbors in our study aligns with findings from the USA, where home food procurement (e.g., home gardening, fishing, hunting) and sharing food was commonplace during the pandemic (Niles et al., 2020a). The support for local vendors and livelihoods in our study, along with preferences for direct producer-to-consumer sales and home delivered groceries supports wider evidence from Australia (Eat Well Tasmania, 2020), Italy (Di Renzo et al., 2020b), India (Narayanan and Saha, 2021), and Jamaica (Oni et al., 2020).

Social capital—a measure of trust, reciprocity, and social networks—underpins community resilience (Magis, 2010) and has been shown to be protective against food insecurity (Niles et al., 2021a). The mobilization of self-help groups in India to provide nutritious food during the pandemic (Kant, 2021) is an example of how existing civic groups with established community relationships and trust can be leveraged to distribute food in times of need (Maybery et al., 2009; Singh-Peterson and Lawrence, 2015). Similarly, in the Pacific Islands where small island developing states are particularly vulnerable to supply chain disruptions (Farrell et al., 2020), home food production and kinship food sharing practices proved protective against food insecurity (Ferguson et al.,). In the past, food sharing between relatives and neighbors has been shown to be important for maintaining food security in settings as diverse as Peru (Lee et al., 2018), Tanzania (Hadley et al., 2007), South Africa (Lemke et al., 2003), and the USA (Martin et al., 2004). Social capital is associated with improved nutrition outcomes in children (Fernandez-Concha et al., 1991; Shiba and Kondo, 2019). However, social support is more effective among wealthier communities, suggesting that under a certain wealth threshold, social support is not sufficient to compensate for absolute poverty (Hadley et al., 2007; Sutcliffe et al.,). This indicates that multi-faceted approaches that foster social capital while also providing financial safety nets are warranted to ensure community food

security.

4.4. Food preparation and consumption: food literacy, food waste and dietary changes

Our findings related to food preparation and consumption highlight the role of home cooking during the pandemic and the willingness among many to improve food literacy skills, supporting findings from the USA (Niles et al., 2020a), Australia (Eat Well Tasmania, 2020), and Italy (Di Renzo et al., 2020b). Food literacy – defined as an individual’s proficiency in food related skills and knowledge – is an example of human capital associated with healthier food behaviors (Poelman et al., 2018). In addition, the increased awareness of food waste found in our study also supports findings from Tunisia (Jribi et al., 2020) and Australia (Eat Well Tasmania, 2020). The enhanced consumer awareness of food waste and health, and interest in food related skills demonstrated during the pandemic, may provide leverage points for promoting adoption of positive food behaviors that align with planetary healthy diet guidelines (Willett et al., 2019). The outcomes could be multi-fold; improved nutrition and stronger immune systems could protect individuals against severe complications of viral infections in the short-term (James et al., 2020; Muscogiuri et al., 2020; Wu et al., 2020) while providing positive downstream effects in environmental preservation, public health, and economic recovery beyond the pandemic (Berners-Lee et al., 2018; Osendarp et al., 2021).

Our findings regarding disparate reported dietary changes highlight contrasting experiences during the initial phase of the pandemic. Some respondents in our study reported eating less fresh fruits and vegetables. In LMICs, loss of diet quantity and quality is likely due to food shortages or loss of income (FAO/IFAD/UNICEF/WFP/WHO, 2021; Picchioni et al., 2021). For example, early evidence from across nine LMICs in April 2020 revealed that more than half of consumers had reduced portion sizes or skipped meals (Egger et al., 2021), similar to the 2014–15 Ebola crisis where Western African households, regardless of income and education levels, consumed lower quality foods (Kelly et al., 2018) and skipped meals due to food shortages (Ordaz-Németh et al., 2017). In MICs and HICs this

decrease in fresh produce intake might be due to reduced shopping frequency (Janssen et al., 2021; León and Arguello, 2021) or loss of employment and increasing food insecurity, as demonstrated in the USA (Niles et al., 2020a). Conversely, some respondents in our study reported eating more fruits and vegetables, aligning with early evidence from Germany, Denmark (quota-based sample) (Janssen et al., 2021), Australia (convenience sample) (Eat Well Tasmania, 2020), Italy (convenience sample) (Di Renzo et al., 2020b), and Spain (convenience sample) (Rodríguez-Pérez et al., 2020), suggesting that the relatively consistent supply of fresh produce in some countries, combined with strong social safety nets, may result in increased consumption by consumers motivated to adopt healthier habits. Interestingly, a state wide representative study in the USA demonstrated that some food insecure households actually increased fruit and vegetable intake during the pandemic due to utilisation of food aid (Bertmann et al., 2021) and home food self-sufficiency (e.g., gardening, fishing, foraging, and hunting) (Niles et al., 2021b). Disparate changes in dietary intake in more developed countries (Di Renzo et al., 2020b; Giacalone et al., 2020; Janssen et al., 2021; León and Arguello, 2021; UNICEF, 2020) also implies that heightened stress, emotional eating and variations in food literacy skills may underscore contrasting changes in eating behaviors (Bemanian et al., 2021; Bhutani and Cooper, 2020; Di Renzo et al., 2020a). To mitigate the public health nutrition consequences of the pandemic, including undernutrition and micronutrient deficiencies (Laborde et al., 2021; Osendarp et al., 2021; Robertson et al., 2020; Victoria et al., 2021) and overweight and obesity (Chopra et al., 2020; Rundle et al., 2020; Zachary et al., 2020) targeted support is needed for vulnerable population groups such as the already malnourished, young, elderly, those experiencing greatest disruption to routine, single parents, and those with lack of social support (Di Renzo et al., 2020b; Janssen et al., 2021; León and Arguello, 2021; Shiba and Kondo, 2019; UNICEF, 2020).

4.5. Policy implications

We identify a series of ten policy entry points to build more resilient food environments and harness positive dietary-related behaviors manifested during the pandemic (Fig. 4). These policy entry points are

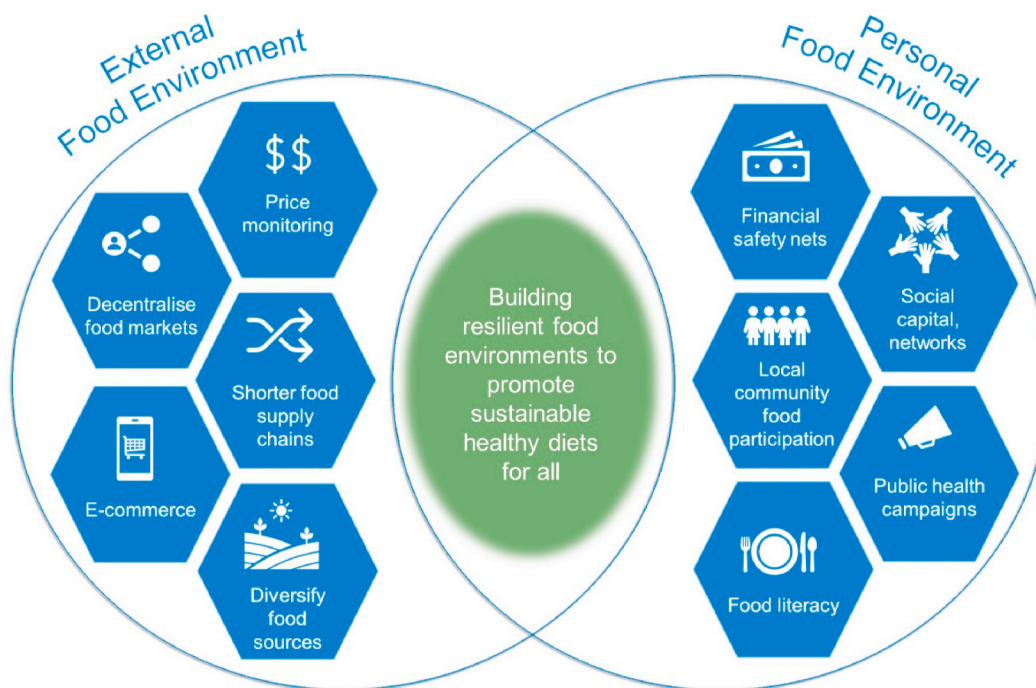


Fig. 4. Ten policy entry points (blue hexagons) to build more resilient food environments and harness positive dietary-related behaviors manifested through the pandemic, mapped to the external and personal food environment domains. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

informed by our primary findings and the discussion of the wider literature above, and are structured according to the external and personal food environment domains from the Turner et al. (2018) framework. The pandemic has catalysed debate around resilient food systems and food environments (Béné, 2020; De Steenhuijsen Piters et al., 2021; Downs et al., 2020; Webb et al., 2021), framed against global narratives of the need to 'build back better'. Resilience it is not merely about withstanding stressors and shocks but more importantly the ability to build capacity to anticipate, prevent, absorb, and adapt from these experiences (Barasa et al., 2018; De Steenhuijsen Piters et al., 2021). The emergent literature has put forward a series of broad resilience capacities related to financial assets, social capital, and human capital (Béné, 2020), and further outlined a set of key properties for resilience building that include: 1) ensuring agency of people to mitigate risks and to respond to shocks; 2) creating buffers to fall back on; 3) stimulating connectivity between actors and markets; and, 4) enhancing multiscale diversity from production to consumption (De Steenhuijsen Piters et al., 2021). We consider these capacities and properties to be embedded throughout our policy entry points, providing a pertinent point of departure for food environment research and policy action going forward.

4.6. Strengths and limitations

Strengths of this study include: 1) the use of a short online survey as per rapid assessment methods recommended by the UN (UN Women, 2020a), allowing for timely and safe data collection during the initial onset of the pandemic; 2) the large heterogeneous sample derived from five distinct geographical regions; 3) the balanced representation between LMICs (51.0%) and HICs (48.9%); 4) the use of a globally applicable food environment framework (Turner et al., 2018) to inform analysis; and, 5) the triangulation of quantitative and qualitative data and high degree of internal consistency across datasets. In terms of limitations, online data collection modalities can be overrepresented by socio-economically privileged individuals. However, mobile phone ownership and affordable data plans are on the rise in MICs, providing increasing access to online surveys (UN Women, 2020a). Due to our convenience sampling, we were unable to quantify nationally representative measures. This study is overrepresented by females from small households working in healthcare, limiting translation of results to other population groups. Given our distribution channels through nutrition and agriculture networks, this study might be over representative of health-aware individuals. Moreover, it is likely to be underrepresented by low-literate, poorer individuals due to the use of online data collection methods. It is important that future pandemic-related food environment research consider methods that can better transcend literacy and financial barriers while still maintaining physical distancing measures such as telephone-based methods (UN Women, 2020a).

5. Conclusion

This study presents consumer experiences of food environments and food acquisition practices from 119 countries spanning Western Europe, North America, Latin America, Asia-Pacific, and Africa during the early months of the Covid-19 pandemic. Given the paucity of qualitative Covid-19 food environment research, this study provides novel contextual depth to the perceptions and lived experiences of consumers across diverse contexts. Our findings reveal a series of common global experiences related to food availability and accessibility, food prices and affordability, food acquisition practices, and food preparation and consumption. The importance of community food participation, food sharing, and time and resource allocation in response to the Covid-19 pandemic is also highlighted, as is an increasing awareness of healthy diets and food waste. As of mid-2021, Covid-19 infections and rolling lockdowns continue across many settings worldwide, reinforcing the urgency of food environment initiatives to address the deepening nutrition crisis. A synergistic approach is needed, combining innovative

responses in food systems and food environments to provide and ensure access to sustainable, healthy diets and harness positive adaptive behaviors adopted by some consumers in response to the pandemic. The ten policy entry points, mapped to the external and personal food environment domains from the Turner et al. (2018) framework, provide a point of departure for research, policy, and action on the road to achieving food environments that are more resilient in the face of chronic stresses and future shocks. This watershed moment in history provides an opportunity to improve food system resilience, promote sustainable healthy diets for all, and contribute to the progressive realization of the right to food.

Author contributions

S.O., D.C.C., C.T. and L.O. conceptualized the manuscript; S.O. and D.C.C. designed and conducted data collection; C.T., provided feedback on the survey design; L.O. and C.T. analyzed data; L.O., and C.T., drafted the manuscript and designed the figures; D.C.C. and S.O. provided critical feedback on the manuscript; all authors read and approved the final manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gfs.2021.100594>.

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