Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Is COVID-19 a threat or an opportunity for healthy eating? An exploration of the factors that moderate the impact of the pandemic on eating habits in Uruguay

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ABSTRACT

In May 2020, Uruguay was one of the few Latin American countries that had managed to control the outbreak of COVID-19 without mandatory curfews or quarantines. However, several social distancing measures created a major disruption in different aspects of the daily life of Uruguayan citizens. In this context, the objectives of the present work were i) to identify changes in eating habits perceived by Uruguayan citizens as a consequence of the COVID-19 pandemic, and ii) to explore factors associated with different perceived changes on eating habits. A cross-sectional online study was conducted with 891 participants, recruited using an advertisement on Facebook and Instagram. Fifty-one percent of the participants indicated that their eating habits had changed since the detection of the first cases of COVID-19 in Uruguay. Large heterogeneity in the categorization of the changes existed: 45% of the participants regarded the changes as positive, 32% as negative and 23% as neither positive nor negative. A multinomial logistic regression analysis was used to study the influence of explanatory variables in the likelihood of belonging to groups who reported different changes in eating habits (no changes, positive, negative, or neither positive nor negative changes). Household income and reliance on instrumental and emotional support increased the likelihood of reporting positive changes in eating habits, whereas negative changes were associated with a reduction in household income due to COVID-19 and the coping strategies self-distraction and self-blaming. Insights for policy making to reinforce positive effects and minimize threats to healthy eating are discussed.

1. Introduction

COVID-19 has created one of the most important health, economic and social crises in recent times (Hevia & Neumeyer, 2020). Latin America has been one of the regions of the world most severely affected by the pandemic, even though it had more time to anticipate the arrival of the disease and formulate measures to mitigate its health and economic effects (Burki, 2020; Callejas, Echevarría, Carrero, Rodríguez-Morales, & Moreira, 2020). For months, Uruguay stood out in the region as one of the few Latin American countries that had managed to contain the outbreak of COVID-19 (Taylor, 2020).

Uruguay is a high-income country with 3.5 million inhabitants, located in the southeastern part of South America. The first cases of COVID-19 in the country were detected on March 13th, 2020 (Sistema Nacional de Emergencias, 2020). As of May 18th, 2020, a total of 207.9 confirmed cases of COVID-19 and 5.7 deaths per million had been reported (Guiad-Covid-19, 2020). The effectiveness of the Uruguayan response to contain COVID-19 has been attributed to mass testing, early diagnosis and rapid isolation (Moreno et al., 2020; Taylor, 2020).

The country also implemented a series of large-scale social

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distancing measures aimed at minimizing physical contact between individuals or groups of individuals. Contrary to many countries, the response of the Uruguayan government to contain the COVID-19 outbreak was characterized by the lack of strict lockdowns or curfews and reliance on voluntary quarantine and adherence to social distancing recommendations (Taylor, 2020). Immediately after the detection of the first cases of COVID-19, the government announced the closure of educational institutions, cancellation of public events, partial closure of borders, mandatory quarantine for travelers and issued a general stay-at-home recommendation to citizens (Uruguay Presidencia, 2020). Additional measures were implemented by the end of March 2020, including closure of shopping malls and bans on international travels, reaching a maximum value of 72.2 in the 0–100 Stringency Index developed by Oxford University (Oxford COVID-19 Government Response Tracker, 2020). During this period, high compliance with stay-at-home recommendations was reported: approximately 80% of the population reported staying at home more frequently (Ares et al., 2020; Grupo Radar, 2020) and 19.3% of Uruguayan workers reported working from home (Instituto Nacional de Estadística, 2020b). Flexibilization of social distancing measures started on April 12th, 2020, reaching a Stringency Index of 61.1 during May 2020.

Social distancing measures cause a major disruption of daily life and create a series of social, psychological and economic challenges (Brooks et al., 2020; Pietrabissa & Simpson, 2020; Tull et al., 2020). Eating habits are one of the aspects of daily life that are expected to be affected by the pandemic (Arora & Grey, 2020). Social distancing measures can encourage consumers to decrease consumption of fruits and vegetables and to increase consumption of ultra-processed products with excessive content of sugar, fat and sodium due to three main reasons. First, mandatory quarantine or stay-at-home recommendations reduce access to food, which may lead to a reduction in the consumption of fresh foods and encourage consumers to stockpile shelf-stable products (Arora & Grey, 2020). Second, COVID-19 can cause a reduction in purchasing power due to job loss or pay cuts, depleting the possibility of the most vulnerable households to access an adequate diet (FAO, 2020). Finally, quarantine and social isolation can induce emotional disturbance, boredom, stress and anxiety, which in turn can lead to greater energy intake and encourage consumption of ultra-processed foods with excessive content of sugar, fat and sodium (Adam & Epel, 2007; Moynihan et al., 2015; Torres & Nowson, 2007; Yılmaz & Gökmen, 2020).

However, COVID-19 also has the potential to encourage positive changes in eating habits. The pandemic can encourage people to engage in health-seeking behaviors, such as healthy eating, to protect themselves from COVID-19, as previously reported during the previous outbreak of a severe acute respiratory syndrome in Asia (Lau, Yang, Tsui, Phil, & Kim, 2005). In addition, distancing measures may provide people with the opportunity to spend more time at home, encouraging them to prepare their own meals and rely less on ready-to-eat ultra--processed products and meals consumed outside their homes. This is particularly relevant given that time scarcity has been identified as a major barrier to healthy eating and to follow dietary recommendations (Jabs & Devine, 2006; Machín et al., 2018). In this sense, the disruption of daily life caused by COVID-19 can encourage people to re-assess their eating habits, triggering the consolidation of long-awaited dietary changes (Wood, Tam, & Witt, 2005).

The impact of COVID-19 on eating habits is expected to be affected by a large range of variables, including socio-economic status, employment changes and psychological traits. Considering that COVID-19 is a stressful situation, its impact on eating habits can be expected to be mediated by coping strategies, i.e. the cognitive and behavioral efforts undertaken by individuals when contending with the challenges created by the pandemic (Lazarus & Folkman, 1984; Skinner, Edge, Altman, & Sherwood, 2003). The strategies people adopt to cope with stressors, such as natural disasters, diseases, and diagnosis of life-threatening illnesses, have been extensively studied in the literature (Carver, 1997). Reliance on maladaptive coping strategies, such as self-blame, has been reported to be associated with greater psychological distress and impaired wellbeing (García, Barraza-Peña, Wlodarczyk, Alvear-Carrasco, & Reyes-Reyes, 2018). These maladaptive coping strategies may be associated with negative impacts of COVID-19 on eating habits, such as stress-induced eating (Aldao, Nolen-Hoeksema, & Schweizer, 2010). On the contrary, adaptive coping strategies, such as active attempts to improve a situation (active coping), adopting a positive perspective (positive reframing), and accepting reality (acceptance) have been reported to reduce psychological distress (Kato, 2015; García et al., 2018). These adaptive strategies may act as protectors from the negative effects of COVID-19 on eating habits (e.g. Alberts, Mulkens, Smeets, & Thewissen, 2010) and could encourage positive changes in eating habits.

The present study was focused on the eating habits of the middle and high-income population. The food choices of this segment of the population are not expected to be largely affected by economic constraints, whereas the eating habits of low-income Uruguayan citizens are mainly determined by economic constraints (Ares, Machín, Girona, Curutchet, & Giménez, 2017). During the COVID-19 pandemic, job loss and income reductions are expected to pose additional constraints on the ability of this segment of the population to access an adequate and nutritious diet, leading to an increase in food insecurity (Ares et al., 2021; FAO, 2020).

The objectives of the present work were: i) to identify the changes in eating habits perceived by middle and high-income Uruguayan citizens as a consequence of the COVID-19 pandemic, and ii) to explore factors associated with different perceived changes on eating habits.

2. Materials and methods

An online cross-sectional survey was conducted between May 6th and 18th, 2020. The study was approved by the Ethics Committee of the School of Chemistry of Universidad de la República (Uruguay).

2.1. Participants

Participants were recruited using an advertisement targeted at adult Uruguayan users on Facebook and Instagram. The advertisement included the text *"Be part of our new study and help us understand eating habits in times of coronavirus"*, accompanied by a drawing of COVID-19 and the logo of Universidad de la República. The purpose of the recruitment was to obtain a diverse sample in terms of gender, age and educational level. Given that the focus of the study was on participants from middle and high socio-economic status, responses from participants who reported a per capita household income below the Uruguayan poverty line (334 US dollars for citizens living in the capital and 217 US dollars for all other citizens, Instituto Nacional de Estadística, 2020a) were excluded from the analysis (n = 274). Table 1 shows the characteristics of the 891 participants retained from the study.

2.2. Questionnaire

The study was implemented using Compusense Cloud (Compusense Inc., Guelph, Canada). When participants clicked on the advertisement, they were directed to the website where the study was located. The full questionnaire is provided in the Appendix (Table A1). Participants provided informed consent in an online form at the beginning of the questionnaire. No compensation was given to participants.

A closed question (Yes/No) asked participants if they had experienced changes in their eating habits since the detection of the first cases of COVID-19 in Uruguay, on March 13th, 2020. Two follow-up questions were asked to participants who answered affirmatively: an open-ended question to explore the changes perceived by participants (not presented in the present work) and a check-all-that-apply question to explore the motives underlying those changes. Seven response options were selected, based on results from a preliminary study (Ares et al., 2021): 'I don't have enough money', 'I have more time', 'I have less

Table 1
Socio-demographic characteristics of the participants (n = 891).

Characteristic	Percentage of participants (%)
Gender	
Femenine	74
Masculine	26
Age range	
18-29	11
30-45	43
46-64	46
Educational level	
Primary school	8
Secondary school	30
University degree or technical studies	43
Post-graduate studies	19
Working status	
Working	75
Not working	25
Number of people living in the household	
1	20
2	28
3	23
4	22
5 or more	7
Number of children under 18 years of age living in the household	
0	57
1	24
2	15
3 or more	4
Household income before COVID-19 [a]	
222–1000 USD	27
1000–2000 USD	46
2000–3500 USD	19
Higher than 3500 USD	8
Changes in household income due to COVID-19	
Reduction	27
Maintenance	63
Increase	3

[a] An exchange rate of 45 Uruguayan pesos per US dollar was considered for currency conversion. The category '222–1000 USD' corresponds to the merged data from the 2nd, 3rd and 4th response options to the question *"In February 2020, which was the total income of your household? (in Uruguayan pesos)"* from the questionnaire (Table A1, Appendix), while the category '1000–2000 USD' corresponds to the merged data from the 5th and 6th response options of the same question.

time', 'I am more interested in health', 'I feel anxious/stressed', 'I am bored', 'Daily routines at home have changed' and 'Others'. Participants who selected the response option 'Others' were asked to provide an explanatory text using a blank space.

All participants were asked about changes in specific aspects of eating habits, assessed using multiple-choice questions, including quantity of food eaten, eating frequency, consumption frequency of take-away foods, consumption frequency of home-made meals, and consumption frequency of different categories of foods and beverages. Then, participants who answered affirmatively to the question about changes in their eating habits were asked to categorize the changes as positive, negative or neither positive nor negative. In addition, all participants were asked to rate the healthiness of their diet before COVID-19 and in the week prior to the study using a 9-point structured scale (0 = not healthy at all, 9 = very healthy) and to indicate if they had experienced changes in their body weight (I have gained weight/My weight has not changed/I have lost weight).

A series of socio-demographic questions were included to characterize participants in terms of their gender, age, educational level, working status the week prior to the study, place of residence, number of people living in the household, number of minors living in the household, household income before and after the detection of the first cases of COVID-19 in Uruguay. This last question was focused on the detection of the first cases in the country as that moment coincided with the application of social distancing recommendations. Finally, participants were asked to complete the Spanish version of the Brief-COPE (Coping Orientation to Problems Experienced) inventory to assess coping strategies. The wording of the items was extracted from García et al. (2018). The inventory is composed of 28 items, has been previously used in Uruguay and has shown good reliability with female Uruguayan participants (Reich, Costa-Ball, & Remor, 2016).

2.3. Data analysis

All data analyses were performed using R software version 4.0.0 (R Core Team, 2020). Descriptive statistics were used to analyze responses to all questions: frequency distributions to closed or multiple-choice questions and calculation of means for continuous variables. Responses were analyzed separately for groups of participants who reported different changes in their eating habits: no changes, positive changes, negative changes, neither positive nor negative changes.

The chi-square test was used to analyze differences among the groups in the patterns of responses to the questions related to changes in their eating habits. In order to evaluate differences among the groups in the average healthiness score of the diet before to COVID-19 and during the week prior to the study, analysis of variance considering group, moment (before COVID-19 and in the previous week) and their interaction as fixed effects was used. For significant effects at 5% significance level, pairwise comparisons were made using Tukey's test.

In addition, generalized linear models (glm) were used to assess differences among the groups in the selection of each response option as motives underlying the changes in their eating habits. When differences were significant at a 5% significance level, Tukey's test was used for pairwise comparisons.

2.3.1. Exploratory Factor Analysis of the Brief-COPE questionnaire

The construct validity of the Brief-COPE questionnaire was assessed using Exploratory Factor Analysis (EFA) based on maximum likelihood estimation and varimax rotation method (Hair, Black, Babin, & Anderson, 2010). Prior to this analysis, the psychometric adequacy of the data matrix was evaluated using Bartlett's test of sphericity (Bartlett, 1950) and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Kaiser, 1970; Kaiser & Rice, 1974). Bartlett's test of sphericity was significant ($\chi^2 = 6104$, $p < 0.0001$), and KMO measure of sample adequacy was 0.77, suggesting that the correlation matrix was suitable for factor analysis. In the EFA solution 10 factors were identified, and 22 of the 24 items had factor loadings greater than the recommended threshold of 0.40 (Hair, Anderson, & Tatham, 1987). Full details of the factor loadings of the items and Cronbach's alpha of each factor are shown in the Appendix (Table A2). The solution identified ten factors instead of fourteen, as reported by Carver (1997) for the English version of the Brief-COPE questionnaire. The subscales *Behavioural Disengagement* and *Venting* of the Brief-COPE questionnaire were excluded, as only one of the two items of each subscale had factor loadings greater than 0.40.

The ten factors identified in the solution were interpreted as: i) instrumental and emotional support; ii) active coping and planning; iii) acceptance; iv) self-distraction; v) denial; vi) humor; vii) self-blaming; viii) positive reframing; ix) substance use and x) religion. Factors i) and ii) differed from the solution reported by Carver (1997) as they each merged two subscales of the original Brief-COPE questionnaire: factor i) merged instrumental support and emotional support, whereas factor ii) merged active coping and planning. Morán, Landero, and González (2010) also reported these merged subscales when analyzing the factorial structure of the Spanish version of the Brief-COPE questionnaire. For each of the identified factors, a score was calculated by averaging the score of the individual items retained in the factor.

2.3.2. Multinomial logistic regression

Multinomial logistic regression models were used to explore the influence of a set of independent (predictor) variables on participants'

Table 2
Percentage of participants who reported having increased and decreased their consumption frequency of different categories of food and beverages for participants who stated not having experienced changes in their eating habits and for those who characterized the changes as positive, negative or neither positive nor negative.

Change in consumption frequency	Food or beverage	No changes (n = 435)	Categorization of the changes		
			Positive (n = 207)	Negative (n = 145)	Neither positive nor negative (n = 104)
More frequently than before	Fruit	23	52	10	29
	Vegetables (excluding potatoes and tubers)	17	63	10	24
	Potatoes and tubers	10	29	34	23
	Pulses	17	43	21	32
	Rice, pasta or polenta	9	21	50	29
	Meat and poultry	8	21	20	19
	Fish	7	19	5	9
	Water	16	34	21	32
	Bakery	9	7	37	18
	Cookies and alfajores	6	5	30	10
	Sweets and chocolates	9	9	38	17
	Yogurt and milk desserts	6	10	10	7
	Cured meats	4	2	29	8
	Savory snacks	4	3	19	13
	Frozen ready-to-eat meals	4	4	30	11
	Sweetened beverages	5	5	24	13
	Alcoholic beverages	14	18	32	25
Less frequently than before	Fruit	5	5	43	19
	Vegetables (excluding potatoes and tubers)	4	4	47	6
	Potatoes and tubers	3	9	12	4
	Pulses	3	2	15	4
	Rice, pasta or polenta	4	15	8	4
	Meat and poultry	8	21	26	13
	Fish	14	15	41	27
	Water	6	6	17	10
	Cookies and alfajores	17	46	25	36
	Sweets and chocolates	16	41	23	37
	Bakery products	26	56	28	40
	Yogurt and milk desserts	8	20	30	18
	Cured meats	17	39	23	28
	Savory snacks	18	38	19	26
	Frozen ready-to-eat meals	18	46	19	29
	Sweetened beverages	12	32	19	19
	Alcoholic beverages	12	17	17	12

membership to groups who experienced different changes in their eating habits (no changes, positive changes, negative changes, neither positive nor negative changes) as dependent variable. The following independent variables were considered: gender, age range, educational level, working status (working/not working), number of people living in the household, children living in the household (Yes/No), household income before COVID-19, changes in household income due to COVID-19 (reduction/maintenance/increase), healthiness of the diet before COVID-19, and the average score of the ten sub-scales of the Brief-COPE inventory identified in the EFA. Successively, a final multinomial logistic regression model included only the variables that had at least one significant coefficient ($p \leq 0.05$, two tailed z test for model coefficients) in the original model. Interactions between variables were not considered in the model. Results were presented as odds ratios with 95% confidence intervals.

3. Results

Fifty-one percent of the participants indicated that their eating habits had changed since the detection of the first cases of COVID-19 in Uruguay. Large heterogeneity in the categorization of the changes existed: 45% of the participants regarded the changes as positive, 32% as negative and 23% as neither positive nor negative.

3.1. Perceived changes in eating habits and diet healthiness

Participants were asked about specific changes in their eating habits. Although 49% of the participants declared having experienced no changes in their eating habits, they then reported changes in the consumption frequency of specific food categories (Appendix, Table A3). Significant differences among the groups were found in changes in consumption frequency of all the food categories ($p < 0.001$). An overview of the changes in the consumption frequency can be found in Table 2, whereas full details are provided in the Appendix (Table A3). The percentage of participants who reported having increased consumption of fruit, vegetables and pulses and having decreased consumption of ultra-processed products which usually contain excessive content of sugars, fat and/or sodium (cookies and *alfajores**, bakery products, sweets and chocolates, cured meats, savory snacks, frozen ready-to-eat meals, sweetened beverages) was higher among those who regarded the changes as positive compared to the rest of the groups (Table 2). On the contrary, participants who regarded changes in their eating habits as negative more frequently reported increasing consumption of ultra-processed products (cookies and *alfajores**, bakery products, sweets and chocolates, cured meats, savory snacks, frozen ready-to-eat meals, sweetened beverages) and alcoholic beverages, as well as decreasing consumption of natural products associated with healthy eating (e.g. fruits, vegetables and fish). In addition, participants who regarded changes in their eating habits as negative more frequently reported having increased their consumption of rice, pasta and polenta (Table 2).

According to the chi-square tests, significant differences among the groups were also found in other aspects of their eating habits. As shown in Table 3, participants who regarded changes in their eating habits as positive reported that they were cooking at home more frequently than before, eating take-away foods less frequently than before and having lost weight to a higher extent compared to the other groups of participants. On the contrary, participants who perceived the changes as negative more frequently reported an increase in the quantity of foods eaten and having gained weight. Interestingly, 80% of the participants who regarded the changes in their eating habits as neither positive nor negative reported more frequently consuming home-made meals, 58% reported eating more, and 50% reported having gained weight (Table 3).

Participants were asked to rate the healthiness of their diet before COVID-19 and during the week prior to the study. According to ANOVA, average healthiness ratings were significantly different across

Table 3
Percentage of participants who reported different changes for participants who stated not having experienced changes in their eating habits and for those who characterized the changes as positive, negative or neither positive nor negative. For each aspect of eating habits, results from the chi-square test are shown.

	No changes (n = 435)	Positive (n = 207)	Negative (n = 145)	Neither positive nor negative (n = 104)
Quantity of food eaten				
Less than before	6	14	14	8
Same as before	78	57	18	34
More than before	16	29	68	58
	$\chi^2 = 208.38$, $p < 0.001$			
Eating frequency				
Less frequently than before	8	9	19	8
As frequently as before	75	55	34	51
More frequently than before	17	36	47	41
	$\chi^2 = 97.99$, $p < 0.001$			
Consumption of take-away foods				
Less frequently than before	54	93	61	83
As frequently as before	44	6	27	16
More frequently than before	2	1	12	1
	$\chi^2 = 149.58$, $p < 0.001$			
Consumption of home-made meals				
Less frequently than before	2	1	12	1
As frequently as before	58	5	26	19
More frequently than before	40	94	62	80
	$\chi^2 = 248.32$, $p < 0.001$			
Body weight				
Weight gain	29	26	74	50
No changes	63	50	17	47
Weight loss	8	24	9	3
	$\chi^2 = 158.97$, $p < 0.001$			

participants who reported different changes in their eating habits ($F_{3,1774} = 76.7$, $p < 0.001$). Changes in the perceived healthiness of the diet as a consequence of COVID-19 differed among the groups, as indicated by the significant interaction between group and moment (before COVID-19 and in the previous week) ($F_{1,1774} = 96.5$, $p < 0.001$). As shown in Fig. 1, changes in perceived healthiness of the diet matched participants' categorization of changes in eating habits. COVID-19 amplified differences in the perceived healthiness of the diet of the four groups. Interestingly, participants who perceived positive changes in their eating habits had the lowest perceived healthiness prior to COVID-19 (5.9) and the highest during the two weeks prior to the study (7.3). On the contrary, participants who reported no changes in their eating habits gave the highest average scores to the healthiness of their diet before COVID-19 (6.8), which remained unchanged (Fig. 1).

3.2. Motives underlying the changes in eating habits

Participants were asked to select the motives underlying the changes in their eating habits from a list of 7 options. As shown in Fig. 2, participants frequently selected changes in their daily routines as one of the main motives underlying changes in eating habits, regardless of the valence of the changes. Responses within the 'Others' category included references to eating at home more frequently, changes in family organization, limiting grocery shopping trips, as well as food and beverages price increases.

According to the glm model, highly significant differences ($p < 0.001$) between the three groups were found in the frequency of selection of the options, except for the option 'Others' ($p = 0.20$). Compared to the other groups of participants, those who regarded the changes as positive more frequently selected the options 'I have more time', 'I am more interested in health' and 'Daily routines at home have changed' as motives of the changes in their eating habits (Fig. 2). On the contrary, they selected the options related to negative emotions ('I feel anxious/stressed' and 'I am bored') significantly less frequently than the other groups. Meanwhile, participants who regarded the changes as negative more frequently selected the response options 'I don't have enough money' and 'I feel anxious/stressed' more frequently than the other two groups. Finally, the most frequently selected motives for the group of participants who reported neither positive nor negative changes were 'I have more time', 'Daily routines at home have changed' and 'I feel anxious/stressed'.

3.3. Influence of explanatory variables in the likelihood of belonging to groups with different changes in eating habits

Initially, all the variables described in section 2.3.2 were included in the multinomial logistic regression analysis to study the influence on explanatory variables in the likelihood of belonging to groups with different changes in eating habits (data not shown). Eight variables were found to be not significant: gender, age range, educational level, number of people living in the household, children living in the household, and the average score of three sub-scales of the Brief-COPE inventory identified in the EFA (Acceptance, Denial, and Religion). A final multinomial logistic regression model was run including only those variables that had a significant effect ($p < 0.05$) and results (odd-ratios) are shown in Table 4. Membership to the group who reported no changes in their eating habits was set as the reference level.

Likelihood of belonging to the group who reported positive changes in their eating habits rather than to the group with no changes decreased 53% when participants were not working at the time of the study (Table 4). On the contrary, household income increased the likelihood of belonging to the group with positive changes in eating habits compared to the one that did not experience changes. As shown in Table 4, the odd-ratios markedly increased with household income. In addition, a unit increase in the perceived healthiness of the diet before COVID-19 was associated with a 38% decrease in the likelihood of experiencing positive changes in eating habits compared to not experiencing changes. Regarding coping strategies, an increase in the scores of the sub-scales *Instrumental and emotional* support and *Self-blaming* of the Brief-COPE questionnaire were associated with an increase in the likelihood of belonging to the group with positive changes (Table 4).

Likelihood of belonging to the group who reported negative changes in their eating patterns rather than to the group that did not experienced changes increased 86% when a reduction in household income was experienced due to COVID-19. Likelihood of experiencing negative changes in eating habits was also significantly influenced by coping strategies: a unit increase in the scores of the subscales *Self-distraction* and *Self-blaming* were associated with 53% and 135% higher likelihood of belonging to the group who reported negative changes, respectively (Table 4). On the contrary, a unit increase in the scores of the sub-scale *Positive reframing* was associated with a 35% decrease in the likelihood of belonging to the group with negative changes rather than to the group with no changes.

As shown in Table 4, likelihood of experiencing neither positive nor negative changes in eating habits rather than no changes significantly increased when household income was reduced due to COVID-19 by 75%, and with increasing scores of the sub-scales *Humor* and *Substance*

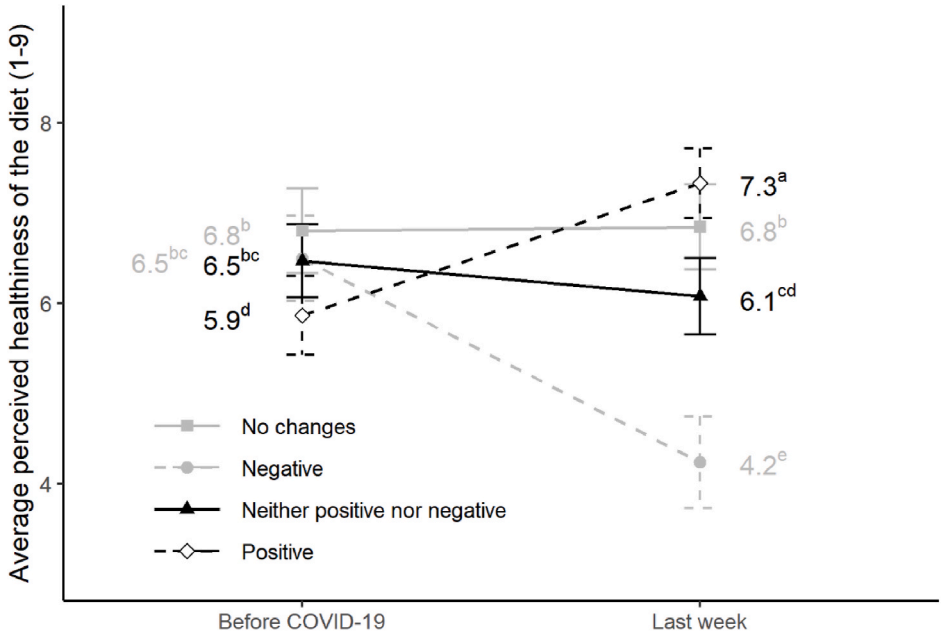

Fig. 1. Average perceived healthiness of the diet before COVID-19 and during the week prior to the study for participants who stated not having experienced changes in their eating habits and for those who characterized the changes as positive, negative or neither positive nor negative. Average values are shown with confidence intervals, and those with different superscripts letters are significantly different ($p < 0.05$) according to Tukey's test.

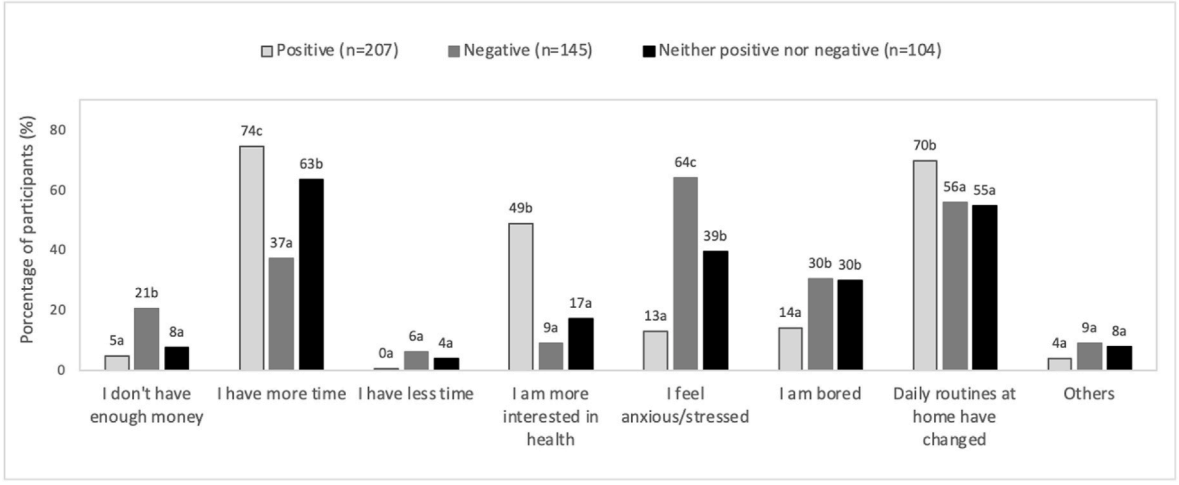

Fig. 2. Percentage of participants who selected different response options as motives for changes in their eating habits, for groups of participants who characterized the changes as positive, negative or neither positive nor negative. For each motive, different letters indicate percentages that are significantly different at a 5% significance level, according to a Tukey's test for general linear models.

use (67% and 91% per unit increase in the sub-scales scores, respectively).

4. Discussion

Results from the present work evidenced that COVID-19 provoked changes in the eating habits of a substantial proportion of participants, middle and high-income Uruguayan citizens. Other studies conducted in different countries worldwide have also reported changes in eating patterns, despite differences in the scale of the outbreak and the associated stringency of the governmental response (Górnika, Drywien, Zielinska, & Hamułka, 2020; Jaeger, Vidal, Ares, Chheang, & Spinelli, 2021; Poelman et al., 2021; Ruiz-Roso et al., 2020; Scarmozzino & Visioli, 2020). The proportion of participants experiencing changes in their eating habits largely vary across studies, from 17% in the Netherlands (Poelman et al., 2021) to 50% in Italy (Scarmozzino & Visioli, 2020).

Changes in eating habits caused by COVID-19 were categorized as positive and negative by different segments of participants. This confirms that COVID-19 was both an opportunity and a threat for healthy eating, in agreement with results reported by Górnika et al. (2020) and Scarmozzino and Visioli (2020). Positive changes in eating habits were associated with an increase in home-cooking and consumption frequency of fruits, vegetables and pulses, as well as a reduction in the consumption of take-away foods and ultra-processed products (e.g. cookies, sweets and chocolates, sweetened beverages). This suggests that the disruption in daily life created by COVID-19 was a catalyst for improving eating patterns for some consumers, as reported by Jaeger et al. (2021) in the USA and Philippe, Chabanet, Issanchou, and Monnery-Patris (2021) in France.

Table 4
Results of the multinomial logistic regression model exploring the influence of explanatory variables on participants' likelihood of belonging to groups who experienced different changes in their eating habits due to COVID-19 (positive, negative or neither positive nor negative).

Variable	Odds ratio (95% confidence interval)		
	Positive	Negative	Neither positive nor negative
Working status			
Not working	**0.47 (0.28–0.79)***	1.25 (0.78–2.01)	0.74 (0.40–1.37)
Household income before COVID-19			
1000-2000 USD	**1.78 (1.08–2.91)***	1.00 (0.61–1.65)	0.72 (0.39–1.32)
2000-3500 USD	**2.39 (1.32–4.31)***	1.39 (0.74–2.61)	1.62 (0.82–3.20)
Higher than 3500 USD	**3.29 (1.56–6.95)***	1.69 (0.72–3.98)	1.96 (0.81–4.75)
Changes in household income due to COVID-19			
Reduction	1.251 (0.82–1.90)	**1.86 (1.19–2.89)***	**1.75 (1.04–2.92)***
Increase	0.94 (0.33–2.66)	1.17 (0.36–3.80)	1.09 (0.29–4.06)
Healthiness of the diet before COVID-19	**0.62 (0.54–0.71)***	0.88 (0.75–1.02)	0.92 (0.77–1.10)
Coping strategies			
Instrumental and emotional support	**1.79 (1.31–2.42)***	1.34 (0.95–1.89)	1.35 (0.91–2.02)
Active coping and planning	1.25 (0.89–1.75)	1.04 (0.72–1.51)	0.78 (0.52–1.23)
Humor	1.13 (0.87–1.46)	1.06 (0.78–1.43)	**1.67 (1.19–2.34)***
Substance use	1.23 (0.87–1.97)	1.48 (0.93–2.36)	**1.91 (1.14–3.19)***
Self-distraction	1.07 (0.83–1.37)	**1.53 (1.15–2.04)***	1.27 (0.91–1.76)
Self-blaming	**1.57 (1.07–2.50)***	**2.32 (1.46–3.70)***	1.20 (0.91–2.19)
Positive reframing	1.13 (0.79–1.49)	**0.65 (0.47–0.89)***	0.74 (0.51–1.06)

Notes: The reference category in the model was the group who reported no changes in their eating habits. For categorical explanatory variables, the reference levels were as follows: Working status (working), Household income before COVID-19 (222–1000 USD), Changes in household income due to COVID-19 (Maintenance). Significant odd-ratios are highlighted with * and bold characters.

In contraposition, negative changes in eating habits were associated with greater quantity of food consumed, an increase in consumption frequency of ultra-processed products, and a decrease in the consumption of fruits, vegetables and fish. Participants who indicated having experienced negative changes in eating habits also reported increased consumption frequency of rice, pasta and polenta. Although this food category is not considered unhealthy according to the Uruguayan dietary guidelines (Ministerio de Salud Pública, 2016), their increased consumption could indicate a substitution of other healthy food categories, such as vegetables and fish.

Perceived changes in eating habits were aligned with self-reported changes in body weight. The majority of the participants who did not perceive changes in their eating habits did not report changes in bodyweight. However, participants who categorized changes in eating habits as negative or neutral frequently reported having gained weight, whereas participants who perceived positive changes more frequently stated that they had lost weight. Similar results have been reported by Górnika et al. (2020), Di Renzo et al. (2020) and Scarmozzino and Visioli (2020). The relationship between negative changes in eating habits and body weight can be explained by an increase in energy intake associated with an increase in the quantity of foods eaten and/or increased consumption of ultra-processed products. In this sense, recent evidence associates diets based on ultra-processed products with excessive calorie intake and weight gain, regardless of their nutritional composition (Hall et al., 2019).

Regardless of how changes in eating habits were categorized, the majority of participants who experienced changes in their eating habits reported an increased consumption frequency of home-made meals and a decrease in the consumption frequency of take-away food, which can be explained by stay-at-home recommendations and social distancing measures. An increase in consumption of home-made meals was also reported in Italy by Scarmozzino and Visioli (2020). This change may be regarded as a positive effect of COVID-19 given that homemade meals have been associated with higher nutritional quality (Mills et al., 2017). However, a more detailed analysis of home food preparation behaviors is needed to understand its effect on nutrient intake. In this sense, it is important to highlight that increased consumption of home-made meals was reported by participants experiencing positive, negative and neither positive nor negative changes in their eating habits.

4.1. Factors that moderate the effect of COVID-19 on eating habits

An in-depth understanding of factors that moderate the effect of COVID-19 on eating habits can provide relevant insights for policy making in order to minimize the secondary negative health effects of the pandemic. Results from the present work showed that the eating habits were not largely modified for participants who followed a healthy diet before the pandemic if their household income was not largely affected. The habitual nature of eating habits supports this result: people accustomed to eating healthily maintained their habits unless major changes in their economic situation occurred (Lin, Wood, & Monterosso, 2016).

Household income was strongly associated with positive changes in eating habits, in line with the strong relationship between household income, access to healthy foods, food purchasing behavior and diet quality (Lallukka, Laaksonen, Rahkonen, Roos, & Lahelma, 2007; Turrell, Hewitt, Patterson, & Oldenburg, 2003). On the contrary, reductions in household income were associated with negative or neither negative nor positive changes in eating habits. COVID-19 has been associated with an increase in food insecurity in Latin American countries, particularly among the most vulnerable households (Gaitán-Rossi, Villar-Compte, Teruel, & Pérez-Escamilla, 2020; Manfrinato et al., 2020). However, considering that the present study involved middle and high-income participants, the effect of the reduction in household income is not expected to have hindered access to enough and nutritious food of a large proportion of participants. In this sense, lack of money was not one of the most frequently selected motives underlying changes in eating habits (Fig. 2). The effect of reduced household income can also be explained by the emotional disturbance it caused. In this sense, participants identified stress/anxiety or to a lesser extent boredom as one of the main motives for negative changes in their eating habits. COVID-19 has been reported to cause psychological disturbance, such as depression and anxiety in a relevant proportion of the population (Ares et al., 2021; McCracken, Badinlou, Buhrman, & Brocki, 2020; Tull et al., 2020). The stress generated by COVID-19 may have triggered negative changes in eating habits, in agreement with research on the relationship between stress, eating behavior and obesity (Adam & Epel, 2007; Moynihan et al., 2015; Torres & Nowson, 2007; Yılmaz & Gökmen, 2020).

Participants who categorized changes in their eating habits as positive identified changes in their daily routines, increased time availability and an increased interest in health as the main motives underlying the changes. This agrees with the fact that time scarcity has been identified as a major barrier for healthy eating in Uruguay (Machín et al., 2018). Interestingly, diet healthiness decreased the likelihood of experiencing positive changes in eating habits. These results suggest that COVID-19 may have provided middle and high-income citizens the opportunity to re-assess their eating habits and to introduce long-awaited dietary changes to improve their eating habits (Wood et al., 2005).

Regarding coping strategies, instrumental and emotional support was positively associated with experiencing positive changes in eating

habits. This result agrees with previous studies suggesting that instrumental and social support are positively related with well-being (García et al., 2018). In addition, social support from family and friends has been associated with psychological resilience during COVID-19 lockdown among US adults (Killgore, Taylor, Cloonan, & Dailey, 2020). Self-blaming was also positively associated with positive changes, although the mechanisms underlying the relationship are less clear.

Coping strategies also played a role in triggering negative changes in eating habits. Participants who relied on self-distraction (relying on other activities to focus away from stress) and self-blaming (criticizing oneself for responsibility in the situation) to cope with the stress generated by COVID-19 were more likely to experience negative changes in their eating habits. These coping strategies have been regarded as maladaptive or dysfunctional, as they usually generate greater psychological distress and have been negatively related with wellbeing (Meyer, 2001; García et al., 2018). On the contrary, positive reframing (trying to see the situation from a positive point of view), acted as a protective approach as it decreased the likelihood of having negative changes in eating habits. Positive reframing has been reported to be one of the most effective coping strategies, being related with satisfaction (Stoeber & Janssen, 2011).

Previous studies have shown that humor can be a positive coping strategy by helping people to deal with tension and stress (Bowers & Smith, 2004; Stroeber & Janssen, 2011). However, in the present work it increased the likelihood of experiencing changes in eating habits categorized as neither positive nor negative. A similar effect was reported for substance use (using alcohol or other drugs to feel better). The underlying mechanism for these associations are not clear and deserve further exploration.

4.2. Implications of the findings

Results from the present study confirm understanding of the effects of COVID-19 on eating habits and provide relevant insights for policy making to reinforce positive effects and minimize threats to healthy eating. Although many of the reported changes will return to normal once the COVID-19 pandemic is over, some of the current eating habits may remain unchanged if consumers perceive them as convenient and affordable (Sheth, 2020). In this sense, strategies aimed at making the positive changes in eating patterns caused by COVID-19 long lasting, could have a constructive public health impact. In this regard, it is worth highlighting having more time and changes in daily routines were identified as the main motives underlying positive changes in eating habits. This poses questions over people's ability to maintain the positive changes in eating habits generated by COVID-19 once their daily life is back to normal. For this reason, the implementation of communication campaigns may be recommended to consolidate the increased consumption of home-made meals, which could lead to an improvement in diet quality.

Negative changes in eating habits, mainly an increase in the quantity of foods eaten and increased consumption frequency of ultra-processed products, can have negative long-term health effects and increase the risk of developing obesity and other non-communicable diseases (Pagliai et al., 2020). These changes were associated with negative emotional reactions to the health and economic impacts of COVID-19. For this reason, strategies that promote the development and training of social-emotional learning could reduce the negative emotional consequences of COVID-19 (Extremera, 2020). In this sense, practical recommendations for people to cope with boredom and isolation could have a positive effect (Brooks et al., 2020). Another aspect that deserves further consideration is the development and implementation of strategies to minimize the impact of digital marketing of ultra-processed products in a context of increased use of social media (White, Nieto, & Barquera, 2020).

4.3. Limitations of the study and suggestions for further research

The present research is not free of limitations. First, results from the present work do not provide a comprehensive overview of the changes in the eating habits of Uruguayan citizens caused by COVID-19 given that the study was focused on middle and high-income participants. Studies focused on the eating habits of low-income citizens are necessary to measure the effect of the pandemic on food insecurity and to identify the strategies implemented by households to cope with food shortage (CARE/WFP, 2003).

The study was based on a retrospective analysis of changes in eating habits which, together with the fact that participants were recruited using an advertisement on social media, may lead to an overestimation of changes in eating habits in the general Uruguayan population. Self-reported changes in the consumption of specific food categories could be potentially affected by social desirability bias. In this sense, in the present study a relatively high percentage of participants (22–42%) indicated not consuming food categories which are regarded as not very healthy (e.g., cookies and *alfajores*, sweets and chocolates, savory snacks, sweetened beverages) (Supplementary Table A3).

Another limitation of the present work was lack of representativity. Although the sample was diverse in terms of gender, age, educational level and household composition, it cannot be regarded as representative of the Uruguayan middle and high-income population as it underrepresented males and younger citizens. In addition, as no compensation was given, participants may have had a higher interest in food than average.

Finally, the present study explored factors associated with changes in eating habits as a consequence of COVID-19. However, only a subset of sociodemographic, behavioral and psychological variables was considered. Additional research is needed to advance the understanding of the effects of the pandemic on eating habits and their moderator variables. In particular, the effect of changes on citizens' working status, such as working from home, on eating habits deserve additional exploration, as well as the contribution of changes in physical activity to perceived weight gain. Last but not least, due to the exploratory nature of this study, and the large number of variables included in the model, interactions were not considered. The inclusion of such interactions may give rise to more nuanced insights on their effect in changes in eating habits as a consequence of COVID-19.

5. Conclusions

Results from the present work suggest that COVID-19 caused changes in the eating habits of Uruguayan middle and high-income citizens, although no mandatory curfews and quarantines were in place. COVID-19 was both an opportunity and a threat for healthy eating, as it promoted positive and negative changes in the eating habits of different segments of the population. Household income, perceived healthiness of the diet and coping strategies were associated with different perceived changes in eating habits due to COVID-19. Household income and reliance on instrumental and emotional support increased the likelihood of reporting positive changes in eating habits, whereas negative changes were associated with a reduction in household income due to COVID-19 and the coping strategies self-distraction and self-blaming.

Credit author statement

LV: Conceptualisation, Methodology, Formal analysis, Writing – Original draft, Writing - Editing & Reviewing; **GB**: Conceptualisation, Methodology, Formal analysis, Writing – Editing & Reviewing; **MRC**: Conceptualisation, Methodology, Writing - Editing & Reviewing; **AG**: Conceptualisation, Methodology, Writing - Editing & Reviewing; **VP**: Conceptualisation, Methodology, Writing - Editing & Reviewing; **DG**: Conceptualisation, Methodology, Writing - Editing & Reviewing; **EP**: Conceptualisation, Methodology, Writing - Editing & Reviewing; **LM**:

Conceptualisation, Methodology, Writing - Editing & Reviewing; **FG**: Conceptualisation, Methodology, Writing - Editing & Reviewing; **VG**: Conceptualisation, Methodology, Writing - Editing & Reviewing; **GA**: Conceptualisation, Methodology, Formal analysis, Writing – Original draft Writing – Editing & Reviewing.

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Declaration of competing interest

All authors declare no conflicts of interest. The funding sources had no role in the design of the study; in the collection/analyses/interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

Appendix A. Supplementary data

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Further reading

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