



Anxiety, Anhedonia, and related food consumption at the beginning of the COVID-19 quarantine in populations of Spanish-speaking Ibero-American countries: An online cross-sectional survey study

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1. Introduction

The COVID-19 pandemic threatens global health (Chen Wang, Pan, et al., 2020). It is causing fear among the population, which in turn may have a deleterious influence on mental health (Xiang et al., 2020). Similar effects on mental health were observed during the previous influenza outbreak (A H1N1v). For instance, during that outbreak, nearly 30% of

the general population recognized being concerned about the possibility of catching the virus (Rubin et al., 2010). Similarly, a recent study in China showed an increase of depression, anxiety, and stress symptomatology due to the COVID-19 pandemic (Cuiyan Wang, Pan, et al., 2020). Another study on Turkish population showed similar results, nearly 45% of participants scored above the cut-off point for anxiety during the pandemic (Özdin & Bayrak Özdin, 2020).

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Due to the rapid spread of the virus and in order to protect public health, the governments of several countries have been forced to take protective measures. These actions have included the closure of cities, stores, schools, and declaration of quarantines and confinement to enforce physical distancing. Lockdown is one of the oldest and most effective tools to control communicable diseases outbreaks (Wilder-Smith and Freedman, 2020). However, just recently, we start to understand its effect on people's life. For example, it has been observed that a greater availability of unstructured time due to the order of "stay at home" is associated with increased stress (Pearl, 2020).

This situation has raised widespread concern about individual vulnerabilities that may lead to increased food consumption, sedentary behavior, and the possibility of gaining weight during the current pandemic (Pearl, 2020). In this way, studies in Italy (Cicero et al., 2021) and Belgium (Drieskens et al., 2021) showed that lockdown was associated with a deterioration of diet quality. Therefore, it seems like during confinement, people are less prompt to maintain a healthy and varied diet and perform regular physical activity.

In this respect, a study in Italy showed that nearly 46% of the participants reported eating more during the lockdowns. Notably, authors reported an increase of the consumption of chocolate, ice cream, deserts, and salty snacks, which was individuals attributed to higher anxiety levels (Scarmozzino & Visioli, 2020). These results are consistent with other studies that show that people tend to regulate their emotions through food when confronting situations that bring on high-stress and anxiety (Braden et al., 2018; Ling & Zahry, 2021). Moreover, it has been shown that anxiety is associated with sweet craving (Penaforte et al., 2019) and increased visual attention to hedonic food (Motoki et al., 2019). It has also been shown that feeling anxious prompt to people to consumed comfort/palatable food and to increase food intake in order to feel better (Renzo et al., 2020). Thus, anxiety and boredom evoked by quarantine could be considered risk factors for consuming more food and food of poorer quality.

On the other hand, reward sensitivity is a crucial factor in food intake and decision-making (Neuser et al., 2020). Anhedonia (i.e., the decrease in the ability to feel pleasure) is associated with blunted reward sensitivity (Liu et al., 2016). Food is a potent natural reward and food choice includes biological determinants of hunger, appetite, and taste (Singh, 2014). Nevertheless, anhedonia as an elusive symptom of depression may have a crucial role in appetite dysregulation (Coccorello, 2019). In this way, anhedonia as a potential common substrate between anxiety and depression could also play a role in the genesis of eating (Grillo, 2016; Spano et al., 2019) and eating emotional disorders (Carriere et al., 2019; Tuncer & Çetinkaya Duman, 2020). Therefore, we could hypothesize that increased food consumption, mainly consisting on unhealthy food is associated with anxiety and anhedonia.

To the date this study was planned, there were few reports analyzing the relation between food consumption and anxiety and anhedonia in the general population of Spanish-speaking countries in the context of the lockdown at the beginning of the COVID-19 pandemic. The main aim of this study was to determine the relationship between anxiety and anhedonia symptomatology and the consumption of palatable food, fruits and vegetables at the beginning of the COVID-19 pandemic in 12 Spanish-speaking Ibero-American countries.

2. Methods

2.1. Study design

The present is a multi-centric and cross-sectional study carried out in 12 countries: Argentina, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Panama, Paraguay, Peru, Uruguay, Mexico, and Spain. Data was collected using an online survey and took place one month after the WHO declared the COVID-19 pandemic, between April 15th and May 4th, 2020.

2.2. Participants

Participants were recruited from the 12 countries mentioned above by convenience sampling. Subjects were invited to participate in the study through different digital platforms and social networks, including Facebook, Instagram, Twitter, personal and institutional emails. In order to participate, individuals have to be 18 years old or older and accept an online informed consent. Sample size calculation determined a minimum of 1194 participants. Sample size calculation was performed using G*Power (Faul et al., 2009) considering the performance of a logistic regression, a unilateral test, an Odds ratio = 1.3, Pr (Y = 1 | X = 1) H0 = 0.2, an α of 0.01 and a power (1- β) of 0.9. We considered the unilateral test because the main hypothesis states that increased serving size and palatable food consumption are positively associated with high anxiety and anhedonia symptomatology.

Pregnant or breastfeeding women (first four months); individuals with pharmacological treatment or psychological therapies for depression, anxiety disorders, stress, or mood disorders; and subjects with pathologies that required dietary treatment were excluded. An initial screening questionnaire included questions to identify exclusion criteria (e.g., currently diagnosed mood disorders or depression; pregnancy). If someone responded "yes" to any of these questions, the questionnaire automatically closed, and participation ended.

2.3. Data collection

Data was collected using Google Forms (Google LLC, Menlo Park, CA, USA). The survey had several sections: the first contained information about the study. At this stage, participants could choose to give their consent to participate and continue to the survey or not doing so and leave. The second consisted of an initial screening to identify the exclusion criteria and questions about socio-demographics, type and duration of confinement/lockdown, and housing (rural or urban). The third section was intended to collect data on mental health and included questions from the Beck Anxiety Inventory (BAI) and the Snaith-Hamilton Pleasure Scale for anhedonia (SHAPS). The last section consisted of a Food Intake Questionnaire. Information about self-reported body weight and changes in serving size during the pandemic was also collected in this section. Participants could answer the survey on a single occasion.

2.3.1. Beck Anxiety Inventory (BAI)

We used a validated Spanish version of the BAI to evaluate anxiety symptoms (Magán et al., 2008; Sanz & Navarro, 2003). Psychometric properties of the instrument in Chilean population have been evaluated with the sample of this study obtaining the following: Cronbach's Alpha = 0.929; 4-factor model fit indexes IFC = 0.93; TLI = 0.918; RMSEA = 0.063; SRMR = 0.041). Additionally, a preprint of psychometric properties for the BAI and the SHAPS across the 12 countries is available online (González-Medina, Lang, Ríos-Castillo, & Landaeta-Díaz, 2021).

The BAI is a useful tool to assess physiological (somatic) and cognitive aspects of anxiety that the subject may have experienced during the last week before its application. The questionnaire consists of 21 questions, providing a range of scores between 0 and 63. Each item is scored from 0 to 3, with the score 0 corresponding to "Not at all", 1 to "Mildly, but it didn't bother me much", 2 to "Moderately, it wasn't pleasant at times", and the score 3 to "Severely - it bothered me a lot". In order to define different levels of severity of anxiety symptoms we categorized the scores using cut-off points recommended in the latest edition of the original manual. In this way, 0-7 was defined as minimal anxiety, 8-15 mild anxiety, 16-25 moderate anxiety, and 26-63 severe anxiety (Beck & Steer, 1993).

2.3.2. Snaith-Hamilton Pleasure Scale (SHAPS)

SHAPS is a rapid screening battery created to assess anhedonia's presence, namely the inability to experience pleasure. The SHAPS was

applied in its Spanish-translated version in the Mexican population (Fresán & Berlinga, 2013), with Alpha Cronbach values of 0.77. The psychometric properties of the instrument were evaluated with the Chilean population obtaining the following: Cronbach's Alpha = 0.904; 4-factor model fit indexes IFC = 0.959; TLI = 0.947; RMSEA = 0.057; SRMR = 0.034. This scale considers 14 sentences with a brief description of situations or pleasant sensations related to the last days and a scale of 4 possible answers, among which the subjects should select one that best describes them: "Totally disagree"; "Disagree"; "Agree"; "Totally agree". Any "Agree" response is scored as 0, and any "Disagree" response is scored as 1. The original scoring was used to investigate the proportion of participants that could be classified as anhedonic (original SHAPS score >2) (Assogna et al., 2011; Franken et al., 2007; Snaith et al., 1995).

2.3.3. Food intake questionnaire

We evaluated food consumption using a food consumption frequency survey, which was elaborated following the Food Based Dietary Guidelines for the Chilean population (Olivares et al., 2013), based on previously validated surveys (Durán Agüero et al., 2014) (Dehghan et al., 2012, 2013). This questionnaire included questions to determine how often individuals consumed a serving per day/week of the following groups of foods: pastries, fried foods, fast food, sugar-sweetened beverages, fruits, vegetables, and others not considered in the present study.

Different food names were incorporated in each category, considering cultural differences between countries. Servings were expressed according to domestic measures such as cups, glasses, or units, depending on the food type. A "food portion exchange list" reviewed by expert nutritionists from each country was used to unify criteria for food servings for all countries (see Supplementary material 1). Participants were also asked to report serving size changes for food consumption in general during the lockdown compared to the period before the pandemic. They were given three options: increased, decreased, or did not change.

2.4. Variables

We performed two analyses, one to study the association of consumption of palatable/healthy foods and anxiety/anhedonia and another to analyze the relationship between change of food serving size during the lockdown and anxiety/anhedonia. For the first analysis our dependent variables were the consumption or not of palatable food including pastries, fried foods, fast food, and sugar-sweetened beverages as well as that of fruits and vegetables. For each of these foods, we created dummy variables indicating the consumption or not of them in the following way: consumption no (0 servings per day/week), consumption yes (≥ 1 serving per day/week). In this case, independent variables of interest were anxiety (minimal/mild/moderate/severe) and anhedonia (no, yes). For the second analysis, our dependent variable was the change of food serving sizes during the lockdown. In this case we also created a dummy variable depicting increased vs. unchanged food serving size. Independent variables of interest, in this case, were also anxiety (minimal/mild/moderate/severe) and anhedonia (no, yes).

2.5. Statistical analysis

We calculated mean, median, standard deviation, and interquartile range for numerical variables, including age, servings per day/week, and BAI and SHAPS scores. Percentages were used to summarize categorical variables including, type (voluntary/compulsory/not in lockdown) and time (\geq four weeks/three weeks/two weeks/one week) of lockdown; self-reported body weight (increased/decreased/did not change) and change in food serving size (increased/decreased/did not change), anxiety (minimal/mild/moderate/severe), and anhedonia (no/yes).

In order to study the relationship between food consumption and anhedonia/anxiety, we implemented a logistic regression model for each type of food. Included types of food considered in the present analysis were: pastries, fried food, fast food, sugar-sweetened beverages, fruits, and vegetables. Dummy variables indicating the consumption or not of these foods were modeled as dependent variables (see Section Variables). Anhedonia and anxiety were included in each model as independent variables, and age, gender, self-reported body weight change, and level of education as potential confounder variables. For categorical variables with more than two levels, we calculated Wald test to check the overall significance of the categorical variable in the regression model.

The association between serving size and anhedonia and anxiety was studied by implementing multiple logistic regression models. We run four multiple logistic regression models. The first model included potential confounders sociodemographic variables, age, gender, country, level of education, and period of lockdown (0, >2 weeks, >3 weeks, >4 weeks). The second model included variables related to consumption of pastries, fried food, fast food, sugar-sweetened beverages, fruits, and vegetables, and self-reported body weight change. The third model included anhedonia and anxiety. In all cases, the dependent variable was a dummy variable for serving size, which compared increased versus unchanged serving size. Finally, we formulate a fourth model where all the significant variables of the three previous models were included.

Descriptive statistical analysis was performed with Jamovi version 1.1 (The jamovi project, 2019), while data transformation, regression models, and plots were made with R (CoreTeam, 2018), R Studio and tidyverse packages including, dplyr (Hadley Wickham et al., 2018), ggplot2 (Wickham., 2016), final fit (Harrison et al., 2019), and jtools (JA, 2020).

2.6. Ethical considerations

The study followed the Declaration of Helsinki, regarding work involving human beings and agreed with the Singapore Statement on Research Integrity and was approved by the Scientific Ethics Committee of the Universidad de Las Americas, Chile, Number 2020001, and was reviewed by committees of the participating countries.

3. Results

3.1. General characteristics of the sample

Responses from 10,789 individuals were collected, from them 238 were excluded because they belonged to individuals not living in the countries of interest. The final sample included 10,551 individuals from the 12 invited countries. The sample was mostly composed of women (women: 79.2% (n = 8360); men: 20.8% (n = 2191)). The median age of the group was 34 years old (IQR 18); 91.6% of participants were living in urban zones. The 47.3% (n = 4996) of the sample reported voluntary lockdown, 47.9% (n = 5058) compulsory lockdown, and 4.8% (n = 497) were not in lockdown. Regarding lockdown duration, most of participants (74.6%, n = 7877) reported \geq four weeks on lockdown, 14.6% (n = 1541) three weeks, 3% (n = 321) two weeks, and 2.4% (n = 254) one week. Finally, 5.3% (n = 559) reported no restrictions on social contact. Appendix A1.

3.2. Pattern of food consumption

Regarding food consumption of the respondents, we observed a high frequency of daily consumption of sugar-sweetened beverages and fast food (hot dogs, burgers, pizza, tacos), with mean values of 4.2 (SD, 5.7) and 3.1 (SD, 2.9) servings per day, respectively. Individuals of certain countries reported a higher mean consumption of certain foods in comparison to the group mean. This is the case of Paraguay, Chile, and Panama that exceeded the group mean consumption of sugar-sweetened

beverages, with values of 6.3 (SD, 6.6), 5.0 (SD, 6.1), and 4.9 (SD, 5.3) servings a day, respectively. Paraguay, Argentina, and Uruguay showed a similar pattern regarding fast food, showing a mean consumption of 4.2 (SD, 4.1), 3.6 (SD, 3.3), and 3.5 (SD, 3.2) servings per day, respectively. Argentina, Uruguay, and Panama showed a similar pattern regarding pastries, with values of 6.8 (SD, 5.6), 6.1 (SD, 5.5), 5.8 (SD, 5.0) servings per day, respectively. Finally, Ecuador, Peru, and Panama were the countries with the highest amount of fried food servings per day, showing a mean consumption of 1.3 (SD, 0.9), 1.3 (SD, 0.8), 1.2 (SD, 0.9), respectively.

On the other hand, Spain was the country with the healthiest food consumption pattern. For Spain, the mean consumption of fruits, vegetables, and dairy products were 12.9 (SD, 6.4), 10.7 (SD, 4.0), and 10.6 (SD, 6.0) servings per week, respectively, while the mean consumption of the total sample that was 10.5 (SD, 6.1), 9.3 (SD, 4.3) and 8.7 (SD, 5.5), respectively.

Concerning the change of serving sizes, our results showed that 29.7% ($n = 3133$) of the sample increased their serving sizes, 52.7% ($n = 5557$) did not change, and 17.6% ($n = 1862$) decreased their food serving sizes at the beginning of the lockdown in comparison to the period before the pandemic. Participants from Argentina, Chile, and Mexico were the most inclined to increase food serving sizes at the beginning of the lockdown compared to the other countries. [Appendix A2](#).

3.3. Anxiety and anhedonia among participants

Anxiety was measured using the BAI and anhedonia using the SHAPS (see Methods). The mean BAI score for the sample was 13.1 (SD = 11.3), with a 10 (IQR = 15) median. The mean SHAPS score for the sample was 2.1 (SD = 3.3), with a median of 1 (IQR = 3). [Table 1](#) shows the scores for BAI and SHAPS for each country. BAI scores were higher for Chile, Guatemala, Mexico, and Ecuador than for the other countries. SHAPS scores were higher for Peru, Ecuador, Chile, Argentina in comparison with the other countries ([Table 1](#)).

Many participants showed minimal (39.5%, $n = 4172$) to mild anxiety (26.4%, $n = 2788$). A smaller percentage showed moderate (18.4%, $n = 1946$) to severe anxiety (15.6%, $n = 1645$). Less than one-third of the participants showed anhedonia (27.8%, $n = 2934$). A visual comparison of severe anxiety and anhedonia among participating countries is provided in [Fig. 1](#).

3.4. Anxiety, anhedonia, and food consumption

We report these results in [Table 2](#). Firstly, independent of gender, age, level of education, and anhedonia, anxiety was associated with consuming palatable foods, including sugar-sweetened beverages



Fig. 1. Severe anxiety and anhedonia by country. Percentage (%) of participants who showed severe anxiety and anhedonia is depicted by country.

(except for mild level), pastries, fried food, and fast food (all $p < 0.001$). Moreover, the odds of consuming these palatable foods were higher as the level of anxiety increased. In this way, the odds of consuming sugar-sweetened beverages, pastries, fried food, or fast food of people with mild, moderate, or severe anxiety were higher than that of people with minimal anxiety. Interestingly, anxiety was not associated with consuming fruits or vegetables (all $p > 0.05$).

In contrast to anxiety, anhedonia was not associated with consuming palatable foods, including sugar-sweetened beverages, pastries, and fried food (all $p > 0.05$). Still, anhedonia was associated with the consumption of fruits, vegetables, and fast food (both $p < 0.001$). In this way, the odds of consuming fruits were lower in people with anhedonia when compared to people without anhedonia. Similarly, the odds of consuming vegetables were lower in people with anhedonia than people without it ([Table 2](#)).

Table 1

Table descriptive the psychologic variables by country (Anxiety and Anhedonia).

	N	BAI ^a (Anxiety)				SHAPS ^b (Anhedonia)			
		Mean	SD	Median	IQR	Mean	SD	Median	IQR
Argentina	1423	12.3	10.5	9	14	2.2	3.1	1	3
Chile	1034	16.7	12.8	14	17	2.2	3.0	1	3
Colombia	573	12.3	10.5	10	13	1.9	3.2	1	2
Costa Rica	577	11.5	11.0	8	14	1.7	3.3	0	2
Ecuador	577	14.0	12.5	11	16	2.5	3.8	1	3
Spain	1288	13.4	11.0	11	15	2.2	3.0	1	3
Guatemala	963	14.1	11.2	11	16	2.0	3.3	1	3
Mexico	1280	14.0	11.8	11	16	1.9	3.3	1	2
Panamá	617	11.9	10.2	9	14	2.0	3.1	1	3
Paraguay	611	13.5	11.6	10	16	2.0	3.5	1	2
Peru	746	12.2	11.1	9	13	2.6	3.6	1	3
Uruguay	862	9.3	9.5	6	11	1.9	3.1	1	2

Abbreviations: n, number; S.D., standard deviation; IQR, interquartile range; BAI, Beck Anxiety Inventory; SHAPS, Snaith-Hamilton Pleasure Scale.

^a High score for BAI indicates a higher presence of anxiety symptomatology.

^b Higher scores for SHAPS indicate a higher presence of anhedonia symptomatology.

Table 2
Consumed palatable food by anxiety and anhedonia level.

	Anxiety ^a			Anhedonia ^b
	Mild OR (C.I.) p- value	Moderate OR (C.I.) p- value	Severe OR (C.I.) p- value	OR (C.I.) p- value
Pastries	1.4 (1.2–1.6) <0.001	1.5 (1.3–1.7) <0.001	1.8 (1.5–2.3) <0.001	1.0 (0.8–1.1) 0.82
Fried food	1.3 (1.1–1.5) <0.001	1.4 (1.2–1.7) <0.001	1.5 (1.3–1.8) <0.001	0.9 (0.8–1.0) 0.45
Fast food	1.4 (1.2–1.6) <0.001	1.4 (1.2–1.6) <0.001	1.5 (1.3–1.8) <0.001	0.9 (0.8–1.1) <0.001
Sugar-sweetened beverages	1.1 (1.0–1.2) 0.05	1.3 (1.1–1.5) <0.001	1.4 (1.2–1.6) <0.001	0.9 (0.8–1.0) 0.61
Fruits	1.1 (0.8–1.6) 0.47	0.8 (0.6–1.2) 0.26	0.7 (0.5–1.0) 0.05	0.5 (0.4–0.7) <0.001
Vegetables	0.8 (0.5–1.5) 0.62	0.7 (0.4–1.2) 0.14	0.8 (0.4–1.6) 0.55	0.4 (0.3–0.7) <0.001

Consumption of each food was modeled in separate models. All models were adjusted by gender, age, and education. ^aAnxiety level according to the Beck Anxiety Inventory (BAI); ^bAnhedonia according to the Snaith-Hamilton Pleasure Scale (SHAPS). Table shows adjusted OR of consumption vs. not consumption for each one of the specified foods. Confidence interval (C.I.) 95%, p-value.

3.5. Anxiety, anhedonia, and increase in serving size

In order to analyze the association between serving size, anxiety, anhedonia, and food consumption, we implemented four logistic regression models, including serving size (increased versus unchanged) as a dependent variable (see Methods). The results of the three models that were first implemented to identify covariates significantly associated with serving size (see Supplementary material 2). Significantly associated variables identified in the three first models were included in the final multiple logistic regression model. Fig. 2 shows a summary of the coefficients, and respective confidence intervals of the variables included in the final multiple logistic regression model.

Fig. 2 shows OR with their respective 95% confidence intervals of increased versus did not change serving for anxiety, anhedonia, and several covariates. The odds of increasing serving size was lower for males in comparison to females (O.R. = 0.76, $p < 0.001$). In comparison to Argentina, other countries had lower odds to increase serving size. In contrast, higher odds of increasing serving size was observed among people who reported a change in their self-reported body weight change (Wald test, $p < 0.001$; for individuals p values see Fig. 2), consumed pastries ($p < 0.001$), fried foods ($p = 0.003$), or sugar-sweetened beverages ($p < 0.001$). Besides, the odds of increased versus did not change serving size was higher for people with severe, moderate, or mild anxiety in comparison to individuals with minimum anxiety (Wald test, $p < 0.001$; for individuals p values see Fig. 2). Finally, we found that the increase in serving size was positively associated with anhedonia (O.R = 1.3, $p < 0.001$).

4. Discussion

Our data show that anxiety and anhedonia were associated with consuming unhealthy/palatable foods and an increase in food serving size. Interestingly, although anhedonia was not related to the consumption of palatable foods, it was related to consuming fruits and vegetables. That is, people with anhedonia consumed fewer fruits and vegetables in comparison to people without anhedonia. These results highlight the growing alarm about mental health problems and their connection with eating habits in Spanish-speaking Ibero-American countries, which has increased since the beginning of the pandemic.

We found that anxiety was related to the consumption of palatable foods, including sugar-sweetened beverages, pastries, fried food, and fast food. This association was independent of age, gender, level of education, and anhedonia. In these ways, we showed that the greater the level of anxiety, the greater consumption of these foods. Our findings are consistent with a recent study conducted in Italy during the pandemic, which showed an increase in the consumption of particular foods such as chocolate, ice cream, and desserts, as well as salty snacks, which were

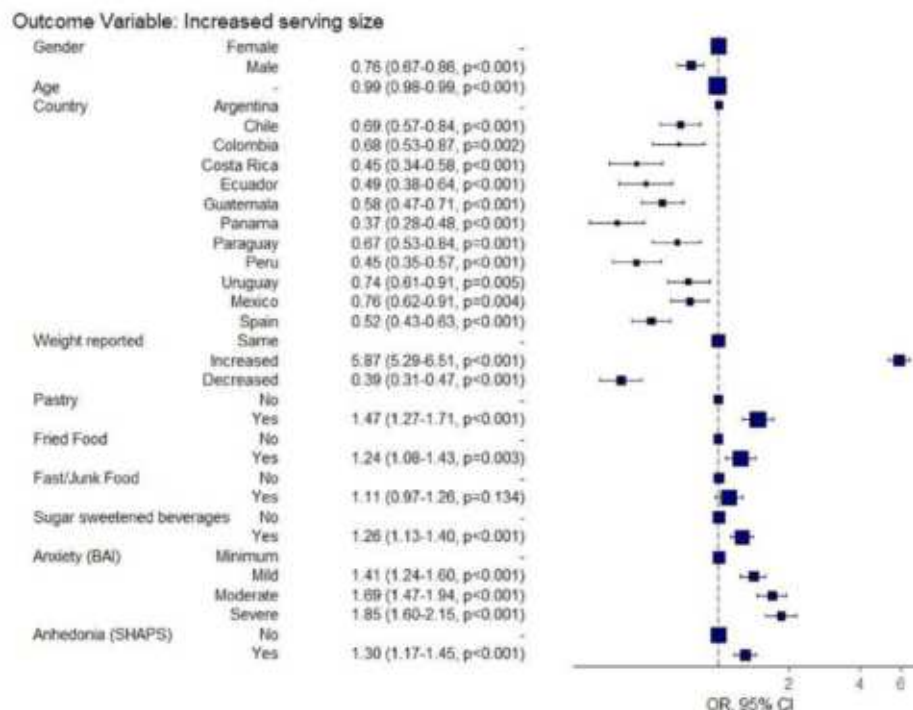


Fig. 2. Multivariable logistic regression analyses. The dependent variable was a dummy variable indicating an increase in consumption versus no change in consumption.

attributed to higher levels of anxiety (Scarmozzino & Visioli, 2020).

Other observations also show that in Italy during COVID-19 home confinement, a high number of people experienced depressed mood and feelings of anxiety (61.3% and 70.4%), and that near half of those felt anxious and were inclined to increase food intake to feel better (Renzo et al., 2020). Moreover, our study showed that anxiety was not related to the consumption of fruits and vegetables. In line with this, scientific literature shows that people tend to regulate their emotions in situations of increased stress and anxiety through the intake of palatable food instead of healthy food (Salazar-Fernández et al., 2021; Usubini et al., 2021).

Thus, people are prone to look for reward and gratification physiologically associated with food consumption, even overriding other satiety and hunger signals (Singh, 2014). Additionally, anxiety disorders and other psychological disorders of greater severity are more frequent in those who consume a more deficient quality diet (Gibson-Smith et al., 2018). This study also reveals that 15.6% of the studied population presented severe anxiety and 18.4% moderate anxiety. These percentages are higher than those shown by other studies.

For example, among Chinese medical students, severe anxiety levels were reported in 0.9% of the sample, while 2.7% had moderate anxiety (Cao et al., 2020). However, our findings are in line with others, including 500 individuals from Hong Kong, where 14% had anxiety (Choi et al., 2020), and another one in the Irish population, where general anxiety disorder was found in 20% (Hyland et al., 2020). Other studies have also shown an increase in the rate of depression and anxiety disorders during the COVID-19 pandemic (Huang & Zhao, 2020; Cuiyan Wang, Pan, et al., 2020).

On the other hand, our study found that anhedonia was not associated with consuming palatable foods, but it was positive associated with increased serving size. Our previous study with a Chilean independent sample (Landaeta-Díaz et al., 2021) found that both anxiety and anhedonia were positively associated with increased serving size. Data were collected in the same months that the current study (April–May), then we have supported our previous findings of the role of anhedonia in eating behaviors. However, we cannot explain why palatable food did not show differences, contrary to what we hypothesized because they have increased rewarding properties. Comorbid disorders could explain heterogeneous results in anhedonia association with eating behaviors (Coccorello, 2019), but it has not been evaluated in these studies, then the palatable food could have a specific effect on a particular profile of participants. Therefore, future studies need to complement self-report measures with a clinical diagnosis to understand the causes of variability.

We also found that an increase in the consumed food serving size was related to symptoms of anxiety and anhedonia. Moreover, those who consumed sugar-sweetened beverages, pastries, and fried food, had greater odds of increasing the serving size of food. These findings are consistent with recent research, where people affected by environmental changes showed increased food consumption (Ramalho et al., 2021), or changes in the type of food, probably caused by increased anxiety levels (Salazar-Fernández et al., 2021; Usubini et al., 2021). Our findings are in line with those of other studies.

For example, a study in Saudi Arabia (Alhuseini & Alqahtani, 2020) showed that people ate more homemade food during the pandemic, but the quality of food decreased. However, fruit consumption had increased (7%), the rise in consumption of fats and carbohydrates was even higher (13% and 21%, respectively). Similarly, our study showed that less healthy food was associated with increased portion sizes, while this did not happen with healthy food such as fruits and vegetables.

The previously discussed evidence indicates that spending more time at home and the possibility of cooking does not necessarily lead to the preparation of healthier food. Spending more time at home enables increased opportunities to eat and offers more stimuli, influencing food intake (da Silva et al., 2020); the problem is that this increased consumption is related to less healthy food. It appears that people prefer to

eat less healthy food for hedonistic reasons rather than for utilitarian ones (because of lack of time and availability) (Park, 2004) and to face negative emotions (Pak et al., 2021). In the present study, we identified associations both for anxiety and anhedonia, independently associated with a caloric increase.

Finally, the psychological impact of social distancing may persist for several months (Brooks et al., 2020), and therefore considering both the immediate and delayed and longer-term effects is an additional important focus. From this perspective, it is necessary to consider that social distancing associated with quarantines may also lead to social isolation and, as a consequence, to feelings of loneliness (Banerjee & Rai, 2020). Thus, the results reported in this study should be used for further research and development in mental health promotion during the COVID-19 pandemic.

4.1. Limitations and strengths

Among the limitations of our study, we can mention the cross-sectional design, which implies that we cannot establish causal relationships. Therefore, we suggest a longitudinal design to determine the causal association between psychological changes and eating behaviors in future studies. Another limitation was that this study did not include a variable related to the level of physical activity. This variable might affect psychological aspects, as well as food consumption patterns. Selection bias is another limitation of our study. Since the access to survey required access to the internet, it is likely that people without internet or limited use of it did not participate. Finally, our sample included mainly well-educated and women, mainly coming from urban areas. Thus, we cannot generalize to other populations.

Regarding the strengths, we can mention the large number of people who participated in the study ($n = 10,551$) and the variety of participant countries ($n = 12$) from the different zones of North, Central, and South America in addition to Spain. On the other hand, the psychological instruments applied in the study are standardized and internationally validated, allowing greater comparability of the results. Similarly, the local participation of the researchers from each one of the invited countries contributed to the dissemination of the surveys, and the elaboration and adaptation of the food intake questionnaire, adjusting it to the cultural diversity.

5. Conclusions

We have shown that during the beginning of the COVID-19 pandemic, in Spanish-speaking Ibero-American populations, both anxiety and anhedonia are related to consuming certain foods. In this way, people with anxiety/anhedonia eat less healthy at the beginning of the lockdown. They were prompt to consume palatable foods more often and increase their serving sizes. Our results suggest that public health decisions such as mandatory confinement must be carefully managed. Moreover, governments implementing those restrictive measures should take the necessary care to ensure that this experience is as healthy as possible. This could be achieved by guaranteeing food security and providing mental health care and support to the populations during lockdown periods.

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Declaration of Competing Interest

BMC is currently the Head of Sciences at Health Care Pediatrics, at Nutricia Argentina. All other authors declare that they have no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmph.2021.100933>.

Appendix A1

Table descriptive variables of the sample by country

Variables	No. (%)												
	Argentina N = 1423	Chile N = 1034	Colombia N = 573	Costa Rica N = 577	Ecuador N = 577	Spain N = 1288	Guatemala N = 963	Mexico N = 1280	Panama N = 617	Paraguay N = 611	Peru N = 746	Uruguay N = 862	Total N = 10551
Age, yr (median, IQR)	38.0 (16)	31.0 (14)	30.5 (15)	43.0 (21)	29.0 (17)	31.5 (14)	31.0 (21)	31.0 (16)	28.0 (16)	34.0 (12)	36.0 (18)	41.0 (21)	34.0 (18)
Age Group													
18–44	969 (68.0)	848 (82.0)	480 (83.6)	323 (55.9)	467 (80.9)	1067 (82.8)	716 (74.3)	1034 (80.7)	520 (84.3)	492 (80.5)	530 (71.1)	502 (58.2)	7948 (75.3)
45–54	275 (19.3)	122 (11.8)	52 (9.0)	141 (24.4)	55 (9.5)	136 (10.5)	144 (14.9)	145 (11.3)	58 (9.4)	75 (12.3)	117 (15.7)	185 (21.5)	1505 (14.2)
55–64	129 (9.0)	50 (4.8)	27 (4.7)	80 (13.8)	47 (8.1)	61 (4.7)	75 (7.8)	83 (6.5)	27 (4.4)	34 (5.5)	74 (9.9)	120 (13.9)	807 (7.6)
≥65	50 (3.5)	14 (1.4)	15 (2.6)	33 (5.7)	8 (1.4)	24 (1.8)	28 (2.9)	12 (1.5)	12 (1.9)	10 (1.6)	24 (3.2)	55 (6.4)	292 (2.7)
Gender													
Female	1248 (87.7)	827 (80.0)	465 (81.0)	440 (76.3)	404 (70.0)	996 (77.3)	702 (72.9)	1047 (81.7)	439 (71.2)	494 (80.9)	560 (75.2)	738 (85.6)	8360 (79.2)
Male	175 (12.3)	207 (20.0)	109 (19.0)	137 (23.7)	173 (30.0)	292 (22.7)	261 (27.1)	234 (18.3)	178 (28.8)	117 (19.1)	185 (24.8)	124 (14.4)	2192 (20.8)
Body-weight self-reported													
Increased	572 (40.2)	503 (48.6)	163 (28.4)	205 (35.5)	198 (34.3)	456 (35.4)	368 (38.2)	456 (35.6)	177 (28.7)	317 (51.9)	280 (37.6)	367 (42.6)	4062 (38.5)
Decreased	178 (12.5)	163 (15.8)	135 (23.5)	94 (16.3)	145 (25.1)	231 (17.9)	160 (16.6)	253 (19.8)	152 (24.6)	68 (11.1)	142 (19.1)	63 (7.3)	1784 (16.9)
Same	673 (47.3)	368 (35.6)	276 (48.1)	278 (48.2)	234 (40.6)	601 (46.7)	435 (45.2)	572 (44.7)	288 (46.7)	226 (37.0)	323 (43.4)	432 (50.1)	4706 (44.6)
Serving size self-reported													
Increased	541 (38.0)	385 (37.2)	147 (25.6)	123 (21.3)	138 (23.9)	315 (24.5)	284 (29.5)	412 (32.2)	114 (18.5)	228 (37.3)	170 (22.8)	276 (32.0)	3133 (29.7)
Decreased	155 (10.9)	159 (15.4)	129 (22.5)	111 (19.2)	157 (27.2)	235 (18.2)	160 (16.6)	262 (20.5)	185 (30.0)	62 (10.1)	188 (25.2)	59 (6.8)	1862 (17.6)
Same	727 (51.1)	490 (47.4)	298 (51.9)	343 (59.4)	282 (48.9)	738 (57.3)	519 (53.9)	607 (47.4)	318 (51.5)	321 (52.5)	387 (51.9)	527 (61.1)	5557 (52.7)
Type of Lockdown													
Voluntary	254 (17.8)	717 (69.3)	149 (26.0)	419 (72.6)	312 (54.1)	131 (10.2)	606 (62.9)	939 (73.3)	217 (35.2)	284 (46.5)	229 (30.7)	739 (85.7)	4996 (47.3)
Obligatory	1134 (79.7)	252 (24.4)	407 (70.9)	127 (22.0)	239 (41.4)	1138 (88.4)	297 (30.8)	261 (20.4)	373 (60.5)	305 (49.9)	491 (65.9)	35 (4.1)	5059 (47.9)
Were not in lockdown	35 (2.5)	65 (6.3)	18 (3.1)	31 (5.4)	26 (4.5)	19 (1.5)	60 (6.2)	81 (6.3)	27 (4.4)	22 (3.6)	25 (3.4)	88 (10.2)	497 (4.7)
Duration of lockdown													
>1 week	24 (1.7)	51 (4.9)	14 (2.4)	8 (1.4)	9 (1.6)	16 (1.2)	24 (2.5)	46 (3.6)	14 (2.3)	6 (1.0)	8 (1.1)	34 (3.9)	254 (2.4)
>2 weeks	20 (1.4)	61 (5.9)	10 (1.7)	23 (4.0)	8 (1.4)	14 (1.1)	27 (2.8)	94 (7.3)	18 (2.9)	11 (1.8)	16 (2.1)	19 (2.2)	321 (3.0)
>3 weeks	292 (20.5)	192 (18.6)	63 (11.0)	73 (12.7)	50 (8.7)	37 (2.9)	205 (21.3)	350 (27.3)	66 (10.7)	53 (8.7)	78 (10.5)	82 (9.5)	1541 (14.6)
>4 weeks	1038 (72.9)	666 (64.4)	470 (81.9)	438 (75.9)	485 (84.1)	1185 (92.0)	652 (67.7)	695 (54.3)	487 (78.9)	514 (84.1)	619 (83.1)	628 (72.9)	7877 (74.6)
Without restrictions	49 (3.4)	64 (6.2)	17 (3.0)	35 (6.1)	25 (4.3)	36 (2.8)	55 (5.7)	96 (7.5)	32 (5.2)	27 (4.4)	24 (3.2)	99 (11.5)	559 (5.3)
Living area													
Urban	1377 (96.7)	928 (89.7)	547 (95.5)	482 (83.5)	487 (84.4)	1114 (86.5)	890 (92.4)	1181 (92.2)	539 (87.4)	580 (94.9)	715 (95.8)	815 (94.5)	9655 (91.6)
Rural	46 (3.2)	104 (10.0)	25 (4.4)	93 (16.1)	90 (15.6)	171 (13.3)	73 (7.6)	98 (7.6)	76 (12.3)	31 (5.0)	31 (4.2)	43 (5.0)	881 (8.4)
N/I		2 (0.2)	1 (0.2)	2 (0.3)		3 (0.2)		1 (0.2)	2 (0.3)			4 (0.5)	15

N/I = Not information;
IQR = Interquartile range

Appendix A2

Average Consumption of Food Servings by Food Group and Country

Country	Food Group mean (DS)											
	n	Sugar sweetened beverages	Meat, Poultry and Fish	Fast Food	Fried Food	Fruits	Eggs	Dairy	Legumes	Pastries	Bread	Vegetables
Argentina	1423	4.68 (6.48)	2.53 (0.87)	3.63 (3.34)	0.78 (0.84)	9.74 (6.06)	2.46 (0.78)	9.38 (5.71)	1.11 (0.97)	6.87 (5.61)	7.45 (5.96)	10.0 (4.32)
Chile	1034	5.00 (6.19)	2.27 (0.98)	3.22 (3.00)	0.94 (0.78)	8.65 (5.50)	2.27 (0.87)	8.53 (5.69)	1.40 (0.80)	5.46 (4.78)	10.6 (5.85)	9.68 (4.29)
Colombia	573	2.41 (4.03)	2.79 (0.62)	2.66 (2.04)	1.00 (0.91)	11.0 (5.76)	2.80 (0.57)	9.34 (5.73)	1.69 (0.95)	5.22 (4.79)	5.78 (4.93)	8.99 (4.22)
Costa Rica	577	4.65 (5.83)	2.54 (0.82)	2.94 (2.12)	1.12 (0.93)	10.6 (5.81)	2.58 (0.78)	8.69 (5.48)	2.33 (0.92)	5.62 (4.74)	7.62 (5.25)	9.04 (4.40)
Ecuador	577	4.29 (5.69)	2.40 (0.92)	2.72 (2.82)	1.38 (0.99)	9.66 (5.74)	2.41 (0.84)	7.33 (4.77)	1.97 (0.89)	4.37 (4.14)	7.13 (5.04)	8.40 (4.20)
Spain	1288	2.33 (4.29)	2.31 (0.97)	3.05 (2.82)	0.74 (0.77)	12.9 (6.41)	2.30 (0.84)	10.6 (6.03)	1.86 (0.86)	4.69 (4.74)	8.85 (5.95)	10.7 (4.08)
Guatemala	963	4.94 (5.47)	2.62 (0.74)	3.04 (2.32)	1.19 (0.94)	9.90 (5.83)	2.57 (0.76)	7.46 (4.86)	2.55 (0.76)	5.39 (4.53)	9.74 (6.19)	8.51 (4.20)
Mexico	1280	4.58 (5.65)	2.62 (0.75)	3.16 (2.99)	1.02 (0.90)	11.4 (5.92)	2.25 (0.94)	7.93 (5.31)	2.09 (0.98)	5.38 (4.71)	7.67 (5.55)	9.82 (4.40)
Panama	617	4.96 (5.39)	2.70 (0.71)	2.83 (2.93)	1.29 (0.98)	9.18 (5.53)	2.39 (0.86)	7.74 (4.84)	2.15 (0.89)	5.80 (5.04)	7.04 (4.88)	7.58 (4.40)
Paraguay	611	6.35 (6.69)	2.67 (0.69)	4.21 (4.14)	1.21 (0.94)	8.62 (6.02)	2.26 (0.90)	10.3 (5.69)	1.25 (0.86)	5.36 (4.65)	10.4 (6.32)	9.44 (4.43)
Peru	746	3.23 (4.71)	2.58 (0.83)	2.30 (2.78)	1.36 (0.89)	10.9 (6.17)	2.55 (0.75)	6.41 (4.57)	1.83 (0.83)	4.33 (3.95)	8.48 (5.41)	7.10 (4.06)
Uruguay	862	4.64 (6.16)	2.40 (0.93)	3.56 (3.21)	0.69 (0.75)	12.5 (6.71)	2.28 (0.83)	9.98 (5.68)	1.16 (0.92)	6.13 (5.55)	8.20 (6.26)	9.72 (4.27)
Total	10,551	4.29 (5.73)	2.51 (0.86)	3.16 (2.99)	1.01 (0.90)	10.5 (6.16)	2.40 (0.84)	8.75 (5.58)	1.75 (1.00)	5.47 (4.91)	8.36 (5.88)	9.32 (4.38)

Ethical statement

The study followed the Declaration of Helsinki, regarding work involving human beings and agreed with the Singapore Statement on Research Integrity and was approved by the Scientific Ethics Committee of the Universidad de Las Americas, Chile, Number 2020001, (March 31st, 2020) and was reviewed by committees of the participating countries.

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