

## Article

# Physical and psychological effects related to food habits and lifestyle changes derived from Covid-19 home confinement Spanish population.

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**Abstract:** As consequence of COVID-19, millions of households suffered mobility restrictions and changes in their lifestyle during several months. The aim of this study was to evaluate the effects of COVID-19 home confinement in food habits, lifestyle and emotional balance of the Spanish population. This cross-sectional study used data collected via an anonymous online questionnaire during the last month before lockdown finished in Spain in a total of 675 participants. 38.8% of the respondents experienced weight gain while 31.1% lost weight during confinement. The increase in body weight was positively correlated with the age ( $Rs = 0.14, p < 0.05$ ) and BMI ( $Rs = 0.20, p < 0.05$ ). We also identified that 39.7% reported poorer quality sleep, it was positively correlated with BMI ( $Rs = -0.18, p < 0.05$ ) and with age ( $Rs = -0.21, p < 0.05$ ). 44.7% of the participants had not performed physical exercise during confinement with differences by sex ( $p < 0.05$ ), by age ( $p < 0.05$ ), by BMI ( $p < 0.05$ ) and sleep quality ( $p < 0.05$ ). According to emotional-eater questionnaire, 21.8% and 11% were classified as emotional eater and very emotional eater, respectively. We emphasize the importance of adopting a healthy lifestyle, as the COVID-19 pandemic nowadays is ongoing.

**Keywords:** COVID-19; Food intake; Lifestyle; Emotional eating; Home confinement; Lockdown.

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## 1. Introduction

Infectious diseases still growing in this century, being one of the greatest challenges is the continuing global impact of illnesses [1]. After Severe Acute Respiratory Syndrome (SARS) in 2002, Ebola and Middle East Respiratory Syndrome (MERS) in 2015, the beginning of 2020 was marked by a novel coronavirus global outbreak [2,3]. The novel coronavirus disease, named as COVID-19 by the World Health Organization (WHO), has causes a novel severe acute respiratory syndrome coronavirus 2 (WHO, 2020). This pathogen has been later renamed as (SARS-CoV-2) by the Coronavirus Study Group [4].

COVID-19 was first reported in Wuhan city (Hubei, China), in early December 2019, and rapidly spread worldwide. In January 2020, the WHO declared the global outbreak as a Public Health Emergency of International Concern [5], and in March 2020, it was declared as a global pandemic [6]. According to the data from the Johns Hopkins University, until the 22<sup>nd</sup> of July, COVID-19 has caused 15,016,440 cases and 618,001 deaths worldwide. Spain is in the seventh position on a global scale, with 896,086 cases, and 33,204 deaths (John Hopkins University, 2020 [Access 14<sup>th</sup> October 2020]).

The high infectivity and spread have been worrying the health authorities and the population. Because of the absence of specific vaccines or treatments, the government authorities, following the WHO recommendations, have forced to declare the health alarm status and order the confinement of citizens. People in most countries were under quarantine, with more or less rigor, in order to reduce the spread of the virus, which then also lessens the impact on medical resources [7]. In Spain, around

47,329,981 people suffered mobility restrictions and changes in their lifestyle during the state of alarm, from the 14th of March 2020 to the 21st of June 2020 [8].

Quarantine is associated to the interruption of free movement and the work routine, and could be result in mood changes, such as anxiety or boredom. This emotional changes are associated with a greater energy intake, as well as the consumption of higher quantities of macronutrients [9,10], linked not only with the confinement, but also with the economic decline, the uncertain situation and the increase of physical inactivity [11].

Eating is a response that takes place due to nutritive and non-nutritive signs of the organism. Increased time at home may provoke additional eating, especially in people with obesity, that often show an oversensitivity to non-nutritive signs (social, emotional, or conditioned craving for certain foods), and a concomitant desensitization, mainly related to normal satiety processes [12,13]. Furthermore, the constant bombardment of news and information by the media, about the COVID-19 pandemic without a break can be stressful. Consequently, the stress pushes people toward overeating. Mostly looking for food that help to release the stress, as the called "comfort foods" [14] mainly composed by caloric nutrients, such as sugars or fats. This desire to consume a specific kind of food is defined as "food craving" [15]. In the bibliography is described that carbohydrate craving is related to serotonin production and, in consequence, a positive effect on mood. The abuse of carbohydrate or fats intake in the diet could increase the risk of developing obesity that beyond being a chronic state of inflammation, that have been demonstrated to increase the risk for serious complications of COVID-19 [16]. The stress related to the confinement also results in sleep disturbances and could increase food intake [17]. Furthermore, during confinement the physical activity is often reduce, which can result in the increase of stress.

In view of the current situation, and thinking of future re-emerging outbreaks, in order to prevent negative impact to the people, the aim of this study was to evaluate the effects of COVID-19 home confinement in food habits, lifestyle and emotional balance of the Spanish population.

## 2. Materials and Methods

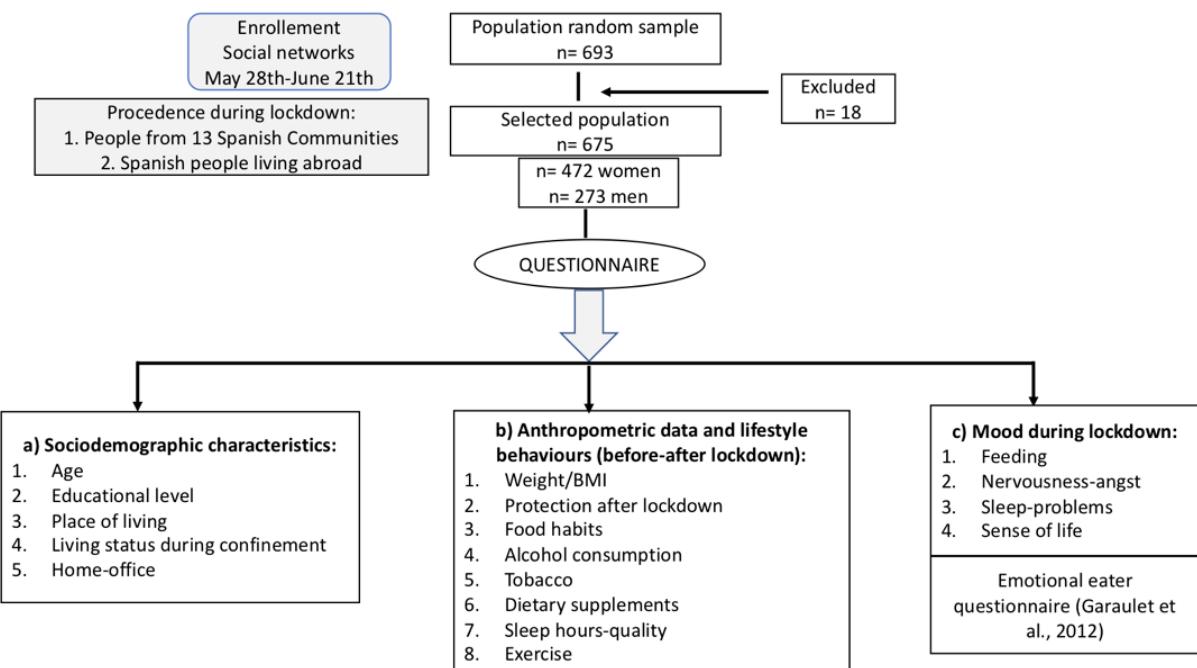
### *1. Participants and Study Design*

In Spain, COVID-19 lockdown became obligatory on 14th of March. An online cross-sectional study was conducted in the last month before lockdown finished, (from the 28<sup>th</sup> of May to the 21<sup>st</sup> of June), in order to obtain representative results of the entire period of confinement. The target population was Spanish people over 18 years old, living in Spain or abroad during the confinement. We also classified participants depending on the inhabitants in own city (< 5.000, 5.000-20.000, 20.000-100.000, 100.000-300.000, > 300.000). Digital informed consent was obtained from participants who confirmed they were over 18 years old, and their willingness to participate voluntarily prior to fill in the online survey. The study was conducted in full accordance with the principles of the Declaration of Helsinki. The study protocol was approved by the Ethics Committee of Francisco de Vitoria University (15/2020).

### *2. Data collection*

Study participants were recruited using social networks such as email, WhatsApp, Twitter, Facebook and Instagram. The "snowball" sampling method was used to recruit more participants. The online survey was made available via online social media, and randomly dispersed to as many people as possible during the last month of lockdown. The data was collected via electronic and anonymous questionnaire using Google Forms (Google LLC, Menlo Park, CA, USA).

This cross-sectional study used data collected via an anonymous online questionnaire consisting of 59 questions about dietary habits and lifestyle to compare habits during and before the lockdown (Figure 1).



**Figure 1.** Flow chart of the study participants and blocks of the electronic questionnaire.

The electronic questionnaire (Appendix A) was divided in different blocks to assess (Figure 1):

*a. Socio-demographic characteristics:* age, gender, educational level, place of living during confinement, living status during confinement (alone, 1 person, 2 people, 3 people, > 4 or more people) and home office (yes or not).

*b. Lifestyle behaviours adopted by the people during the lockdown with respect to pre-epidemic conditions:*

1. Anthropometric data. Body Mass Index (BMI) calculated as body weight in kg divided by height in meters squared, height and weight before and during confinement. According to the criteria of the World Health Organization, the BMI was categorized as: underweight (below 18.5 kg/m<sup>2</sup>), normal (18.5-24.9 kg/m<sup>2</sup>), overweight (25.0-29.9 kg/m<sup>2</sup>) and obese (above 30.0 kg/m<sup>2</sup>) [18].
2. Protection used during lockdown (no use protection, handwashing, gloves, mask, protective screen).
3. Food habits: Current diet; Whether quarantine resulted in change dietary of habits, increased some food consumption and specific food consumed, snacking, and specific type of cooking during lockdown; Daily number of consumed meals and frequency of meals before and during lockdown; Sources of the food during isolation time: methods for purchasing or obtaining food, three usual foods more consumed; Soft drink and type consumed.
4. Frequency and type of alcohol consumption.
5. Smoking frequency during confinement.
6. Dietary supplements consumption during confinement
7. Sleep hours before and during lockdown and sleep quality during confinement.
8. Exercise before and during the lockdown with respect to the time and intensity dedicated.

*c. Mood changes during lockdown with respect: feeding, nervousness, sleep-problems, sense on life.*

Emotional eater questionnaire (EEQ). A ten-item questionnaire developed to assess to what extent emotions affect eating behaviour [19]. The questions had four possible replies: 1) never, 2) sometimes; 3) generally and 4) always. The total score ranged from 0 to 30. The subjects were classified into 4 groups: non-emotional eater (score 0-5), low emotional eater (score 6-10), emotional eater (score 11-20) and very emotional eater (score 21-30).

*3. Data analysis*

Data was checked in Excel file for duplicates and any errors before importing and analysing using SPSS 22 (IBM, Chicago, IL, USA). Firstly, a descriptive analysis of socio-demographic characteristics of the respondents was conducted. Data is represented a means  $\pm$  standard deviation and percentages in parentheses (%) for categorical variables. Shapiro-Wilk test was performed to evaluate variables distribution. Mann-Whitney U and Kruskal-Wallis test were conducted to compare continuous variables among two or more groups, respectively. Chi square test was calculated to evaluate the association between categorical variables. The Spearman correlation coefficient was employed to assess the correlation between variables. Results were significant for p value  $<0.05$ .

### 3. Results

*Socio-demographic characteristics*

The online survey was collected during the last month of lockdown in Spain. In this cross-sectional study, a total of 693 participants were recruited by social media. 18 participants were excluded due to missing data. Finally, 675 participants with an age range between 18 to 85 years old, were included in this study: 472 men and 203 women.

The territorial coverage spread to: Andalucía, Canarias, Galicia, Comunidad de Madrid, Castilla la Mancha, Asturias, La Rioja, Comunidad Valenciana, País Vasco, Extremadura, Cataluña, Aragón, Castilla y León. Among the results obtained, the 41.6% passed the period of confinement in a large city, 48.7% had university studies and the 69.9% of the participants have been home office during confinement. Table 1 shows the main general characteristics of the study population.

**Table 1. General characteristics and demographics of the participants enrolled in the study.**

	All (n=675)	Women (N=472)	Men (N=203)	P-value
<b>Age (years)</b>	39.1 (SD 12.9)	39 (SD 12.8)	39.2 (SD 13.2)	0.888
<b>Education, N(%)</b>				0.138
Until middle School	6 (0.9)	2 (0.4)	4 (2.0)	
High School	31 (4.6)	19 (4.0)	12 (5.9)	
Vocational Training	58 (8.6)	36 (7.6)	22 (10.8)	
Undergraduate	329 (48.7)	238 (50.4)	91 (44.8)	
Postgraduate	181 (26.8)	127 (26.9)	54 (26.6)	
PhD	65 (9.6)	45 (9.5)	20 (9.9)	
Others	5 (0.7)	5 (1.1)	0 (0.0)	
<b>Living status during confinement</b>				0.659
Alone	161 (23.9)	109 (23.1)	52 (25.6)	
1 person	158 (23.4)	106 (22.5)	52 (25.6)	

2 people	151 (22.4)	106 (22.5)	45 (22.2)	
3 people	136 (20.1)	101 (21.4)	35 (17.2)	
≥ 4 people				
<b>Home-office, N(%)</b>				0.707
Yes	472 (69.9)	328 (69.5)	59 (29.1)	
No	203 (30.1)	144 (30.5)	144 (70.9)	
<b>Protection used after lockdown, N(%)</b>				
Mask	667 (99.4)	469 (99.4)	202 (99.5)	0.044
Gloves	167 (24.7)	120 (25.4)	47 (23.2)	0.531

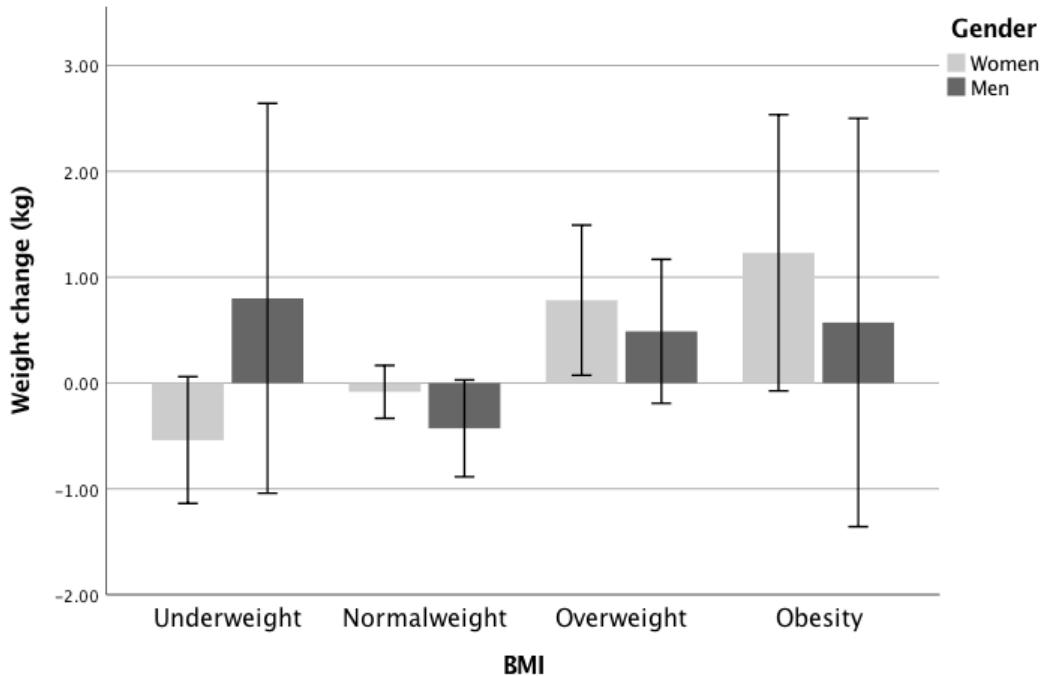
#### *Anthropometric data*

In the present study, 31.8% of the respondents were overweight / obese before the lockdown while during this period the figures reached 33.2% with differences by age and sex ( $p<0.05$ ) (Table 2). Specifically, 49.7% of the men were overweight/obese during confinement while in the case of the women it reached 27.3% ( $p<0.05$ ). Furthermore, 38.8% of the participants gained weight, an average of 2.57 kg during lockdown while 31.1% reported lost body weight during confinement, 2.81 kg on average.

**Table 2. Anthropometric parameters: Body Mass Index (BMI) and reported changes in body weight.**

	All (n=675)	Women (N=472)	Men (N=203)	p-Value
Weight before	68.7 (SD 15.3))	63.5 (SD 13.4)	80.5 (SD 13.4)	<0.001
Weight after (kg)	68.8 (SD 15.8)	63.7 (SD 14.2)	80.5 (SD 13.5)	<0.001
Height (m)	170.3 (SD 35.5)	166.7 (SD 41.5)	178.8 (SD 9.9)	<0.001
BMI before (kg/m <sup>2</sup> )	23.9 (SD 4.9)	23.4 (SD 5.2)	25.2 (SD 4.0)	<0.001
BMI after (kg/m <sup>2</sup> )	24.2 (SD 10.8)	23.8 (SD 12.6)	25.2 (SD 4.0)	<0.001
Change in body weight (kg)	0.12 (SD 2.7)	0.15 (SD 2.6)	0.07 (SD 2.8)	0.758

The weight variation was positively correlated with the BMI ( $Rs = 0.20$ ,  $p <0.05$ ) and age ( $Rs = 0.14$ ,  $p <0.05$ ). Participants who were obese or overweight gained an average of 1 kg and 0.7 kg, respectively ( $p >0.05$ ) (Figure 2).



**Figure 2.** Weight change in different BMI groups and by gender. *BMI: Body mass index.*

Concerning dietary pattern, Figure 3 shows the changes in dietary habits during confinement. In general, 54.4% of the participants reported having changed their diet during confinement: 112 (16.2%) declared a change to worse and 266 (38.4%) claimed to have improved their diet, respectively. Furthermore, an improvement in the perception of eating habits was greater among subjects with greater weight loss during confinement (-0.6 kg vs. +2.1 change for the worse; ( $p < 0.05$ ). In the case of perceiving food consumption, 19.6% answered having increased food intake while 33.3% considered having decreased it with differences according to weight variation ( $p < 0.05$ ).

Greater and more efficient preparation of food was declared by 64.2% of the participants. In the same way, a positive association was observed between the variation of weight and planning with meals and reading the labelling ( $p < 0.05$ ). The purchase of snacks and processed foods increased by 39% and 25% respectively. In addition, the consumption of snacks was associated with weight loss ( $p < 0.05$ ) and BMI ( $p < 0.05$ ). In the case of fresh food, the 55.7% of the participants stated that they increase the consumption, being higher among those who lost greater body weight ( $p < 0.05$ ) (Figure 3).



**Figure 3. Changes in lifestyle behaviours during the confinement.**

The pattern of the number of meals was modified since, during confinement, 23% of the respondents declared eating 5 meals per day, whereas previously, it was only done by 1%. The number of meals were associated positively with the BMI ( $p = 0.003$ ) and the weight gain (Rs = 0.143,  $p < 0.05$ ). In addition, 31.3% reported increased snacking between hours during confinement, reaching 53.4% among obese participants ( $p < 0.05$ ).

#### *Intake of dietary supplements*

Regarding the intake of supplements, 20.3% stated to consume them, with a higher incidence among women (22.5% women vs. 15.3%;  $p < 0.05$ ). In particular, the dietary supplements most consumed amongst the population were vitamin C (7.1%) and vitamin D (4.9%). The users who declared ingesting supplements gained on average  $0.62 \pm 2.5\text{kg}$  vs  $0.04 \pm 2.7\text{kg}$  for those who did not take supplements ( $p = 0.014$ ). Similarly, 60.6% of the respondents who took supplements reported that they had changed their eating habits through confinement ( $p < 0.05$ ).

#### *Changes in alcohol and tobacco consumption*

In the case of alcoholic beverages, only 26.7% of the participants declared not ingesting them during the period of confinement and 18.3% consumed them more frequently than usual. Among the different alcoholic beverages, beer (47.9%) and wine (20.6%) were the beverages most consumed among drinkers. In the same way, a positive association was observed between the variation of weight with alcohol consumption ( $p < 0.05$ ).

Regarding the consumption of tobacco, 17.2% of participants reported smoking and 7.5% smoked more frequently than before the confinement. Furthermore, an association between alcohol consumption and the perception of apathy, smoking and itching between meals could be observed ( $p < 0.05$ ).

#### *Physical exercise and sleep*

With regard to sleep, the average number of hours of sleep was  $7.02 \pm 0.93$  h per day, slightly lower than the  $7.33 \pm 1.22$  h per day, prior to confinement. Sleep hours were correlated with BMI (Rs

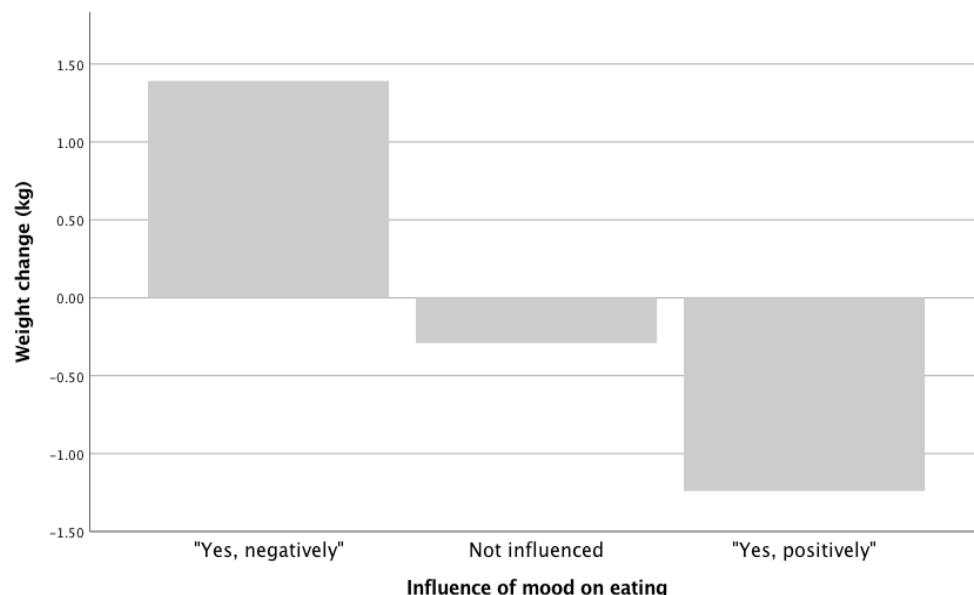
$= -0.177, p < 0.05$ ) and with age ( $Rs = -0.209, p < 0.05$ ). Furthermore, 39.7% of the participants stated that they had poorer quality sleep, in contrast to 19.7% who declared to have better quality sleep. Regarding the difficulty of falling asleep, 28.9% agreed "very much" or "quite agreed".

Concerning physical exercise, 44.7% of the participants had not performed physical exercise during confinement with differences by sex (44.7% women vs. 48.7% men;  $p < 0.05$ ), by age ( $p < 0.05$ ), by BMI ( $p < 0.05$ ), sleep quality ( $p < 0.05$ ) and snack between meals ( $p < 0.05$ ). Similarly, 20.9% continued the same training rhythm and 13.8% began to exercise during this period with differences by sex (15.5% women vs 9.9% men;  $p < 0.05$ ). Interestingly, differences in weight variation were found depending on the degree of physical exercise during confinement, as those who maintained physical exercise or started exercising in this period lost an average 0.9 kg and 0.8 kg respectively while respondents who did not exercise during lockdown gained on average 1 kg ( $p < 0.05$ ).

Furthermore, the participants who increased smoking during confinement, 36.5% did not do sports before or after. However, among those who reported smoking less during confinement, 27.8% began exercising during confinement ( $p < 0.05$ ).

#### *Influence in the emotional status*

During the period of confinement 43% of women and 23.4% of men reported nervousness and distress to a greater extent ( $p < 0.05$ ). The perception of boredom and apathy was stated by 33.2% of the participants (33.9% women vs. 31.6% men;  $p > 0.05$ ) and 27.7% declared that they were looking for meaning in their life (30.9% women vs. 20.2% men;  $p < 0.05$ ). In addition, 35.6% stated that their mood affected them negatively about eating with differences by gender (38.6% women vs. 28.6% men;  $p < 0.05$ ). The negative impact of mood was greater among participants with obesity, reaching 62.1%. ( $p < 0.05$ ) (Figure 4).



**Figure 4.** Influence of mood on body weight.

Based on the results of the emotional-eater questionnaire, previously validated by Garaulet et al. (2012), most of the participants (40.5% women vs. 37.9% men) were categorized as low emotional eater. Similarly, 21.8% (22% women vs. 21.2% men) and 11% (13.1% women vs. 5.9% men) were classified as emotional eater and very emotional eater, respectively.

The EEQ score was positively correlated with the BMI ( $Rs = 0.24; p < 0.05$ ), the number of meals ( $Rs = 0.18; p < 0.05$ ) and the weight gain during confinement ( $Rs = 0.19; p < 0.05$ ). Subjects who reported having "always" or "generally" difficulty stopping eating sweets had a weight gain of 1.7 kg compared to the 0.2 kg lost by those who "never" had difficulty stopping eating sweet foods during confinement ( $p < 0.05$ ). Likewise, participants who reported eating when stressed, angry or bored "always" gained

1.6 kg during the confinement, while those who reported "never" lost 0.3 kg ( $p < 0.005$ ). Surprisingly, the weight gain was higher (4.5 kg) in the participants who answer "always" and they were following a diet during confinement ( $p < 0.05$ ).

#### 4. Discussion

The main goal of this study was to evaluate the effects of COVID-19 home confinement in food habits, lifestyle and emotional balance of the Spanish population, in order to prevent the negative impact to people habits and lifestyle in future re-emerging outbreaks. Generally a quarantine period is associated with stress/depression leading to unhealthy diet and reduced physical activity [20]. Mass media seem to have a significant influence both on the knowledge and attitudes of people, nevertheless, their role of the mass media in health communication is often debated [21].

The global outbreak of COVID-19 resulted in restrictive isolation measures in many parts of the world, which led to lifestyle changes prior to this period of confinement. We report that 38.8% of respondents increased their body weight by an average of 2.6 kg. These data are similar than those reported in Spanish population by Sánchez-Sánchez et al. where a 37.3% gained between 1 and 3 kg [22]. This result obtained concerning the change in the body weight is lower compare to the 48.3% observed in a study of the Italian population. However, in the survey the researchers were based on perceived weight gain and not on weight before and during confinement [23]. On the other hand, Zachary et al. reported better results concerning changes in the body weight, were the 22% reported an increase in this parameter, although this survey only analysed the period of initial confinement [13]. In this sense, it is important to consider that obese subjects with COVID-19 have a worse prognosis since they have a higher risk of intensity care unit (ICU) admission and invasive mechanical ventilation [24,25].

An interesting finding of this work was that, on average, hardly any important changes in body weight were observed, however a great heterogeneity was seen in the variation among the subjects surveyed. Similarly, Sidor & Rzymski et al. found that 29.6% and 18.6% of Polish respondents reported an increase and decrease in body weight, respectively [26]. The lower variability with respect to the present study may be due to the fact that in Poland the stay-at-home order encompassed six weeks, while in Spain it lasted 14 weeks. It was also found an increased BMI and age correlated with increased weight gain during confinement, much like previous works [26]. Until know, there is limited evidence between physiopathology of Covid-19 and obesity, but age is one of the risk factors for hospitalization due to COVID-19 disease, therefore an increase in weight in this population group means greater vulnerability to this disease [27,28] Overweight and obesity were continuous increasing in our country, as in the rest in the world. Actually, as reported Petrova et al. obesity could also be a risk factor not only aged people as in young individuals and this issue should be deeper investigated [29].

In our study, 54.4% change eating habits during lockdown: 25.6% had worse intake of fast-food and, on the contrary, 57.2% has better intake of fresh food. These results are in line with those reported by Rodríguez-Pérez et al. (2020), showed better food choices as before confinement in the north of Spain [8]. Di Renzo et al. found that 53.9% of the Italian population surveyed claimed to have modified their dietary habits and increased in unhealthy foods and snacks during the home confinement has been observed [23]. A better cooking at home has reported by 73.5% of the respondents because of the fact that people spend more time at home. According to the WHO recommendations, this fact can be related to spend more time cooking [3]. In the same way, Ruiz-Roso et al., (2020), have seen that during confinement families had more time to cook, but apparently, did not increase diet quality [30].

Zhao et al. reported that further investigations are needed to measure the consumption of processed foods and its effects on health during future disease outbreaks [31]. It seems really important to consider the impact of this pandemic situation in population lifestyle habits and probably on the susceptibility to COVID-19 and recovery [32]. We observed an increase of weight correlated with numbers of meals, and this behaviour was also reported for other countries [8,13].

Regarding supplement consumption, several dietary behaviours used to cope with COVID-19 were identified including an increase in the consumption of vitamins C and D, probiotics and other dietary supplements. Similar as the results observed by Zhao et al. [31]. There is limited evidence for the clinical utility of different supplements and vitamins on COVID-19 [33]. Grant et al. pointed that vitamin D deficiency could participate between the relationship obesity and higher susceptibility to infections/death due to Covid-19 [34]. Strikingly in this work, respondents who reported taking supplements were more likely to have greater weight gain during confinement, suggesting that the use of these supplements may be related to a belief in compensating for poor nutrition.

A significant association between alcohol consumption and the perception of apathy and itching between meals could be observed. We found an adverse behaviour such an increase of alcohol consumption with respect before Covid-19 pandemic situation (18.8%) maybe due to the stressful situation of lockdown. Similar results were observed by Chodkiewicz et al., (2020), in Poland that during lockdown 28% of individuals reported higher alcohol consumption [35]. In Chile Reyes-Olavarria et al. [36] detected an increase of 30% and Scarmozzino and Visioli. reported that alcohol consumption increased by 10.1% in the Italian population [37]. On the contrary, Rodriguez-Pérez et al. [8] and López-Bueno et al. [38] observed a decrease of alcohol consumption in a Spanish population.

Stress is a prominent risk factor for the onset and maintenance of alcohol misuse [39]. The type of beverages more consumed were vine and beer (68.5%) and less frequently distilled alcohol. Similar results were obtained in a Spanish population [40]. With regard to our data, near one third of participants drunk less frequently than before lockdown. As Ozamiz-Etxebarria et al. reported the confinement may tend to produce or exacerbate such psychological problems specially with alarming information from the news and social media [41]. For this reason, is important to ensure effective health information.

Regarding tobacco, the participants seems not modify their smoking habits, because only 7.7% smoked more frequently than before the confinement rewardingly the total smoker population (17.2% of participants were smokers). These results are consistent with previous work that reported a smoking habit with little difference from the period prior to confinement [23,42].

The average sleep duration reported prior to the onset of COVID-19 was 7.1 h/day like our results (7.3 hours/night), with 50.7% reporting no change in sleep quality. Considering sleeping habits, participants reported maintaining the number of hours of sleep, but with poor sleep quality, that agree with a previous study related in China [43]. These findings are in line with those reported by other previous works that found that, although sleep hours hardly changed, 40.7% declared negative change in sleep quality [42]. Furthermore, Cellini et al. also observed a decrease in sleep quality of 11.9 % and change in sleep-wake rhythms [44]. This effect may be due to the psychological impact of the COVID-19 since 18.7% and 21.6% of the Spanish population have been potentially diagnosed of depression and anxiety respectively [45]. In addition, the isolation situation causes less time spent outdoors and exposure to sunlight is a determining factor in the regulation of internal circadian rhythms, fundamental to the sleep pattern [46]. Likewise, sleep disruption was associated with a higher BMI. In this sense, poor sleep quality seems to affect the regulation and activity of hormones related to appetite and energy expenditure such as leptin and ghrelin by affecting the function of the hypothalamic-pituitary-adrenal [47].

Due to Covid-19 pandemic, Pappa et al. in a systematic review suggests that a considerable proportion of mood (23.2% depression across ten studies) and sleep disturbances (insomnia 38.9% across five studies) during this outbreak [48], reported it is necessary to establish ways to mitigate mental health risks and adjust interventions under actual and future pandemic conditions. The consequences of sleep deprivation is a misalignment of circadian rhythms leading to increased cortisol levels and this has been associated with an impaired glucose homeostasis, insulin resistance and visceral fat [17].

In times of crisis, the benefits of empowering people to actively preserve their own health should be underlined [49]. After the Spanish Government decreed the state of emergency, it was impossible to practice physical activity outside, and gyms and sport clubs were closed. Exercise has clear health benefits for healthy individuals and during lockdown was important the maintenance of routinely

exercising in a safe home environment [50]. Our findings showed that 45.9% did not practice physical exercise during lockdown and into this group 28.7% practice physical activity before confinement. Due to this diminished physical activity in our study, an increase body weight was observed gaining on average 1 kg, depending on the degree of physical exercise during confinement. This increase of body weight was lower than observed by Zachary et al. (2020), who reported an increase of 2.2 to 4.4 kg, due to less physical activity. In this way, Reyes-Olavarria et al. reported in a Chilean population an inverse association with body weight increase [36].

In addition to the effect of exercise on body weight as seen in the present survey, it also plays an important role in mental health, because prolonged home stays can lead a sedentary lifestyle who contribute to anxiety/depression [50–52]. Previous studies reflect that those subjects in whom confinement negatively affected physical exercise were at greater risk of depression, anxiety and stress [42], which could partly explain the relationship with poor sleep quality among sedentary participants seen in this our work.

This study compared mood levels of participants in the present from past before the COVID-19 crisis began. It has been observed that the COVID-19 crisis is indeed impacting negatively on the mental well-being of individuals and the mood of a sample of individuals at quarantine onset was generally poorer compared to before lockdown [53]. Casagrande et al. observed as COVID-19 crisis is indeed impacting negatively on the mental well-being of individuals [54]. We found that 37.1% of the participants reported suffering from nervousness and stress to a greater extent. Wang et al. (2020) and Cao et al. (2020), observed an increase of depression, anxiety, and stress in China population during lockdown [49,55].

In the exceptional situation, it is difficult to accurately estimate the emotional consequences of lockdown. There is a bidirectional relationship between foods and moods. The pandemic of COVID-19 has caused significant disruption in everyday lifestyle and day-life and work routine. In this way, being physically and psychologically unhealthy habits has critical implications in the quality of life. It has been observed that a stressful situation could develop in overeating and undereating behaviours and also, due to this stress situation people increased the eating of "comfort foods" [56]. We observed that 21.8% and 11% of participants were classified as emotional eater and very emotional eater, respectively. Individuals with emotional eating behaviour could eat for motives other than hunger increasing the intake of palatable foods [57,58].

The EEQ score was directly correlated with the BMI, the number of meals and the weight gain during confinement. As regard subjects having "always" or "generally" difficulty stopping eating sweets foods, had a weight gain of 1 kg and 0.7 kg respectively during lockdown. Antunes et al. suggest the importance of working towards creating strategies to promote healthy eating habits, by not eating more or more often and by carefully choosing what to eat [59].

Likewise, participants who reported eating when stressed, angry or bored "always" gained 1.6kg during the confinement, while those who "never" lost 0.3kg. These results are in line with some studies that showed that in situations of greater stress and anxiety people tend to regulate their emotions through food [13,60,61]. Scarmozzino & Visioli et al. observed that 42.7% of the respondents reported that their body weight varied during lockdown due to increased stress, anxiety and/or boredom [37]. Is interesting the data related to individual who are always in diet, we observed this group of population increased an average of 4.5 kg because they reported to eat out of control during lockdown.

The study has some limitations because sociodemographic, lifestyle habits, food intake, toxics habits and emotional variables, were not studied in depth to avoid an excessive length of the questionnaire, in order to obtain a sample more representative of Spanish population. This is the main reason why we used different social networks. However, the number of subjects enrolled in the study was not as large as in other studies from other countries, maybe due to the strongest and difficult situation around our country from March to June. The main limitation of this study was the use of self-declared questionnaires, which can lead to misreporting of data.

Spain is divided in 17 Autonomous Communities and we obtained results from 13 Autonomous Communities, so the sample showed a good people participation. The Spanish Communities with

more representability were Comunidad de Madrid and Andalucía. The main strength of the present study was that the entire lockdown was studied.

## 5. Conclusions

As overview of our results, some unfavourable nutritional behaviours, decreased physical activity levels, increased sedentary time and weight gain was observed during the 3 months of confinement in Spain. The lockdown also resulted in the change of habits and, in some cases, eating to compensate for boredom or anxiety with an increase of weight. For some individuals, an increase in alcohol intake was also reported.

On the contrary, we also highlighted individuals with more favourable nutritional behaviours such as increasing of cooked home meals and increased and/or maintained their physical activity and eventually lost weight. However, the present study should be considered as preliminary state of the data during Covid-19 lockdown. It is unknown to what degree our data could be generalized to other populations. Our intention is to highlight the need to emphasize the importance of adopting a healthy lifestyle, as the COVID-19 pandemic nowadays is ongoing. In the same way, future studies should assess whether these changes have been maintained after the period of confinement.

**Author Contributions:** The authors contributed in the same way in the conception and design of the study, acquisition of data, revising the article and approval of the final version to be submitted. Analysis and interpretation of data was due to MLM.

**Funding:** This research was funded by Agencia Estatal de Investigación (AEI) and Fondo Europeo de Desarrollo Regional (FEDER) AGL2017-89213.

**Acknowledgments:** The authors thank all the anonymous individuals for their participation in this COVID-19-specific research.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

### SECTION A

**Q1. How old are you?.**

**Q2. In which Community or Autonomous City have you spent the period of confinement?**

**Q3. In which municipality have you spent the period of confinement?**

**Q4. Gender:** Female/Male

**Q5. What is your level of education?** Primary school/Secondary school/Vocational training//University/Master's degree/PhD/Others.

**Q6. How many people have you lived with at home during your confinement?** Alone/ 1 person/2 persons/3 persons/ 4 or more persons

### SECTION B

**Q7. Weight before the pandemic:**

**Q8. Current body weight (kg):**

**Q9. Height (cm):**

**Q10. Have you been on telework/online classes during your confinement? Yes/No**

**Q11. Do you use personal protective equipment when you leave home? Select the ones you use?**  
Mask/Gloves/Protective screens

**Q12. Where did you eat before confinement?** House/cafeteria/homemade

**Q13. In general, how do you think the following habits have been affected by the confinement situation?**

**Q13.1 Elaboration of meals at home:** For better/for worse/equal

**Q13.2 Reuse of surplus food:** For better/for worse/equal

**Q13.3 Shopping list planning:** For better/for worse/equal

**Q13.4 Meal planning:** For better/for worse/equal

**Q13.5 Healthy food choices:** For better/for worse/equal

**Q13.6 Label reading:** For better/for worse/equal

**Q13.7 Purchase of snacks:** For better/for worse/equal

**Q13.8 Fresh food:** For better/for worse/equal

**Q13.9 Processed/Prepared Foods:** For better/for worse/equal

**Q14.** What type(s) of culinary preparations have you increased during confinement? (fried food, spoon dishes, sandwiches, grill, steam, prepared food, etc.):

**Q15.** List 3 foods/products that you have deemed indispensable during the confinement:

**Q16.** Have you started taking any vitamin/mineral supplements? Yes/No

**Q17.** If yes, which supplement(s)?

**Q18.** Do you smoke more than before confinement? I do not smoke/Yes, I smoke more/No, I smoke the same/No, I smoke less

**Q19.** Do you drink alcoholic beverages more often than before confinement? I do not drink alcoholic beverages/No, I just drink as often/No, I drink less often/Yes, I drink more often

**Q20.** In case you consume more alcoholic beverages, which one(s)?

**Q21.** Do you drink more soda than before confinement? I don't drink soda/Yes, I drink more soda than before/No, I drink just as often/No, I drink less often

**Q22.** In case you consume more soft drinks, which one(s)?

**Q23.** How many hours of sleep did you get on a typical day before confinement?

**Q24.** How many hours do you usually sleep these days?

**Q25.** In general, how do you rate the quality of your sleep compared to before confinement? Better/Same/Worse

**Q26.** Have you been able to keep up with the exercise during confinement?

I didn't do sport then and I don't do it now/Yes, I've kept up my training/Yes, but with less intensity/Yes, but for less time/No, I couldn't keep up with the exercise/I have begun to exercise during confinement

**Q27.** Has the time spent on housework changed during confinement? It has decreased/It has remained the same/It has remained the same

**Q28.** Do you consider that you have changed your eating habits during confinement? Yes/No

**Q29.** How many intakes do you make per day of these top five. Check the ones you usually do.

**Q29.1 Before confinement:** Breakfast/Mid-morning/Lunch/Snack/Dinner/Bedtime snack

**Q29.2 During confinement:** Breakfast/Mid-morning/Lunch/Snack/Dinner/Bedtime snack

**Q30.** Do you think you are eating better or worse than before? Better/Worse/Same

**Q31.** Do you think you are eating more or less than before? More/Less/Same

**Q32.** Does it sting between hours more or less than before confinement? More than before/Less than before/Same as before

## SECTION C

**Q33.** Do you think there is a relationship between food and health? Yes/No

**Q34.** Do you like to eat? Yes/No

**Q35.** Do you consider that your state of mind during confinement has influenced your diet? Yes, in a positive way/Yes, in a negative way/It has not influenced

**Q36.** Indicate your degree of agreement with the changes in mood you have felt since the confinement began:

**Q36.1 Nervousness/anxiety:** Nothing/A little bit/Regular/Quite a lot/Very much in agreement

**Q36.2 Boredom/Apathy/Irritability:** Nothing/A little bit/Regular/Quite a lot/Very much in agreement

**Q36.3 Difficulty in falling asleep:** Nothing/A little bit/Regular/Quite a lot/Very much in agreement

**Q36.4 Looking for the meaning of my life:** Nothing/A little bit/Regular/Quite a lot/Very much in agreement

Emotional eater questionnaire (EEQ) Garaulet

**Q37.** Do you weight scales have a great power over you? Can they change your mood?

Never/Sometimes/Generally/Always

**Q38.** Do you crave specific foods? Never/Sometimes/Generally/Always

**Q39. It is difficult for you to stop eating sweet things, especially chocolate?**

Never/Sometimes/Generally/Always

**Q40. Do you have problems controlling the amount of certain types of food you eat?**

Never/Sometimes/Generally/Always

**Q41. Do you eat when you are stressed, angry or bored? Never/Sometimes/Generally/Always**

**Q42. Do you eat more of your favourite food and with less control when you are alone?**

Never/Sometimes/Generally/Always

**Q43. Do you feel guilty when eat “forbidden” foods, like sweets or snacks?**

Never/Sometimes/Generally/Always

**Q44. Do you feel less control over your diet when you are tired after work at night?**

Never/Sometimes/Generally/Always

**Q45. When you overeat while on a diet, do you give up and start eating without control, particularly food that you think is fattening? Never/Sometimes/Generally/Always**

**Q46. How often do you feel that food controls you, rather than you controlling food?**

Never/Sometimes/Generally/Always

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