

# Changes in lifestyle behaviors during COVID-19 isolation in Argentina: A cross-sectional study

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## Abstract

**Objective:** Our aim was to identify changes in population habits induced by COVID-19 confinement in Argentina. **Methods:** An internet-based cross-sectional survey was conducted among adults in Argentina on December 2020, requesting possible changes occurring during the COVID-19 outbreak. It included 26 questions regarding general information (age, gender, location), eating habits, desire/anxiety for food or to eat between meals, weight gain, physical activity, and hours of sleep. We ran a descriptive statistical analysis of changes in habits and lifestyle during the confinement, followed by a logistic regression analysis to explore the relation between these changes and weight gain. **Results:** Out of 1536 survey participants, 57.1% were female, aged  $38.8 \pm 13.1$  years. Data showed that during the outbreak, people experienced significant changes in food intake, physical activity, nutritional supplement consumption, anxiety, and sleeping disorders. These changes in behavior resulted in an elevated percentage of people (39.7%) that gained weight (average  $4.8 \pm 2.8$  kg). Weight gain was associated with more food consumption (OR: 9.398), increased snacking between meals (OR: 1.536), anxiety about food (OR: 3.180), less practice of physical activity (OR: 0.586) and less consumption of nutritional supplements (OR: 0.762). **Conclusions:** COVID-19 outbreak was associated with unhealthy lifestyle changes and body weight increase. These adverse side effects could be prevented by active promotion of nutritional advice and physical activity, implementing virtual activities associated with regular mass promotion campaigns.

## Keywords

COVID-19 lockdown, lifestyle changes, weight gained

## 1. Introduction

Lockdown implemented everywhere due to SARS-CoV-2 global pandemic has produced to date almost 6,000,000 deaths across the five continents (COVID 19 Dashboard by the Center for Systems Science and Engineering, CSSE, 2022).

Initially, in the absence of effective vaccines and treatment, preventive confinement and physical distance, have been the only and most effective strategy to contain the progression and severity of this pandemic (Anderson et al., 2020). Argentina was not an exception, and consequently, national health authorities had to appeal to similar prevention strategies, ordering a compulsory social isolation for all citizens residing in the country on March 20th, 2020 (Decreto de Necesidad y Urgencia, 2020). This measure was extended until August 2020, giving rise to a gradual reopening with measures of different degrees of isolation and social distancing throughout the entire country depending on the severity and rate of local spread of the disease.

Although these measures were effective for the spread prevention of COVID-19, many people suffered undesirable

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secondary side effects such as stress, negative psychological impact, altered circadian rhythms, sleep and food intake disorders, as well as the serious socioeconomic impact of the lockdown (Brooks et al., 2020; Ingram et al., 2020; Scarmozzino and Visioli, 2020).

Several authors have reported changes in food habits and physical activity (PA) during isolation in several countries (Zhao et al., 2020; Pietrobelli et al., 2020; Robinson et al., 2021); further, a local survey implemented 45 days after the initiation of outbreak prevention supports these variations (Aguirre Ackermann et al., 2020).

All these changes in lifestyle can negatively affect the control and evolution of chronic diseases such as cardiovascular risk factors in many people as widely reported (Cheval et al., 2020; King et al., 2020; Chandrasekaran and Ganesan, 2021; Di Giuseppe et al., 2019). A better understanding of changes in health-related behaviors, such as eating behaviors, PA, and lifestyles, would provide important information for designing appropriate health promotion strategies at the population level (Pérez-Rodrigo et al., 2021).

In view of all the above-mentioned evidence and attempting to explore how an extension of isolation measures could affect lifestyle changes, our main aim was to 1) analyze the impact of the current COVID-19 lockdown on eating and general lifestyle habits on the Argentine population and 2) to evaluate the influence of changes in habits and lifestyle by isolation on body weight gain. Health authorities could thereafter utilize this information to design and implement effective strategies to prevent the negative side effects induced by COVID-19 confinement policies on the Argentine population and other populations as well.

## 2. Methods

### 2.1. Study design and participants

We performed an internet-based cross-sectional survey in Argentina on changes occurring during the COVID-19 outbreak. The survey was disseminated through local radio stations (radio Universidad AM1390, FM Comahue 102.9, UN Comahue), institutional (CONICET and UNLP) and private social networks (i.e., WhatsApp, Twitter, Instagram, and Facebook), and also the researchers' mailing list. Participants were sent an internet link to the survey created with the Google Forms application (Google LLC, Mountain View, CA, USA), an established method for use in healthcare research (Buchanan and Hvizdak, 2009).

Data collection began on December 2nd and ended on December 22nd, nine months after the start of the official lockdown imposed on March, 20th by the Argentine government.

*Inclusion criteria:* to participate in the survey, people had to be adults ( $\geq 18$  years) residing in Argentina, capable of understanding the purpose of the study and willing to participate voluntarily.

### 2.2. Survey questionnaire

The survey (available as Sup. Material) was designed by the authors based on and adapted from a similar questionnaire reported in the literature and facilitated by its own authors (Sinisterra-Loaiza et al., 2020). The online survey included 26 questions organized as follows: a) *First section:* respondents were asked about: age, gender, place of residence during confinement, indicating whether they were located in a rural or urban area; b) *Second section:* related to eating habits (9 questions asking about their eating habits during the confinement period compared to the period before the pandemic), including consumption frequency by groups of foods, time spent preparing pastries and/or homemade bread, increased desire/anxiety for food or to eat between meals, and weight gain. Subsequently, they were asked about the consumption of alcoholic beverages, information about gastronomy and nutrition, time dedicated to cooking and the culinary techniques used. They were also asked about PA, hours of sleep and whether they took naps; they were also asked whether they had taken any type of food supplements aimed at strengthening the immune system as well as if their smoking habit had changed. All the questions were formulated in comparison to habits before confinement.

Of the 1574 surveys received, only 1536 were considered valid: 10 participants had to be excluded for not meeting the inclusion criteria (age and/or place of residence) and 28 for having submitted their questionnaire incomplete.

### 2.3. Data management and analysis

To avoid survey fatigue (ÓReilly-Shah, 2017), we recorded self-reported changes that occurred during social isolation by using binary answer options (Yes/No) or a type of Likert scale to self-rate change in each item, with the following answer options: less, the same (including No consumption/use), or more than the amounts usually consumed before confinement.

Fully completed questionnaires were extracted from Google Forms and exported to Statistical Package for Social Science (SPSS) version 26 software for data analysis.

The responses on the Likert scale were recoded to be binary as follows: a) we identified whether there were changes in habits compared to the situation before isolation (less or more than before vs. the same or no consumption/use); and b) in the group that reported changes during isolation, we identified those who increased or decreased the habit or consumption of each food.

Descriptive data are indicated as frequencies and percentages as well as mean  $\pm$  standard deviation (SD). A sub-analysis also compared changes in habits and lifestyles in persons who gained weight compared to the rest of the respondents (persons who lost weight or reported no changes). Differences in continuous variables were assessed by parametric and nonparametric tests according to the normal distribution of the variables (Kolmogorov–Smirnov test), using the  $\chi^2$  test to evaluate differences in proportions. Finally,

multivariable logistic regression analyses were conducted to explore the influence of changes in habits and lifestyle by isolation on weight gain. Their results are provided as odds ratio (OR) with their respective 95% confidence intervals (95%CI). A significance level of  $p < 0.05$  was applied to all statistical analyses.

#### 2.4. Ethical considerations

The study was conducted according to Good Practice Recommendations (International Harmonization Conference) and the ethical guidelines of the Helsinki Declaration. All the participants were informed about the characteristics of the study before agreeing to participate. The anonymous response to the survey was completely voluntary. The participants had to check a specific box to give their consent to participate in the study. The anonymous nature of the web-survey does not, in any way, allow the tracing of sensitive personal data.

### 3. Results

#### 3.1. General description of surveyed population

As explained before, we finally included 1536 of the 1574 responses received.

The majority of respondents were from Buenos Aires City and surrounding areas (60.5%), 75.1% of them being women. Only 10% were smokers and 37% of these (66 people) increased the amount of tobacco consumption during the confinement (Table 1).

**Table 1.** General Characteristics of the Sample (N = 1536).

Parameter	Value	N
Female (%)	75.1	1153
Age (years)	38.8 ± 13.1	1536
<b>Place of residence</b>		
Urban (%)	95.4	1466
Rural (%)	4.6	70
<b>Geographic distribution</b>		
Buenos Aires metropolitan area (AMBA) (%)	60.5	929
Rest of the country (%)	39.5	607
<b>Smoking habits</b>		
Smokers (%)	10.0	153
Increased consumption during confinement (%)	4.3	66
<b>Body weight</b>		
<b>Change in body weight during outbreak</b>		
Gained weight (%)	39.7	610
Did not gain weight (%)	43.5	668
Unknown (%)	16.8	258
Average weight gained (Kg) *	4.8 ± 2.8 (4.0 [3.0–6.0])	610
Average weight lost (Kg) *	5.1 ± 4.4 (4.0 [3.0–6.0])	323

\* In parentheses (Median [IQR]). IQR, interquartile range.

#### 3.2. Changes Recorded in Food Consumption During Confinement.

The survey form included a list of foods with different general health impact; in that context we included foods like fresh and dried fruit, fish, vegetables, legumes, eggs and milk and its derivatives, which increased consumption could be beneficial; and some others, like beef, poultry and pork, pasta, sausages, cookies, bread, sodas, wine, beer and some others, that its excessive consumption could be associated with a harmful health situation. Since the survey did not register the amount of each food consumed before and during confinement, we cannot be conclusive as to whether these changes were beneficial or detrimental for their health condition; however, we can associate the data with the auto-reported body weight gain in the survey, as shown in Table 2.

We found that in the general population, the percentage of people who increased consumption of foods arbitrarily qualified as “healthy foods” and decreased intake of “unhealthy foods” is higher than the opposite situation (with the exception of fish in the first group and bread and wine in the second). These data suggest that in our population most people tried to consume a reasonable amount of healthy food.

However, a very interesting result was achieved when we compared food consumption between people who did or did not gain weight. In this context, people who increased weight showed a significant reduction ( $p < 0.05$ ) in the consumption of fresh fruits, vegetables and legumes compared to those participants who did not change their body weight. Although the percentage of people who decreased consumption of dried fruits, milk, and eggs was also higher in that group of people, their differences were not significant.

On the other hand, the percentage of people who increased the consumption of all those foods arbitrary ascribed with “unhealthy effect” (except for salt), was also significantly higher ( $p < 0.05$ ) in people that gained weight.

#### 3.3. Habits and behavior

Participants were asked about changes recorded in different habits and behavior related to their health and nutrition care (Sup. Material and Table 3).

Most of the people surveyed reported having changed the frequency with which they shopped for food (72.7%) and also the kind of stores where they made these purchases (49.3%). No significant differences were recorded in these habits among people who did or did not gain weight (Table 3).

Regarding the attitude that people showed about food and meal preparation, 63.9% of participants spent more time preparing food during the pandemic isolation than before. 71.7% used to have at least one meal in their work/study place before establishment of confinement and 60% stated that they were more anxious about food consumption during the latter period. This situation correlated well with 37.6% of people that increased the amount of

**Table 2.** Changes Recorded in Food Consumption During Confinement.

Food	Overall (N = 1536)						Did not gain weight (n = 668)		Gained weight (n = 610)		p*
	Changed consumption		Increased Consumption		Decreased Consumption		%	n	%	n	
	%	n	%	n	%	n	%	n	%	n	
<b>Decreased consumption</b>											
Fresh fruit	36.5	561	25.8	396	10.7	165	7.8	52	14.4	88	0.000
Fish	31.5	484	15.1	232	16.4	252	13.5	90	19.2	117	0.006
Vegetables	40.1	616	32.6	501	7.5	115	5.2	35	11.1	68	0.000
Legumes	38.5	591	26.6	409	11.8	182	10.3	69	15.2	93	0.008
Dried fruits	36.3	557	26.1	401	10.2	156	10.0	67	11.6	71	0.354
Milk and its derived	31.0	476	15.9	244	15.1	232	16.9	113	14.4	88	0.222
Eggs	34.7	533	26.9	413	7.8	120	7.5	50	8.7	53	0.430
<b>Increased consumption</b>											
Meat	32.5	499	11.8	181	20.7	318	9.7	65	13.8	84	0.025
Pasta	38.2	586	18.4	283	19.7	303	12.9	86	23.6	144	0.000
Bread	40.8	626	24.7	379	16.1	247	18.3	122	30.7	187	0.000
Sausages	38.5	591	14.8	227	23.7	364	7.5	50	23.9	146	0.000
Cookies	39.4	605	15.6	239	23.8	366	9.0	60	22.5	137	0.000
Bakery products	47.9	735	19.9	305	28.0	430	10.9	73	29.7	181	0.000
Candies	41.7	641	17.9	275	23.8	366	10.0	67	26.4	161	0.000
Sodas	24.9	383	9.0	138	16.0	245	5.2	35	13.4	82	0.000
Fried snacks (chips)	34.1	524	14.6	225	19.5	299	7.8	52	21.3	130	0.000
Butter	23.8	365	8.3	127	15.5	238	3.9	26	13.9	85	0.000
Wine	26.0	399	17.2	264	8.8	135	5.8	39	8.9	54	0.038
Beer	33.0	507	17.9	275	15.1	232	12.4	83	20.7	126	0.000
Fast Food	41.4	636	17.9	265	23.5	361	8.4	56	27.4	167	0.000
Sugar	25.0	384	9.5	146	15.5	238	6.9	46	14.8	78	0.000
Salt	15.2	234	3.2	49	12.0	185	2.4	16	4.1	25	0.084

\*p-value between groups ("did not gain weight" vs. "gained weight"). Table shows the results obtained from the analysis of the different food consumption. The first columns (left panel) show changes in food consumption (global change, increase and decrease) in the total population surveyed (N = 1536). The right panel shows results obtained in the subpopulations of people who did not change weight during confinement (n = 668) and those who did gain it (n = 610). To evaluate the possible negative impact of the lockout on the quality of food ingested, we compared both subpopulations in relation to the decrease in the amount of some food ingested (upper panel) and increased intake of others (bottom panel). Differences are considered significant when  $p < 0.05$ .

food consumed and 36.3% that increased the consumption of informal food between meals (increased snacking). Except for the time dedicated to meal preparation, all these habits and behaviors were significantly ( $p < 0.05$ ) more relevant in the subpopulation that increased their body weight.

Concerning the importance the surveyed population gave to nutrition knowledge, 62.3% searched for information about nutrition on the internet and social networks (45.5%) or by consulting a professional (31.3%), although only 21% consumed some nutritional supplements. In this context, we found that the percentage of people who cared about all the nutritional aspects that we have just mentioned, was significantly higher ( $p < 0.05$ ) in the group of people who did not change their weight compared to those who increased it.

### 3.4. Practice of physical activity and changes in sleeping habits

Our survey also included questions about the level and quality of PA practice by participants during confinement

(Sup. Material). As shown in Table 4, 81.8% of the people stated that they practiced PA during pandemic isolation. However, 70.2% of them admitted that during confinement, they changed the level of PA they used to practice before the pandemic started, of which 46.2% reduced it. Further, 68.8% practiced a low level of PA and 21.5% dropped its practice when they realized that pandemic isolation would be extended for too long a time. Only 31.3% practiced moderate (13.2%) and/or high level (18.1%) PA, and 35.7% were able to maintain their practice throughout the whole period of confinement. It must be stressed that frequency and quality of PA practiced during pandemic isolation was significantly higher ( $p < 0.05$ ) in people who did not gain weight (Table 4).

Concerning sleep quality, 63.0% of people reported having changed sleeping habits: 28.6% slept fewer hours than before the pandemic and 10.2% declared that they added sleeping supplements. Only 6.3% adopted an afternoon nap in their sleeping habits. No significant changes in hours or quality of sleep were reported by people who did or did not gain weight (Table 4).

**Table 3.** Changes in Habits and Behaviors Related to Food Purchase, Meals and Nutritional Information (N = 1536).

Parameter	Overall (N = 1536)		Did not gain weight (n = 668)		Gained weight (n = 610)		p*
	%	n	%	n	%	n	
<b>FOOD PURCHASE</b>							
Changed food purchase frequency	72.7	1117	70.1	468	74.9	457	0.052
Increased food purchase frequency	22.2	341	18.3	122	24.1	147	0.011
Changed the kind of stores in which to purchase food	49.3	758	47.5	317	52.5	320	0.074
- Changed from supermarkets to convenience stores #	60.9	462	64.0	203	59.7	191	0.257
- Changed from convenience stores to supermarkets #	8.8	67	6.6	21	10.0	32	
- Online purchase #	30.2	229	29.3	93	30.3	97	
<b>ATTITUDE ABOUT MEALS AND FOOD PREPARATION</b>							
Used to eat out at least once a day before confinement	71.7	1102	67.1	448	74.6	455	0.003
Ate more than before	37.6	577	13.2	88	67.5	412	0.000
Snacked between meals more than before	36.3	558	19.3	129	55.6	339	0.000
Increased anxiety about food	60.0	921	44.8	299	79.0	482	0.000
<b>NUTRITIONAL FACTS</b>							
Searched for nutritional information	62.3	957	67.5	451	59.8	365	0.004
Consulted the web, social networks, etc	45.5	699	48.8	326	42.1	257	0.017
Asked for professional support	31.3	480	36.4	243	30.2	184	0.019
Spent more time preparing food	63.9	981	63.0	421	64.1	391	0.690
Increased consumption of nutritional supplements	21.4	328	25.9	173	19.5	119	0.007

\*p-value between groups ("did not gain weight" vs. "gained weight"). The first 2 columns in the left panel show changes in habits and behaviors recorded in the total population surveyed (N = 1536). In the right panel, columns show the subpopulations of people who did not change weight during confinement (n = 668) and those who gained weight (n = 610). Differences between groups are considered significant when p < 0.05. #% were calculated compared to the total of people that changed food purchase habits (n = 758 overall: n = 317 in "did not change weight" group and n = 320 in "gained weight" group).

### 3.5. Determinants of weight gain during COVID-19 lockdown

Multiple logistic regression analyses presented in the Figure show that having gained weight during the outbreak was positively associated with eating more (OR: 9.398, 95% CI: 1.107–1.767), having increased snacking between meals (OR: 1.536, 95% CI: 1.064–2.215) and anxiety about food (OR: 3.180, 95% CI: 2.208–4.579). Conversely, the increase in body weight was negatively associated with the intensification of the practice of PA (OR: 0.586, 95% CI: 0.384–0.895) and the consumption of nutritional supplements (OR: 0.762, 95% CI: 0.426–0.945) during pandemic isolation. Figure 1.

## 4. Discussion

Our data show that during the lockdown, people made significant changes in their habits related to food intake, PA, nutrition supplement consumption, anxiety and sleep disorders. Similarly, Frederik et al. (2020) showed in a descriptive cross-sectional study carried out in Buenos Aires (Argentina) in June 2020, that people suffered multiple behavioral changes that could be reflected unevenly in clinical and metabolic aspects concluding -as currently we did- that it is necessary to design and implement effective interventions to prevent isolation-induced food consumption alterations.

In our study, an alarming data was also recorded: the high percentage of people (39.7%) who increased their body weight (average  $4.8 \pm 2.8$  kg) during the isolation period. Supporting this result, a survey implemented in our country 45 days after the initiation of COVID-19 preventive lockdown, including 5635 respondents, reported that changes in eating habits and the lower level of PA were directly associated with the increment of 1 to 3 kg in weight in 62.1% of the participants (Aguirre Ackermann et al. 2020). This study also showed that people that reported most weight gained were those having been overweight prior to isolation. Although in our study we do not know whether participants' body weight before isolation were on the normal, overweight, or obese range, we registered a significantly increased body weight gained during the confinement period analyzed (8 months and 12 days vs. 45 days). In that context and due to the high prevalence (25.4%) of overweight/obesity in our country (4ta Encuesta Nacional de Factores de Riesgo, 2018), prolonged confinement could exacerbate the obesity problem in Argentina.

Comparable results were reported in other studies run in several countries with different cultures and life-style habits. A study performed in France with 37,252 participants, showed important decrement in PA and consumption of fresh food, while sweets, cookies, cakes, and snacks consumption increased, resulting in major percentage of people that gained weight (35% vs. 23% that lost weight).

**Table 4.** Changes Recorded in Physical Activity and Sleep Habits (N = 1536).

Parameter	Overall (N = 1536)		Did not gain weight (n = 668)		Gained weight (n = 610)		p*
	%	N	%	n	%	n	
<b>PHYSICAL ACTIVITY (PA)</b>							
Changed PA level	72.7	1117	70.1	468	74.9	457	0.052
Reduced PA level during isolation	22.2	341	18.3	122	24.1	147	0.011
Practiced PA during isolation	49.3	758	47.5	317	52.5	320	0.074
Not at the beginning, but started latter on #	30.1	378	28.8	166	29.1	137	0.000
Dropped its practice during isolation #	26.3	330	17.7	102	37.4	176	
Maintained PA throughout the whole isolation period #	43.7	549	53.5	308	33.5	158	
PA level							
Practiced PA at a low level	68.8	1056	62.1	415	73.4	448	0.000
Practiced PA at a moderate level	13.2	202	15.4	103	11.2	68	
Practiced PA at a high level	18.1	278	22.5	150	15.4	94	
<b>SLEEP HABITS</b>							
Changed sleep habits	63.0	967	59.0	394	66.9	408	0.004
Slept less hours than before	28.6	440	27.7	185	30.7	187	0.244
Sleep time							
Slept less than 6h/day	11.3	174	10.0	67	14.1	86	0.079
Slept 6 to 8 h/day	68.8	1056	70.5	471	66.7	407	
Slept more than 8h/day	19.9	306	19.5	130	19.2	117	
Took a nap	58.5	898	57.5	384	60.3	368	0.302
Added a nap	6.3	97	5.7	38	7.4	45	0.221
Consumed sleep supplements	10.2	156	10.2	68	11.0	67	0.640

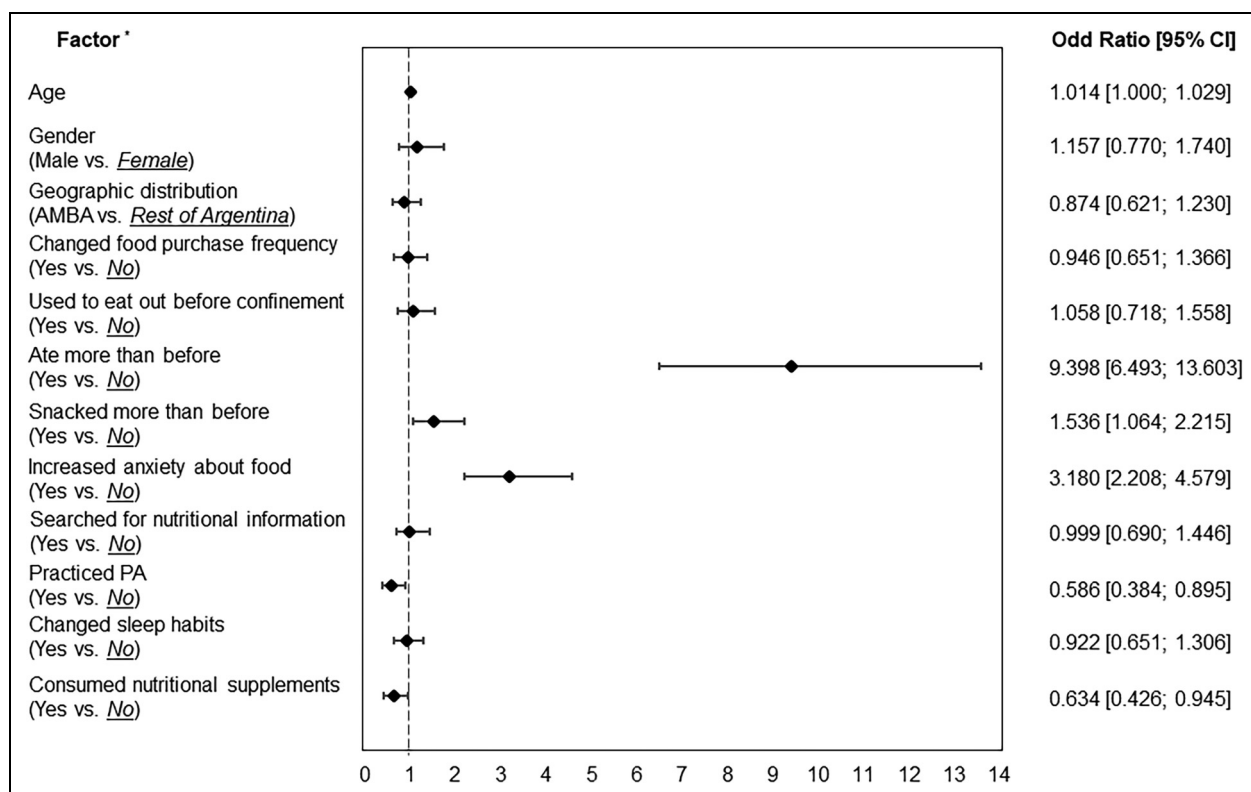
\*p-value between groups (Did not gain weight vs. Gained weight). The columns in the left panel show changes in habits and behaviors recorded by the total population surveyed (N = 1536). In the right panel, columns show the subpopulations of people who did not change weight during the lockdown (n = 668) and those who gained weight (n = 610). Differences between groups are considered significant when  $p < 0.05$ . # % were calculated compared to the total of people that practiced physical activity (n = 1257 overall: n = 576 in did not change weight" group and n = 451 in "gained weight" group)

Deschassaux-Tanguy et al., 2019). Another study performed in the UK with 620 participants showed that the increase in snacks and energy-dense foods consumption, uncontrolled eating and anxiety during the Covid-19 blockade were associated with gender (Couthard et al., 2021). In Galicia (Spain), Sinisterra-Loaiza et al. (2020) evaluated the changes produced in eating habits and lifestyle in 1350 adults during COVID-19 confinement. They recorded increased consumption of healthy foods (fruits and vegetables) and a decrease in other less healthy ones, however, they also reported a decrease in PA and an increase in the amount of food consumption, in the degree of anxiety about food, resulting in an increase in body weight in 50% of the population. Further, a study made in the Netherlands including 1030 adults showed that participants that started pandemic isolation period with overweight were more likely to eat unhealthier during lockdown compared to those with a healthy weight (Poelman et al., 2021). A recent review that summarizes 23 of 4300 studies concluded that the effect of COVID-19 lockdown, significantly impacted on diet, in association with other poor lifestyle outcomes including weight gain, mental health issues and limited PA, thus leading to negative effects on the health of the population (Bennett et al., 2021). A recent study conducted in Shanghai (China) reported a sharp decrease in the daily

step count during the COVID-19 lockdown, with a subsequent increase recorded when the lockdown was lifted (Ding et al., 2021). Reinforcing the concept of behavior inertia, a cross-sectional study performed in the USA showed an increase in obesogenic behaviors that favored weight gain during COVID-19 lockdown that could persist thereafter (Bhutani et al., 2021).

All the above evidence shows that the outbreak induced comparable side-effects independent of different national/cultural/basal lifestyle habits profiles: an increase in food consumption and a decrease in PA that results in overweight. Therefore, health authorities must be aware that its excessive prolongation, may trigger social anxiety and lead to the appearance of consequent health problems associated with the diet even long after its implantation.

Strategies such as massive information campaigns concerning infectious disease and encouraging the public to obey government guidelines and take self-protective procedures at home were reported to be quite effective (Zheng et al., 2020). All together, these results demonstrate that, although the lockdown policy is effective to decrease the spread of SARS-CoV-2, its implementation presents, like any prescription drug, some undesirable side effects that must be considered when prescribed (Galeano et al., 2020). As with new drugs, rather than to avoid its



**Figure 1.** Factors contributing to weight gain during COVID-19 confinement. Multivariable logistic regression analysis showing adjusted odds ratio and 95% CIs for the associations between gained weight during COVID-19 outbreak and listed variables. \*Reference modality in underlined and italic text

implementation, health authorities might design preventive measures to counteract obesity-related behaviors in the long-term and their concomitant cardiovascular risk (Zupo et al., 2020). These programs could include education for the active promotion of healthy nutrition and the practice of safe PA, utilizing virtual platforms rather than live attendance, focused mainly on reducing sedentary behavior (Stockwell et al., 2021). Mass media could be wisely utilized for these promotional/preventive activities.

Although our results are clear and are based on current evidence, some limitations of our study should be highlighted: 1) although the survey used was adapted from other one previously employed (Sinisterra-Loaiza et al., 2020), it was not previously validated. 2) the survey was self-reported, which may lead to misreporting of data. 3) the sample may not be fully representative of Argentinean population for several reasons: a) data was collected from internet and/or social media users that could be excluding people with no access to those services, b) although population surveyed belongs to different towns and cities around the entire country, majority of them are from Buenos Aires and surroundings; and c) the characteristics of the lockdown in Argentina were not uniform in all the country and varied during the period analyzed depending on the severity and rate of local spread of the disease.

In conclusion, our results showed that COVID-19 breakdown was associated with unhealthy lifestyle changes,

namely increased food intake, decreased PA, anxiety, sleep disorders, and weight gain. These adverse side effects can be prevented by the active promotion of nutritional advice and PA, implementing virtual activities associated with regular mass promotion campaigns.

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### Authors' contribution

LEF and JFE contributed equally to this work. JGG conceived the study, and, together with LEF and JFE led the study design. AC and ACC elaborated the survey, LEF, JFE, AGA, GLG, RT and JGG distributed the survey, collected their responses, and analyzed the results. JFE conducted the statistical analysis of the derived data. All the authors contributed to prepare this article, read and approved the final manuscript.

### Consent for publication

All the authors have agreed to submit this paper for publication in Nutrition and Health.

## Data sharing statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Ethical statement

This study was exempted from approval by the Ethics Committee because there was no direct involvement of animals or humans. All study participants voluntarily answered the questionnaire anonymously. They provided consent to use the recorded data in a research work by agreeing to participate on the Internet-based survey.




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## Informed consent

All study participants voluntarily answered the questionnaire anonymously. They provided consent to use the recorded data in a research work by agreeing to participate on the Internet-based survey.

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## Supplemental material

Supplemental material for this article is available online.

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