# Weight gain during the COVID-19 lockdown; survey of the Spanish Society of Obesity.

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## Summary:

Obesity, after age, is the main factor of poor prognosis during the COVID-19 infection. The lockdown to which the Spanish population has been exposed for several weeks can be a cause of weight gain. Worse, an online survey was performed from the website of the Spanish Society for the Study of Obesity (SEEDO), between April and May 2020, and 1,859 people responded. The population consisted of 77.3% women, with an average age of 52 [41; 60] years. Half of the population reported being overweight before lockdown (50.0%). During lockdown, 49.8% of the individuals gained weight, 86.6% between 1 and 3 kg. Females, younger age, previous excess weight, did not weigh in themselves frequently or took measures to avoid weight gain during lockdown, and having spent lockdown in Southern Spain, as well as in the Balearic or Canary Islands, were the main characteristics that were related to weight gain. The main cause (66.5%) to which this weight gain is attributed was the combination of higher intake with less physical activity. 40.3% of the respondents who gained weight, did not take any action to manage this situation. In conclusion, a significant percentage of the Spanish population self-reported a weight gain of between 1 and 3 kg during lockdown. The consequences of this weight gain on future transmission and severity from COVID-19 is worth of further investigation.

### Keywords:

- Lock-down
- COVID-19
- Spain
- Obesity
- Weight

### Introduction

In late 2019, a new coronavirus was first reported in patients with pneumonia of unknown origin in Wuhan, China [1]. The World Health Organization officially declared the pandemic due to the COVID-19 disease (coronavirus disease 2019), caused by SARS-CoV-2, on March 11, 2020. In May 2020, COVID-19 has affected the world with more than 5.1 million cases and more than 333,000 deaths in all countries [2]. Spain, being one of the most affected countries in the entire planet [3].

Different clinical manifestations of COVID-19 have been described, ranging from asymptomatic or mild to severe, life-threatening forms of disease. Multiple chronic conditions, such as chronic obstructive pulmonary disease, cardiovascular disease, diabetes, and hypertension seem to worsen the prognosis of positive COVID-19 patients [4-6]. The influence of obesity on the severity of COVID-19, which was not initially observed, has been confirmed later [7-11]. In addition, a higher prevalence of obesity has been described in COVID-19 patients admitted to intensive care units [12,13]. Similarly, obesity had already been recognized as an independent risk factor in other viral infections such as H1N1 [14].

The Government of Spain, in use of the powers granted by Section 116.2 of the Constitution, declared a state of alarm on March 14, 2020 as an exceptional measure to contain the COVID-19 pandemic. This measure limited the movement of people, initiating a lockdown period of the population with potential impact on health. Although a negative consequence of the restriction of movement could be the cause of weight gain, so far, its effect on the Spanish population has been hardly studied.

Therefore, our objective was to deeply study the self-perceived evolution of weight in a sample of the Spanish population that voluntarily decided to complete an online survey.

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In addition, we explored the main characteristics of the individuals who had gained weight, as well as the influence of considering themselves overweight on the weight evolution.

## Material and methods

### Study design and survey features

The survey was conducted anonymously and included 9 closed questions on sociodemographic data, as well as on the evolution of the weight of those surveyed during lockdown by COVID-19 (**Supplementary Table 1**).

| Age in years |
| --- |
| Gender ? Male /Female |
| In what region have you spent the lockdown? Northern Spain / Southern Spain / Central Spain / Balearic or Canary Islands / Ceuta or Melilla / Other |
| Have you weighed frequently during lockdown? If not |
| Do you think you were overweight before lockdown? If not |
| Have you gained weight during the first month of lockdown? If not |
| If you have gained weight during the first month of lockdown, how much have you gained? More than 3 Kg / Between 3 and 5 kg / More than 5 kg |
| If you have gained weight, what do you think the cause is? Increase in food intake / Decrease in physical activity / Both |
| Have you taken any measures during lockdown to prevent weight gain, regardless of the result obtained? If not |

*Supplementary table 1. Complete online survey.*

The survey was performed using Google-forms. This online application is an efficient tool to administer questionnaires to a specific population [15]. In our case, in order to reach the maximum number of people, Facebook and Twitter were used to distribute it (https://www.facebook.com/Sociedad-Española-para-el-Estudio-de-la-Obesidad-SEEDO-579422768848827) (@sociedadSEEDO) of the Spanish Society for the Study of Obesity (SEEDO). A total of 1,859 people responded to the survey between April 18 and May 15, 2020. In April, 1,271 (68.4%) responded, and 588 (31.6%) in May. Once the responses were recorded, they were analyzed without any modification.

### Statistical analysis

The quantitative variables did not follow a standard distribution when they were evaluated using the Kolmogorov-Smirnov test. Given its non-standard distribution, quantitative data are expressed as the average [interquartile range]. Comparisons between the group that gained weight and the group that kept it, were made using the Mann-Whitney U test for quantitative variables and Pearson's Chi-square test for categorical variables. A multivariate logistic regression model was developed for the presence of self-reported weight gain, by adjusting the following troubling elements: age, gender, date of the survey, geographical area of Spain in which lockdown continued, previous overweight, weighing frequency and steps to prevent weight gain. Model calibration and discrimination were assessed using the Hosmer-Lemeshow welfare-of-fit test and the area under the receiver operating characteristic (ROC) curve, respectively. The significance of the statistical tests was established bilaterally at p≤0.05.

All statistical analyzes were performed using the SSPS statistical package (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY, USA).

## Results

The Spanish population interviewed was made up of 1,437 (77.3%) women and 422 (22.7%) men, with an average age of 52 [41; 60] years. The participants were locked down in the Northern area of Spain (30.4%), the Central area (30.0%), the Southern area (30.1%) or the Balearic or Canary Islands (2.8%). Only 6.7% of those who answered the survey claimed to be in another geographic area, and none in Ceuta or Melilla.

Half of the population considered that they were already overweight before the lockdown (n = 930, 50.0%). During such period, 49.8% of the individuals claimed to have gained weight: 86.6% between 1 and 3 kg, and only 13.4% more than 3 kg. The combination of higher food intake and less physical activity was the main reason for the weight gain. Although 55.2% of those surveyed reported having weighed frequently during lockdown, only 59.7% answered that they had taken some measure to manage their body weight.

When comparing the respondents who reported having gained weight during the first month of the lockdown with those who had not, we observed significant differences between the groups (Table 1). Female, younger individuals, who had not weighed themselves frequently during lockdown, and who had not taken measures to prevent weight gain, answered that they had gained weight. Furthermore, the weight gain was also more frequent among those who answered the survey in May, the individuals who were in lockdown in the South of Spain and those who considered they were previously overweight. The combination of a higher intake and sedentary lifestyle was the most frequent justification for the weight gain (66.5%), followed by an isolated decrease in physical activity (22.7%) and an isolated increase in food intake ( 10.6%).

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| | Don't gain weight | Gain weight | p |
|---|---|---|---|
| Age (years) | 53 [42; 62] | 50 [41; 58] | <0.001 |
| Survey in April, n (%) | 687 (73.6) | 584 (63.1) | <0.001 |
| Survey in May, n (%) | 247 (26.4) | 341 (36.9) | |
| Females, n (%) | 697 (74.6) | 740 (80.0) | 0.006 |
| Males, n (%) | 237 (25.4) | 185 (20.0) | |
| Northern Spain, n (%) | 293 (31.4) | 277 (29.9) | <0.001 |
| Central Spain, n (%) | 340 (36.4) | 222 (24.0) | |
| Southern Spain, n (%) | 230 (24.6) | 334 (36.1) | |
| Balearic or Canary Islands, n (%) | 20 (2.1) | 33 (3.6) | |
| No frequent weighing, n (%) | 358 (38.3) | 475 (51.4) | <0.001 |
| Frequent weighing, n (%) | 576 (61.7) | 450 (48.6) | |
| No previous overweight, n (%) | 509 (54.5) | 420 (45.2) | <0.001 |
| Previous overweight, n (%) | 425 (45.5) | 505 (54.6) | |
| No measures to avoid weight gain, n (%) | 283 (30.3) | 473 (51.1) | <0.001 |
| Measures to avoid weight gain, n (%) | 651 (69.7) | 452 (48.9) | |

*Table 1. Results of the survey in the study population according to the presence of weight gain during lockdown.*

| | Gain 1-3 kg | Gain >3 kg | p |
|---|---|---|---|
| Age (years) | 51 [41;59] | 47 [38;55] | <0,001 |
| Survey in April, n (%) | 526 (65,9) | 78 (50,0) | <0,001 |
| Survey in May, n (%) | 272 (34,1) | 78 (50,0) | |
| Females, n (%) | 697 (74,6) | 740 (80,0) | 0,006 |
| Males, n (%) | 237 (25,4) | 185 (20,0) | |
| Northern Spain, n (%) | 246 (30,8) | 35 (22,4) | 0,013 |
| Central Spain, n (%) | 202 (25,3) | 29 (18,6) | |
| Southern Spain, n (%) | 273 (34,2) | 78 (48,1) | |
| Balearic or Canary Islands, n (%) | 23 (2,9) | 10 (6,4) | |
| No frequent weighing, n% | 408 (51,1) | 87 (55,8) | 0,289 |
| Frequent weighing, n % | 390 (48,9) | 69 (44,2) | |
| No previous overweight, n (%) | 392 (49,1) | 47 (30,1) | <0,001 |
| Previous overweight, n (%) | 406 (50,9) | 109 (69,9) | |
| Increase in food intake, n (%) | 85 (10,7) | 18 (11,5) | <0,001 |
| Decrease in physical activity, n (%) | 207 (25,9) | 16 (10,3) | |
| Both, n (%) | 504 (63,2) | 122 (78,2) | |
| No measures to avoid weight gain, n (%) | 385 (48,2) | 104 (66,7) | <0,001 |
| Measures to avoid weight gain, n (%) | 413 (51,8) | 52 (33,3) | |

*Table 2. Results of the survey in the study population according to the amount of weight gain during lockdown.*

**Table 3** shows the main characteristics of those answering the survey who considered that they were overweight before lockdown. It can be seen how overweight respondents claimed to have gained weight more frequently than those with normal weight (54.3% vs. 45.4%, p <0.001), which is accompanied by a greater amount of weight gained (gain> 3kg : 21.6% vs. 11.2%, p <0.001, respectively).

| | Non-self-referred overweight before lockdown | Self-referred overweight before lockdown | p |
|---|---|---|---|
| Age (years) | 50 [38;59] | 53 [44;60] | <0,001 |
| Females, n (%) | 728 (78,4) | 709 (76,2) | 0,274 |
| Males, n (%) | 201 (21,6) | 221 (23,8) | |
| Northern Spain, n (%) | 281 (30,2) | 289 (31,1) | 0,115 |
| Central Spain, n (%) | 307 (33,0) | 255 (27,4) | |
| Southern Spain, n (%) | 266 (28,6) | 298 (32,0) | |
| Balearic or Canary Islands, n (%) | 22 (2,4) | 31 (3,3) | |
| They did not gain weight, n (%) | 509 (54,8) | 504 (45,7) | <0,001 |
| Weight gain, n (%) | 420 (45,2) | 505 (54,3) | |
| Weight gain 1-3 kg, n (%) | 372 (88,8) | 393 (78,4) | <0,001 |
| Weight gain> 3 kg, n (%) | 47 (11,2) | 108 (21,6) | |
| No frequent weighing % | 422(45,4) | 411 (44,2) | 0,593 |
| Frequent weighing % | 507 (54,6) | 519 (55,8) | |
| Increase in food intake, n (%) | 55 (11,7) | 52 (9,3) | 0,134 |
| Decrease in physical activity, n (%) | 129 (27,5) | 134 (24,0) | |
| Both, n (%) | 285 (60,8) | 372 (66,7) | |
| No measures to avoid weight gain, n (%) | 367 (39,5) | 389 (41,8) | 0,308 |
| Measures to avoid weight gain, n (%) | 562 (60,5) | 541 (58,2) | |

*Table 3. Results in the survey in the study population based on the presence or absence of overweight prior to lockdown.*

The same differences were observed when comparing those individuals who had gained between 1 and 3 kilograms in weight and those with a gain of more than 3 kilograms, except that there were no differences regarding the frequency with which they weighed (Table 2). Although the combination of a higher intake with a decrease in physical activity was acknowledged as the main reason for the weight gain in both groups, those who gained more than 3 kg in weight attributed their weight gain with less frequently to sedentary lifestyle.

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The multi-variable logistic regression model for weight gain during lockdown showed a significant association with age, gender, the geographical area of Spain where lockdown was performed, the estimation of previous overweight, having weighed frequently and having taken measures to avoid weight gain **(Table 4).**

| | Odds Ratio (95% confidence interval) | *p* |
|---|---|---|
| Age (years) | 0,99 (0,98 a 0,99) | <0,001 |
| Survey in April | Reference | |
| Survey in May | 1,11 (0,87 a 1,42) | 0,399 |
| Females | Reference | |
| Males | 0,77 (0,60 a 0,97) | 0,029 |
| North of Spain | Reference | |
| Central Spain | 0,76 (0,59 a 0,97) | 0,027 |
| South of Spain | 1,44 (1,11 a 1,88) | 0,006 |
| Balearic or Canary Islands | 2,05 (1,11 a 3,77) | 0,021 |
| No frequent weighing | Reference | |
| Frequent weighing | 0,67 (0,57 a 0,82) | <0,001 |
| No previous overweight | Reference | |
| Previous overweight | 1,49 (1,22 a 1,82) | <0,001 |
| Measures to avoid weight gain | Reference | |
| No measures to avoid weight gain | 2,37 (1,93 a 2,91) | <0,001 |
| Hosmer-Lemeshow goodness of fit | - | 0,314 |
| Area under the ROC curve | 0,68 (0,65 a 0,70) | <0,001 |

*Table 4. The multi-variable logistic regression model for the presence of weight gain in Spanish individuals during lockdown for COVID-19.*

Finally, **Figure 1** summarizes the determining factors in the weight gain of the Spanish population during lockdown due to COVID-19: female , younger age, previous excess weight, who had not been weighed frequently or taken measures to avoid the weight gain during lockdown and having spent it in the South of Spain, as well as in the Balearic or Canary Islands.
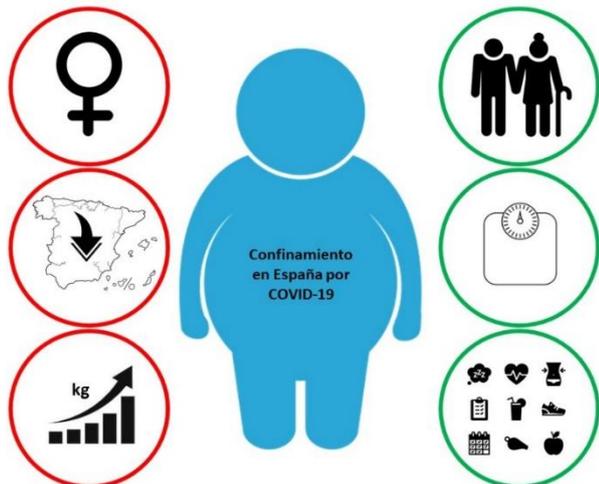


*Figure 1. Determining factors for weight gain (in red) and for weight maintenance (in green) of the Spanish population during lockdown due to COVID-19.*

## Discussion

Our study confirms that lockdown  proclaimed as a result of the COVID-19 pandemic has induced a moderate weight gain in almost half of the Spanish population that has voluntarily answered the online survey.

In addition, we have identified some independent variables related to weight gain: female, younger age, previous excess weight, not having weighed frequently or taken measures to avoid weight gain during lockdown, and having spent it in the South of Spain, as well as in the Balearic or Canary Islands. Our results confirm the close relationship between obesity and lifestyle habits. Thus, when lifestyle habits are changed negatively, there is an impact on weight, confirming once again that this is a variable sensitive to lifestyle [16]. In this sense, although the combination of a higher intake with a decrease in physical activity is the main reason why respondents justify the weight gain during lockdown, those who gained between 1 and 3 kg their weight, attributed this gain to the decrease in physical activity than those who gained more than 3 kg. And paralleled, the percentage of individuals who did not modify their habits to avoid weight gain during these weeks increased from 48.2% among those who gained 1 to 3 kg to 66.7% among those who gained more than 3 kg.

This is an extremely important piece of information that should be included in the public health recommendations addressed to the general population.

In our study, 80.0% of the women surveyed claimed to have gained weight during lockdown, compared to only 20.0% of the men. Obesity rates reach 34.9% of adults in the United States, with a higher prevalence in women [17]. In Spain, 21.6% of adults suffer from obesity, a percentage that increases to 32.1% among women over 55 years of age [18]. This is crucial, as women are responsible for more than 75% of the $ 400 billion in direct excess spending on health care attributed to obesity in the United States [19]. The difference between the genders has been attributed, in part, to the lower body size of the women in relation to the portions of food, as well as to the weight gain with each pregnancy [20]. Recently, a study performed in Lleida analyzed the data of 50,019 individuals (57.6% of women) over a 10-year follow-up. This work shows how young women with a lower initial body mass index (BMI) are the group with the highest risk of increasing their BMI by more than 2 points over those 10 years, data that partly reinforce the validity of our results [21]. As a whole, we believe that females should be identified as one of the groups on which to focus a large part of the policies for the prevention of obesity.

It is also worth remarking the greater weight gain the further South of Spain, becoming double for residents of the Balearic and Canary Islands. Although the higher incidence of obesity in Southern Spain has been previously described [18], it is important to observe that in our survey the prevalence of overweight prior to lockdown was homogeneous in all territories. In our study, people who did not consider themselves to be overweight gained weight less frequently and to a lesser extent than people who reported being overweight. A chronic disease such as obesity may get worse more easily when it is already present, and the right circumstances exist. But we also know that health education and motivation for change is low in people with obesity, which can help them gain weight more easily in adverse situations [22]. As mentioned above, the combination of higher food intake and less physical activity was the main reason for weight gain. In agreement with this argument, the nutritional needs of the population would have decreased between

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10% and 50% of the expenditure prior to lockdown as the factor decreased the correction of basal metabolism [23].

In addition, data from the Ministry of Agriculture, Fisheries and Food of Spain remark that, after a few weeks in which basic necessities were bought and stored, a moderation has been observed in these purchases while the acquisition of products that they habitually consumed in bars and restaurants [24].

Thus, the purchase of wine, beer and spirits, as well as chocolate bars, pastry products, snacks and nuts, has grown over 50% [24].

All of these high-calorie products would have helped to keep and even exceed energy consumption prior to lockdown due to the COVID-19. This fact would be more obvious among young people, probably the population that has modified their lifestyle the most during lockdown.

Weight gain during the weeks of lockdown could be predicted from the onset of the state of emergency, since, in similar situations, such as holiday seasons, a gain in body weight has been described in adult individuals, even in those seeking to lose weight and in people motivated in their self-control [25]. Paralleled, data similar to ours have been published in the young population of Italy [26]. In the adult population we have surveys (IFOP Institute for Darwin Nutrition, PronoKal Group, and professors of the higher nutrition and herbo-dietics course at Deusto Salud) that coincide in their conclusions of average weight gain of around 3 kg in French and Spanish populations.

A weight gain between 1 and 3 kg during a period of 4 to 6 weeks can be considered insignificant as it is less than 5% of the weight. However, weight gain produces adverse metabolic consequences, including increased blood glucose, dyslipidemia, high blood pressure, and cardiovascular disease, especially among women [30]. In this sense, a mathematical simulation model has predicted an increase in glycated hemoglobin values after 30 and 45 days of lockdown due to the COVID-19 of 2.2 and 3.6% respectively [31]. Also, we should not forget that obesity also has effects on the lung function, contributing significantly to the burden of respiratory disease [32].

Within the current context, we cannot forget that obesity is the second risk factor for a poor prognosis after the COVID-19 infection. There is a hypothesis based on the fact that the pathophysiological mechanism could be the decrease in the expiratory reserve volume and the functional capacity of the respiratory system of people with obesity. Especially in individuals with abdominal obesity, it has been observed that lung function is even more compromised if they are in supine position, due to the decrease in diaphragm movements, facilitating ventilatory failure [33]. Another pathophysiological mechanism proposed for the increase in morbidity and mortality due to the COVID-19 in people with obesity has been the existence of low-grade chronic inflammation [34]. In this regard, the increased concentration of inflammatory cytokines associated with obesity could be further exacerbated by the COVID-19 [35]. Additionally, Dhurandhar et al. described the details on how BMI can influence the response to certain infections, as well as preventive and treatment measures [36].

Considering that obese individuals affected by the COVID-19 are clearly at a disadvantage compared to patients with normal weight, and given the abundant scientific evidence linking the COVID-19 and obesity, it is important to say that the multidisciplinary obesity and surgery units bariatric procedures will be more necessary and effective than ever [37-39]. Other proposals that we believe are interesting to advance in tele medicine assistance, which allows current and much-needed technology would have been in lockdown, is the remote monitoring of patients using smart scales that transmit information online, in a way similar to continuous glucose meters, and thus be able to identify non-face-to-face patients who gain the most weight [40]. In order to advance in these aspects, we should already include instructions for self-examination, collection and sending of anthropometric data or all those that technology is incorporating in the therapeutic education of the overweight and obese patient.

Our research presents several limitations that we must observe, especially related to the methodology. The first, linked to the system chosen for data collection, is that the subjective perception of excess weight and obesity is usually associated with a significant bias. Data recently published by SEEDO show that only 17.7% of individuals with a BMI> 30 kg / m2 express the perception of being truly obese [41]. Due to the fact that the survey was distributed through SEEDO's social networks, the data could have a bias since those people who participated may be individuals who are more concerned about their weight. Furthermore, the survey was not administered by a health professional. However, SEEDO is a pioneer in online data acquisition using techniques such as Computer-assisted Telephone Interviewing [39]. These tools are enforced, and more after the COVID-19. Another limitation is related to the generic definition of geographic areas (North, Center, South, islands and others), which has helped us to add the data, but could lead to a certain degree of confusion. Especially in the Balearic or Canary Islands, given the size of the sample of this region, the data could be more distorted compared to the other regions.

Furthermore, the prevalence of overweight and obesity in the Canary Islands is one of the highest in Spain, but this is not the case in the Balearic Islands. For these reasons, it is important to analyze the data with caution.

## Conclusions

A significant percentage of the Spanish population self-report a gain in weight during the first month of the lockdown due to the COVID-19, the vast majority between 1 and 3 kg. The consequences this weight gain will have on the severity of future COVID-19 infections are worthy of further investigation.

Having identified the population at greatest risk, if a new worsening of the infection occurs in the following months, in young people, females, who are already overweight and who live in the South of Spain and the Balearic Islands or the Canary Islands should focus the efforts of health professionals, weighing themselves frequently and taking measures to avoid negative weight gain.

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