



Short Communication

Healthier eating: Covid-19 disruption as a catalyst for positive change

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ABSTRACT

Healthy and sustainable diets are necessary for global development goals, but people struggle to modify their eating behaviours which are often habitual and resistant to change. However, disruption can provide the impetus for change, and in the present research we view the Covid-19 pandemic as a potential catalytic disruption with the potential to induce positive behaviour change. Data were obtained from ~900 USA adults, of which 44% self-reported to have made positive dietary change/s. Those who did so tended to be younger rather than older and with higher educational attainment. They also were less food neophobic than people who did not make positive change/s and placed greater importance on health as a motive of daily decisions about what to eat and drink. The contribution of psychographic variables in differentiating between groups of people who did / did not make positive changes once again show their importance in uncovering and explaining the complex factors that motivate food-related consumer behaviour. It seems this holds also when daily lives are disrupted by unforeseen events.

1. Introduction

Achieving healthy and sustainable diets is necessary for global development goals (Willett et al., 2019). However, encouraging people to modify their eating behaviour has proven to be a difficult task. A significant part of our eating behaviours consists of habits that are enduring and difficult to change, as they usually arise automatically in response to particular cues in specific contexts (van't Riet et al., 2011). Yet, habits can also be disrupted by change, and major disruptions in daily life are, therefore, opportunities to achieve healthier and more sustainable dietary behaviours (Schäfer, Jaeger-Erben, & Bamberg, 2012).

Covid-19 is undoubtedly one of the most disruptive events faced by humankind in recent times. The measures implemented to curb the pandemic have modified daily life and have introduced marked changes in consumer behaviour (Sheth, 2020). Although Covid-19 has been reported to cause both positive and negative changes in eating behaviours (Borsellino et al., 2020), the focus of the present work was directed to whether the pandemic can be a positive catalyst for healthier eating habits.

Previous Covid-19 studies have reported that some people are

making positive changes in their eating habits. However, uncertainty exists over how large this segment is since reports vary from ~10% to ~35% (Poelman et al., 2021; Di Rienzo et al., 2020). In addition, the socio-demographic, psychological and attitudinal variables associated with positive dietary changes remain underexplored. In the present work, focus was directed to whether factors and attitudes known to influence individual food choice decisions exerted an influence on consumers' likelihood of experiencing positive dietary changes in the context of the Covid-19 pandemic. Special attention was placed on food neophobia (FN) and motives underlying food choices, which have been reported to influence healthy eating and food-related behaviour in general (e.g., Pollard, Steptoe, & Wardle, 1998; Jaeger, Roigard, Hunter, & Worch, 2021).

Building on the above, the aims of the present work were to explore whether consumers, when faced with a catalytic disruption to their daily lives, made positive dietary changes, and if so, to explore who made such changes and what motivated the changes. To this end, the investigation had three objectives: 1) identify people who made positive dietary changes towards healthy eating, 2) explore demographic, socio-economic and disruption-specific factors linked to positive changes, and 3) explore psychographic variables and attitudes linked to positive

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changes.

2. Materials and methods

2.1. Participants

The research was conducted in USA (full geographical coverage) with 904 adult consumers (18–65 years old, 50% women) with varying backgrounds (ethnic, socio-economic, political, etc.) (Suppl. Mat. 1).

Participants were registered with an ISO-accredited web panel provider. All were free of major dietary restrictions and allergies; all were involved in at least some of the household grocery shopping.

The research was covered by a general approval for sensory and consumer research from the Human Ethics Committee at the New Zealand Institute for Plant and Food Research.

2.2. Questionnaire

2.2.1. Impact of Covid-19 on eating and drinking behaviour

Guided by the research aim and objectives, the first three questions sought consumers' opinion on the impact of Covid-19 on their daily food and beverage consumption. The questions were open-ended (Table 1) with the instruction to "please write as much as you can" (no minimum reply length).

Next, participants rated their degree of agreement with 6 statements regarding the impact of Covid-19 on food-related behaviour and well-being (Fig. 2 has full wordings). Responses were collected on Likert scales (1 = disagree strongly, 7 = agree strongly). Statement order was randomised across participants.

2.2.2. Covid-19 incidence, restrictions and personal experience

Supplementary information about whether the Covid-19 pandemic had/was directly impacting participants was gained through four questions, answered by selecting "yes", "no", or "don't know" (Suppl. Mat. 2 has full wordings).

Information on Covid-19 incidence and government responses were retrieved from the Oxford Covid-19 Government Response Tracker's data for USA (OxCGRT) (Hale, Atav, Kira, Phillips, Petherick, & Pott, 2020). For Covid-19 incidence, two variables were considered: confirmed cases per million people and deaths per million people; both were computed using the total cases or deaths and state population data. Regarding government response, two indices were considered: the economic support index (which measures how much economic support has been made available in the state) and the stringency index (which measures the strictness of the closure and containment policies restricting people's behaviour). For each participant, data from the corresponding state and date of survey completion was considered.

2.2.3. Supplementary and background questions

Food-related background information was obtained in the form of food neophobia (FN), where 6 statements were used based on Ritchey et al. (2003). Statements were presented in randomised order across participants, with responses on Likert scales (same as above).

The importance of different food choice motives was captured using the food choice questionnaire (FCQ) variant from Onwezen et al. (2019) with 11 factors (see Fig. 1). The measurement approach was best-worst scaling (BWS) where each participant was presented with 11 subsets of 5 FCQ factors and for each subset had to indicate which was, respectively, most and least important when deciding what to eat on a typical day (Suppl. Mat. 3a shows the task). This resulted in a full scaling of factors for each participant. FCQ factor order was randomised within subsets, and the presentation of subsets was randomised across participants.

A measure of perceived body shape was also obtained. Looking at a series of figures (male and female specific) participants selected the image that best corresponded to their perceived body shape (1 = most underweight, 9 = most obese) where 1–6 was coded as 'not obese' and

Table 1

The three open-ended questions and exemplar verbatim responses used to classify participants who made positive dietary change/s in response to Covid-19.

Question	Exemplar verbatim responses	Percentage of participants reporting positive changes in dietary habits (%)
Q1: For most people taste, price and health are the top-3 factors that determine what to eat and drink. Has the Covid-19 pandemic made you think differently about the importance of these factors, and why?	"I try to eat more healthful" "Yes, especially the health factor. Eating food with healthier results has proven to me your body can fight virus and infections quicker and easier for people my age" "Yes, because we need more healthy foods for better immunity" "Yes, since cooking more at home has become more healthy choices"	10
Q2: Compared to before the Covid-19 pandemic began, name some foods and beverages you now consume more often / in greater quantity.	"Green leafy vegetables and still water" "Spinach is one of them, because I get good deals from local markets. It does build up immune system" "Kefir, berries, bananas, broccoli, asparagus, water, oatmeal, nuts" "Fresh fruits and vegetables from the farmers market" "Salads they are good for you" "Water, rice, beans, cereal, milk, fruits"	39
Q3: Dietary guidelines for Americans recommend that adults eat five or more daily servings of fruits and vegetables. Compared to before the Covid-19 pandemic began, has your daily intake of fruits and vegetables changed? How and why?	"I eat slightly more vegetables and fruits because my focus on health has increased somewhat" "Fruit and vegetables intake has increased because I am trying to lose a couple of pounds" "I have increased the veggies, decrease sugar of fruit servings" "Fruits have increased and veggies have remained about the same" "My daily intake has increased by eating more plant-based meats"	20

7–9 as 'obese' (Bulik et al., 2001). Other background questions included gender, age, ethnicity, educational attainment, income, household size, household composition, place of living and political affiliation.

2.3. Data collection

Data collection took place from 11 to 22 June 2020. Participants completed the survey from a location of their choosing, using a laptop or desktop computer. The average completion time was ~ 7 min. The survey also covered other topics which are not discussed further due to lack of relevance.

2.4. Data analysis

Analyses were performed in R and XLSTAT software. The significance level was 5%.

A)

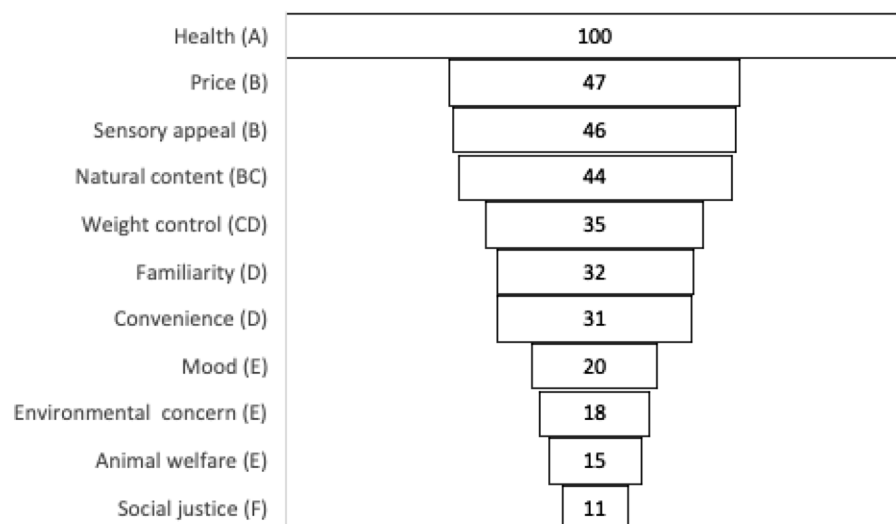
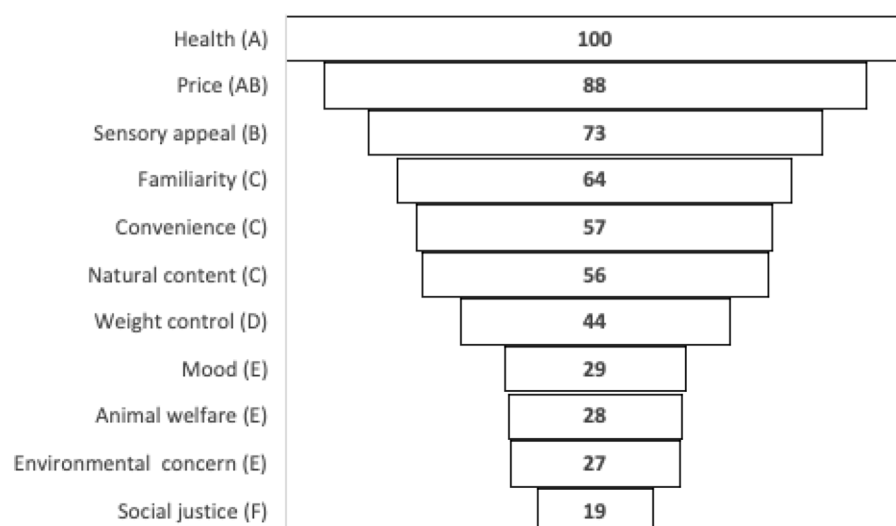


Fig. 1. Funnel plots of importance of food choice motives (Food Choice Questionnaire - FCQ factors) for US consumers who made positive dietary change/s (A: “positive change” group, $n = 373$) during Covid-19 compared to those who did not (B: “not-positive change” group, $n = 478$). The shown values are $\sqrt{(B/W)}$ which have ratio measurement properties, with Tukey’s HSD results from analysis of B-W scores given with factor names. Within each group of consumers, FCQ factors that share a letter are not significantly different at the 5% level of significance.

B)



2.4.1. Text data

For Obj. 1, computer-assisted analysis of the open-ended responses was performed. This began by discarding responses that did not include English language words (through automated comparison with a dictionary) and those without interpretable information (e.g., “reasons”, “meh”, “N/A”), leaving a total of 851 participants for further analysis.

Next, responses were manually coded using a deductive-inductive process. Responses were first coded by one author, then checked by two other authors and final categories were obtained by consensus. For each question, responses indicating positive dietary change/s were identified: i) responses indicating “more importance attached to health” in Q1; ii) responses reporting increased consumption of healthy foods in general, or of any of those recommended by the American dietary guidelines MyPlate (fruits, vegetables, meat, seafood, other protein food, dairy, grains and beans, and water), and not reporting increased consumption of unhealthy foods in Q2; and iii) responses reporting increased consumption of fruits and/or vegetables for Q3.

Two groups of participants were defined: “positive change” and “not-

positive change” group. To classify into the former group, participants had to meet the criteria for positive change for one or more of Q1, Q2 and Q3; else participants were assigned to the “not-positive change” group.

2.4.2. Regression

For Obj. 2, logistic regression was performed with group membership as the dependent variable (“positive change” or “not-positive change”). The independent variables were gender, age group, annual household income, household size, child/ren aged under 18 living in the household, education level, employment status, body shape, deaths per million in state of living, confirmed cases per million in state of living, economic support index in state of living, stringency index in state of living, having received hospital treatment for Covid-19, and having someone in the family or personal network who received hospital treatment for Covid-19. All independent variables were included to a stepwise modelling procedure to select a model with a subset of variables minimizing the AIC criterion.

A total of 36 people were excluded because their responses to one or more of the questions serving as independent variables were “prefer not to say” or “don’t know,” leaving 815 respondents for analysis.

2.4.3. Comparison of consumer groups on food-related variables

For Obj. 3, the “positive change” and “not-positive change” groups derived on the basis of Q1-Q3 were compared. T-tests were used for summed FN scores (Cronbach $\alpha = 0.83$) and the statements regarding the impact of Covid-19 on food-related behaviour and wellbeing. For ease of comparison with past studies involving FN, the mean FN summed scores were scaled to correspond to the expected value had 10 FNS items been used (10/6 multiplier).

2.4.4. Best-worst scaling

The importance of FCQ factors was measured using BWS. For each participant, responses were collated across the 11 subsets and condensed to a count of times that each factor was selected as, respectively, most and least important. These values were subtracted to calculate individual-level B-W scores for each FCQ factor (Suppl. Mat. 3b has an example) and input to t-tests as described above. Refer to Louviere, Flynn and Marley (2015) for a full explanation of how to convert BWS raw data to B-W scores.

The BWS responses were also used to derive a scaling of factor importance with ratio measurement properties. Within each of the “positive change” and “not-positive change” groups, sums for B (best) and W (worst) were calculated across all participants and from these $\sqrt{(B/W)}$ was derived. Fitting with Louviere et al. (2015) the relationship between B-W scores and $\sqrt{(B/W)}$ was near linear in both groups ($R^2 > 0.94$) (Suppl. Mat. 4).

3. Results

3.1. Positive dietary change/s

Responses to the open-ended questions are summarised in Table 1 and confirmed that COVID-19 was a positive catalyst toward healthy eating for a relevant proportion of the participants (Obj. 1). For 373 participants (44%), the Q1 to Q3 responses evidenced that Covid-19 caused changes to build healthier eating through an increase in the importance attributed to health or/and an increase in the consumption of foods recommended in the dietary guidelines for Americans. Based on Q1, 10% of participants reported giving more importance to health for determining their food and beverage choices than before the pandemic. The exemplar verbatims show that the main reason underlying the higher importance attached to health was interest in boosting immunity and protection from Covid-19. About 4-in-10 of the participants (39%), stated that they were consuming foods recommended in the dietary guidelines for Americans more often and/or in greater quantity than before the pandemic (Q2), specifically: vegetables (14%), fruits (13%), water (7%), meat (4%), grains and beans (3%). Finally, when asked specifically about changes in the intake of fruits and vegetables (Q3), 20% of the participants reported having increased their intake of these product categories since the start of the pandemic.

3.2. Demographic, socio-economic and Covid-19 specific factors associated with positive dietary change/s

To explore which demographic, socio-economic and Covid-19 specific factors were associated with positive dietary change/s (Obj. 2), logistic regression was performed. The results show that age and level of education had a significant effect of the likelihood of making positive dietary change/s (Table 2). Specifically, a significant predictor for “positive change” was high educational attainment, while being aged between 40 and 59 years old was a significant predictor of “not-positive change”. The remaining variables included in the model were non-significant predictors of belonging to the group of participants who

Table 2

Results of the logistic regression model exploring the influence of explanatory variables on participants’ likelihood of making positive dietary change/s during the Covid-19 pandemic among US consumers. Only variables selected in the stepwise procedure are shown.

Variable [#]	Odds ratio ^{##} (95% C.I.)
Deaths per million in state of living	1.00 (0.99–1.00)
Age group	
30–39	0.62 (0.33–1.00)
40–49	0.32 (0.16–0.59)*
50–59	0.47 (0.27–0.80)*
60–65	0.63 (0.37–1.01)
Household size	
2 people	1.05 (0.70–1.60)
3 people	0.71 (0.44–1.14)
4 people	1.38 (0.83–2.29)
5 + people	1.35 (0.75–2.42)
Level of education	
Associate/technical	1.05 (0.57–1.89)
Some college	1.73 (1.08–2.81)*
College	2.03 (1.32–3.16)*
Postgraduate	2.33 (1.45–3.78)*
Having received hospital treatment for Covid-19	
No	1.86 (0.95–3.80)

Notes: n = 815. C.I. = confidence interval. [#]) The reference category in the model was not reporting changes to build healthier eating habits (“not-positive change” group). The following reference levels were considered for each of the variables: Gender (men), Age group (18–29 years old), Household size (1 person), Level of education (High school or lower), Having received hospital treatment for Covid-19 (Yes). ^{##}) Significant odds ratios are highlighted with * and shown in bold font.

made positive dietary change/s.

3.3. Comparison of consumer groups for psychographic variables and food-related attitudes

Regarding Obj. 3, there was a significant difference in degree of food neophobia (FN), which was higher in the “not-positive change” group than the “positive change” group ($p < 0.001$). The mean FN values were, respectively, 34.8 (SD = 12.5) and 31.8 (SD = 12.5).

Fig. 1 shows FCQ factor importance values for each of the two consumer groups, sorted from most to least important. *Health* was the most important food choice motive in both groups (Tukey’s HSD = ‘A’ and $\sqrt{(B/W)} = 100$), and *Price* and *Sensory Appeal* were the two next most important factors. However, the importance of *Health* relative to *Price* was 2.1 (100:47) in the “positive change” group, while it was 1.1 (100:88) in the “not-positive change” group. Relative to *Health*, the importance of *Sensory Appeal* was also more reduced in the “positive change” group than in the “not-positive change” group (46:100 vs. 73:100, respectively). Other differences between the two groups were reflected by the post-hoc tests for *Natural Content*, *Weight Control*, *Convenience*, and *Familiarity*. The former two FCQ factors were more important in the “positive change” group. Further, in the “positive change” group, *Natural Content* had nearly the same importance as *Price* (0.94 = 44:47), while in the “not-positive change” group *Natural Content* was less important (0.64 = 56:88). The greater importance of *Familiarity* in the “not-positive change” group fitted with higher FN.

With regard to the 6 statements exploring impact of Covid-19 on wellbeing and food-related behaviours, significant differences ($p < 0.0001$) were found between the two groups in all instances, and average scores were always higher in the “positive change” group (Fig. 2). That is, participants who made positive dietary change/s, more strongly agreed with the statements that they had made changes to improve their diets, and that were more likely to eat fresh fruit during the pandemic than before it. They also agreed more strongly that diet is one of the main ways to protect themselves from Covid-19 and that they would buy foods that could boost their immunity. With regard to having

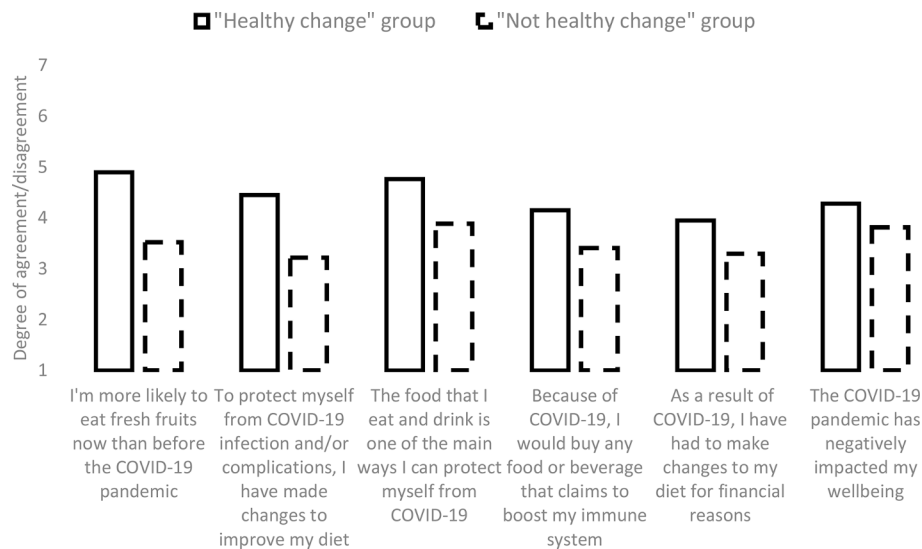


Fig. 2. Mean scores for behavioural statements regarding the impact of Covid-19 on food-related behaviour and wellbeing (1='disagree strongly' to 7='agree strongly'). Shown for groups of US consumers who made positive dietary change/s ("positive change" group, $n = 373$) during Covid-19 compared to those who did not ("not-positive change" group, $n = 478$). Significant differences between groups were found for all statements ($p < 0.0001$).

to make dietary changes for financial reasons, participants in the "positive change" group also agreed more strongly than their "not-positive change" counterparts. The smallest difference between the two groups was for the statement "The Covid-19 pandemic has negatively impacted my wellbeing".

4. Discussion

The present research was built on the premise that major disruption to everyday life has the potential to trigger behavioural changes and progress toward the healthier and more sustainable diets necessary for global development goals (Willett et al., 2019). The Covid-19 pandemic was conceptualised as such a major disruption, and data collected in June 2020 evidenced a behavioural change in 44% of the participants due to increased importance attached to health or increased consumption of foods recommended by the American dietary guidelines MyPlate. Although the present research was exploratory in nature, responses to the open-ended questions provided potential explanations for such positive change/s. Some of the participants reported an increased interest in healthy eating as a strategy to boost immunity and protect themselves from Covid-19. Another plausible explanation for the positive changes in eating habits is related to increased consumption of home-made food due to having more time at home and reduced consumption of foods away from home. This agrees with the negative association between meals consumed away from home and intake of fruits, vegetables and other healthy food groups (Binkley & Liu, 2019).

The severity of Covid-19 incidence (in terms of cases or death per million people) or the stringency of the governmental response were not significant predictors of positive changes in dietary habits among US consumers. This suggests that the ability of the pandemic to trigger positive changes in dietary habits was related to people's response rather than environmental cues. In this sense, the present work also identified socio-demographic variables associated with the likelihood of experiencing positive dietary change/s as a consequence of Covid-19. High educational attainment increased the probability of "positive change" group membership, which can be explained by an increased opportunity to work from home and with time to prepare and cook wholesome meals. Conversely, being aged 40 to 59 years old was a barrier to positive change/s in eating behaviours. Previous research reported conflicting findings on the impact of the pandemic on food behaviours by age, suggesting that further research is needed to better

understand this relationship (Poelman et al, 2021; Snuggs & McGregor, 2020).

Having been tested or diagnosed Covid-19 was not associated to a change for a healthier diet. This could be explained by the fact that one of the symptoms of Covid-19 is loss of smell and taste, with long recovery times that could contribute to weight loss and malnutrition (Di Filippo et al 2020). For those individuals the impact on food perception could be so disruptive that FCQ factors other than health could be more relevant (e.g., sensory appeal).

Regarding attitudinal variables, people who experienced positive changes in eating habits were less food neophobic than their "not-positive change" counterparts, and the relative importance attributed to the FCQ factor *Health* compared to the other Top3 factors - *Price* and *Sensory Appeal* - was higher compared to the "not-positive change" group (Fig. 1). These results suggest that health interest was a key factor underlying positive changes in eating habits as a consequence of the pandemic. In addition, these results contributed new evidence of the pervasive effect of FN on food-related behaviour, even during a major disruptive period such as a pandemic. The negative association between food neophobia and vegetable consumption could have also contributed to this result (e.g., Guzek et al., 2018).

The two groups of participants identified in the present work also differed in the relative importance attributed to other factors. For example, *Familiarity* was much less important in the group with "positive changes" compared to "not positive change" group. Other authors have found that *Familiarity* decreased in importance after Covid-19 lockdown (Snugg & McGregor 2020; Marty et al., 2021), possibly in search for novelty and stimulation after a period of restriction. Our findings suggest that such variety seeking is unlikely among neophobics. This is supported by a strong negative correlation between food neophobia and variety seeking tendency (e.g., Meiselman, Mastroianni, Buller, & Edwards, 1998). Possibly, avoidance among food neophobics of unknown foods may also prevent them from consuming unfamiliar healthy products.

Regarding the limitations of the present work, they foremost concerned the focus on positive dietary change/s. While justified given our interest in changes needed to progress toward the healthier and more sustainable diets necessary for global development goals (Willett et al., 2019), this was a calculated shortcoming considering that reports of both negative changes and no changes during the Covid-19 pandemic exist (Poelman et al., 2021; Borsellino et al., 2020). Seen through a lens

directly focused on Covid-19, a more detailed account of all dietary changes, including quantitative measures of the magnitude of change would have strengthened the research, as would a longitudinal extension to determine if positive dietary change/s endure throughout pandemic and extend beyond it. In addition, motives underlying food choices were only measured at the time of the study. Previous research has shown that the importance attributed to factors underlying food choice have changed in France and the UK before and after Covid-19 lockdowns (Snugg & McGregor 2020, Marty et al., 2021). For completeness, it should be noted that vegans and vegetarians were excluded as directed by a part of the overall survey that was unrelated to the present research.

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CRediT authorship contribution statement

Sara R. Jaeger: Conceptualization, Methodology, Investigation, Formal analysis, Writing - original draft, Writing - review & editing. **Leticia Vidal:** Formal analysis, Writing - original draft, Writing - review & editing. **Gastón Ares:** Formal analysis, Writing - original draft, Writing - review & editing. **Sok L. Chheang:** Investigation, Data curation. **Sara Spinelli:** Writing - original draft, Writing - review & editing.

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.foodqual.2021.104220>.

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