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ORIGINAL ARTICLE

Weight change and lifestyle modifications implemented during the COVID-19 pandemic lockdown are associated with the development of gastrointestinal symptoms

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KEYWORDS
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Abstract
Introduction and aims: Pandemic lockdown measures are a cause of concern, regarding their negative impact on the mental health of individuals. The results of numerous studies have associated the appearance of gastrointestinal symptoms with different psychologic disorders, such as stress, depression, and anxiety, due to gut-brain axis interaction. The aim of the present study was to determine the prevalence of, and factors associated with, gastrointestinal symptom onset related to the COVID-19 pandemic lockdown and various lifestyle modifications.
Methods: An analytic, observational, and cross-sectional study was conducted on an open population that agreed to participate within the time frame of January to May 2021.
Results: A total of 298 subjects, 165 of whom were women (55.4%), agreed to participate and the mean patient age was 36.1 ± 12.6 years. There was a significant increase in the frequency of several gastrointestinal symptoms: epigastric burning, early satiety, heartburn, regurgitation, constipation, and diarrhea. Changes in weight and modifications in lifestyle were found to be associated variables.
Conclusions: The results of this study showed a significant increase in a wide variety of gastrointestinal symptoms related to lifestyle changes due to the pandemic lockdown. Weight change, supplement and multivitamin intake, and reduced physical activity were the main associated risk factors. Public healthcare systems should take a multidisciplinary approach into consideration for the care of affected individuals.

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PALABRAS CLAVE
COVID-19;
SARS-CoV-2;
Confinamiento;
Cambio en el estilo de vida;
Síntomas gastrointestinales

Cambios en el peso y modificaciones en el estilo de vida implementados durante el confinamiento por la pandemia de COVID-19 se asocian como desencadenantes del desarrollo de síntomas gastrointestinales

Resumen
Antecedentes: Las medidas de confinamiento pandémico han generado preocupaciones sobre su impacto en la salud mental de las personas. La aparición de síntomas gastrointestinales ha sido asociada en múltiples estudios con diversos trastornos psicológicos como el estrés, la depresión y la ansiedad, debido a la interacción del eje intestino-cerebro. Este estudio tuvo como objetivo determinar la prevalencia y los factores asociados con el inicio de síntomas gastrointestinales relacionados con el confinamiento por la pandemia de COVID-19 y varias modificaciones en el estilo de vida.
Métodos: Se realizó un estudio observacional, transversal y analítico en una población abierta que aceptó participar entre enero y mayo de 2021.
Resultados: Doscientos noventa y ocho sujetos aceptaron participar, 165 mujeres (55,4%); la edad promedio fue de 36.1 ± 12.6 años, se observó un aumento significativo en la frecuencia de varios síntomas gastrointestinales: ardor epigástrico, saciedad temprana, acidez, regurgitación, estreñimiento y diarrea. Los cambios en el peso y las modificaciones en el estilo de vida se encontraron como variables asociadas.
Conclusiones: En este estudio, se encontró un aumento significativo en una amplia variedad de síntomas gastrointestinales relacionados con modificaciones en el estilo de vida debido al confinamiento. Los cambios en el peso, la ingesta de suplementos y multivitaminas, y la disminución de la actividad física fueron los principales factores de riesgo asociados. Los sistemas de salud pública deben tener en cuenta un enfoque multidisciplinario para el cuidado de estas personas.

Introduction

More than 462 million confirmed cases of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection have been registered. At least 6 million persons have died from severe forms of coronavirus disease 2019 (COVID-19). Mexico is one of the countries with a high impact of the disease on the number of cases and mortality rate, in addition to an indirect economic one, as well.[1] In the absence of a specific treatment and the low availability of vaccines at the beginning of the pandemic, lockdown and physical distancing measures were implemented worldwide.[1–3] Such measures have increased the levels of stress, anxiety, and depression in the population, even resulting in suicide in some cases.[3–5] A long period of lockdown, the fear of contagion, frustration, boredom, and misinformation also negatively impact mental health.[6–10]

During the pandemic, multiple studies demonstrated that the presence of gastrointestinal symptoms can be related to the SARS-CoV-2 infection itself.[11] There is also a relation between symptoms, such as abdominal pain, and a more severe course of COVID-19.[12] On the other hand, it is well known that functional gastrointestinal symptoms have been associated with situations of stress, in which the interaction of the gut-brain axis plays an important role. Nevertheless, very few studies have evaluated the effect of stressful phenomena and lifestyle changes occurring during the pandemic lockdown. Therefore, we hypothesize that the factors due to the COVID-19 pandemic, in addition to and independent of SARS-CoV-2 infection, could have an impact on the prevalence of different gastrointestinal symptoms during the pandemic lockdown period.[10,13–17]

The aim of this study was to determine the prevalence of gastrointestinal symptoms during the period of the COVID-19 pandemic lockdown and evaluate whether there was a relation between said gastrointestinal symptoms and the stressful phenomena and lifestyle changes occurring during said lockdown.

Methods

Type of study: An analytic, observational, cross-sectional study following the STROBE guidelines was conducted on an open population that agreed to participate in the survey, within the time frame of January and May 2021. The study was approved by the research and ethics committees of the *Hospital General de México* and the procedures utilized in the analysis followed the principles of the Declaration of Helsinki at all times.

Inclusion criteria: Subjects of both sexes above 18 years of age were included. In line with the aim of verifying whether psychosocial factors, stressful phenomena, and lifestyle changes during the pandemic lockdown had an impact on the gastrointestinal health of individuals, in order to maximally reduce the possibility that the development of

gastrointestinal symptoms was due *per se* to the SARS-CoV-2 infection itself, ideally, subjects with no previous history of a diagnosis of SARS-CoV-2 infection were included. However, given that a large number of individuals had already experienced viral contact, the study subjects that had presented with the infection had to be asymptomatic and have presented with a mild clinical course, been treated as outpatients, and have had no gastrointestinal symptoms at the time of acute SARS-CoV-2 infection.

To participate in this survey, having maintained lockdown and physical distancing measures for at least 6 months during the first or second wave of the COVID-19 pandemic was also obligatory.

Exclusion criteria: Pregnant or breastfeeding women were excluded from the study, as were individuals with a history of previous diagnoses of gastrointestinal diseases, such as cancer, ulcers, erosions, or any type of gastrointestinal lesion.

To maximally reduce its influence, individuals with a history of SARS-CoV-2 infection and moderate-to-severe COVID-19 disease, consequently requiring hospitalization, or that had presented with gastrointestinal symptoms during COVID-19 presentation, were also excluded.

Sample size calculation: We utilized the formula for estimating a proportion, considering a reasonable population per 10,000 inhabitants, and assuming that at least 20% of those surveyed could present with gastrointestinal symptoms attributable to the lockdown and all the related lifestyle changes, with a 95% confidence interval and a 5% absolute accuracy, we obtained a minimum of 240 subjects to survey.

Data collection: The sociodemographic data, lifestyle changes, daily physical activities, exercise, changes in diet, and medication and dietary supplement use before the pandemic and during the pandemic lockdown were collected through the survey. In addition, the levels of stress of those surveyed before and during the lockdown were evaluated using the Perceived Stress Scale (PSS-10 [Table 1]).[18] With respect to gastrointestinal symptoms, the presence of heartburn, regurgitation, epigastric burning, early satiety, dysphagia, abdominal pain, bloating, diarrhea, and constipation were explored through the survey.

Statistical analysis: Descriptive statistics were utilized to describe the variables. The quantitative variables were expressed through mean and standard deviation when they had parametric distribution and median and interquartile range when they had nonparametric distribution. The variables were compared in the periods before the pandemic and during the lockdown, utilizing the Student's t test for related samples or the Wilcoxon test for the quantitative variables, the McNemar's test for the dichotomous variables, or the Cochran's Q test for the categorical variables.

The prevalence of gastrointestinal symptoms in the population surveyed was calculated before the pandemic and during the exposure to lockdown and physical distancing measures during the pandemic. The prevalence ratio, along with the 95% confidence interval for each gastrointestinal symptom, was also obtained.

Lastly, a risk analysis was performed, determining the odds ratios with their respective confidence intervals. Binary logistic regression was used to carry out the adjusted multivariate analyses, to evaluate the risk factors associated with the development of gastrointestinal symptoms during the lockdown. Statistical significance was set at a $p < 0.01$. The SPSS version 25.0 and Epidat 3.1 (Galicia, Spain) statistics programs were employed.

Ethical considerations

Ethical approval: Informed consent was obtained from each study participant. The study was approved by the ethics and research committees of the *Hospital General de México*. The procedures utilized in this study followed the principles of the Declaration of Helsinki at all times.

Protection of humans and animals. No experiments were performed on humans or animals in this research study.

Data confidentiality and privacy of the subjects. To safeguard the confidentiality of the individuals that agreed to participate in the survey, the data collected included no personal information that could identify the participating subject by first or last name. Only the researchers had access to the data collected. All protocols at our work center were followed, respecting the privacy and confidentiality of the individuals participating in the study, preserving their anonymity at all times.

Right to privacy and informed consent. Because a survey was employed, all the participants gave their informed consent to participate in it, answering the questions that were then evaluated. No personal data were published in this article that could identify the individuals surveyed.

Results

Sociodemographic data: A total of 298 individuals agreed to participate in the survey; 133 were men (44.6%) and 165 were women (55.4%); their mean age was 36.1 ± 12.6 years. At the time of the survey, 34 subjects (11.4%) reported having previously had mild COVID-19 and/or a positive SARS-CoV-2 test and no symptoms, whereas 264 subjects (88.6%) had not had the disease, nor had they presented with a positive SARS-CoV-2 test.

According to educational level, 218 subjects (73.2%) had a college degree, 31 subjects (10.4%) had a high school diploma, 24 subjects (8.1%) had postgraduate studies, 22 subjects (7.4%) had a technical profession, and 3 subjects (1.0%) had a junior high school education.

Diet and lifestyle: A total of 264 of those surveyed (88.6%) reported changes in their diet during the COVID-19 pandemic lockdown; 66 (22.1%) of them made positive changes favoring a higher quality and healthier diet and 198 (66.5%) of them made negative changes to their diet, consuming less water and fiber and more industrialized or highly processed foods; 34 subjects (11.4%) did not respond to the question.

Regarding body weight, 89 surveyed subjects (29.9%) reported having no change, 147 subjects (49.3%) gained weight, and 62 subjects (20.8%) lost weight. Of those that gained weight, the mean initial weight was 67.8 ± 10.0 kg, compared with 71.4 ± 9.8 kg during the pandemic ($p < 0.0001$). Among the subjects that lost weight, the mean initial weight was 71.2 ± 8.5 kg, compared with 68.0 ± 8.7 kg ($p < 0.0001$).

Table 1 Perceived Stress Scale (PSS-10).

Item	In the past month	Never	Almost never	Sometimes	Fairly often	Very often
1	How often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2	How often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3	How often have you felt nervous or stressed?	0	1	2	3	4
4	How often have you felt confident about your ability to handle your personal problems?	4	3	2	1	0
5	How often have you felt that things were going your way?	4	3	2	1	0
6	How often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7	How often have you been able to control irritations in your life?	4	3	2	1	0
8	How often have you felt you were on top of things?	4	3	2	1	0
9	How often have you been angered because of things that were outside of your control?	0	1	2	3	4
10	How often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Regarding physical activity, 83 subjects (27.9%) reported no changes, 40 subjects (13.4%) reported an increase, and 175 subjects (58.7%) reported a decrease.

Stress perception: The PSS-10 scale showed a significant increase in all its items evaluated individually and in its overall score, upon comparing the perception of those surveyed before and during the pandemic lockdown: 6.0 ± 2.6 vs. 24.4 ± 5.0 ($p < 0.0001$).

Gastrointestinal symptom evaluation: In the comparison of gastrointestinal symptoms before the COVID-19 pandemic and during the pandemic lockdown, there was a significant increase in the frequency of the following gastrointestinal symptoms: epigastric burning, early satiety, heartburn, regurgitation, constipation, and diarrhea. There was no difference with respect to the presence of dysphagia (Table 2).

Factors associated with the development of gastrointestinal symptoms during the pandemic lockdown

Epigastric burning: Female sex was associated with a lower risk for developing epigastric burning, compared with male sex (OR = 0.48, 95% CI: 0.24–0.97, p = 0.04); as would be expected, patients with epigastric burning were more prone to self-medication or PPI prescription (OR = 6.9, 95% CI: 2.7–18.1, p < 0.0001). The patients with epigastric burning had a history of self-medication or vitamin or nutritional supplement use with more frequency ''for improving their health'' (OR = 7.4, 95% CI: 2.1–25.8, p = 0.002). A lifestyle with less physical, social, and workplace activity and less interaction (a more relaxed lifestyle) was associated with a lower risk for developing epigastric burning (OR = 0.16, 95% CI: 0.07-0.37, p < 0.0001). Other factors had no influence (Table 3).

Early satiety: Female sex was the most important risk factor associated with the development of early satiety, compared with male sex (OR = 2.1, 95% CI: 1.1-3.97, p = 0.02); changes in body weight were also related to said symptom (weight gain: OR = 2.8, 95% CI: 1.3-6.3, p = 0.01; weight loss: OR = 4.2, 95% CI: 1.6-10.97, p = 0.004). Early satiety was related to a greater likelihood of self-medication or PPI prescription (OR = 5.5, 95% CI: 2.3-13.6, p < 0.0001); changes in physical activity were related to a lower risk for developing early satiety (exercise: OR = 0.1, 95% CI: 0.03-0.46, p = 0.003), and to a lesser degree, maintaining less workplace activity, physical labor, and social interaction (a more relaxed lifestyle) were also associated with lower risk (OR = 0.46, 95% CI: 0.24-0.89, p = 0.02) (Table 3).

Heartburn: Female sex was associated with a lower risk, compared with male sex (OR = 0.29, 95% CI: 0.16-0.53, p < 0.0001). Patients with heartburn had a history of self-medication or vitamin and/or nutritional supplement use with more frequency ''for improving their health during the pandemic'' (OR = 4.2, 95% CI: 1.3-13.4, p = 0.02); the lack of physical activity was a risk factor for presenting with heartburn (OR = 2.1, 95% CI: 1.1-4.1, p = 0.03). Other factors had no influence (Table 3).

Table 2 Comparison of gastrointestinal symptoms in the general population, according to 2 different time periods; before and during the COVID-19 pandemic, in which lockdown measures and lifestyle modifications were implemented.

Symptom	Frequency reported pre-pandemic n = 298	Frequency reported during lockdown n = 298	Prevalence of symptoms pre-pandemic (not exposed)	Prevalence of symptoms during the pandemic lockdown (exposed)	Prevalence ratio (95% CI)	OR (95% CI)	p
Epigastric burning	28 (9.4%)	56 (18.8%)	0.09	0.19	2.0 (1.3-3.1)	2.2 (1.4-3.6)	<0.001
Early satiety	25 (8.4%)	73 (24.5%)	0.08	0.24	2.9 (1.9-4.5)	3.5 (2.2-5.7)	<0.0001
Heartburn	32 (10.7%)	81 (27.2%)	0.1	0.3	2.5 (1.7-3.7)	3.1 (2.0-4.8)	<0.00001
Regurgitation	13 (4.4%)	40 (13.4%)	0.04	0.12	3.0 (1.7-5.6)	3.4 (1.8-6.5)	0.0001
Dysphagia	45 (15%)	45 (15%)	0.15	0.15	1.0 (0.7-1.5)	1.0 (0.7-1.6)	1.0
Abdominal pain	10 (3.4%)	42 (14.1%)	0.03	0.14	4.2 (2.2-8.2)	4.7 (2.3-9.6)	<0.00001
Bloating	30 (10.1%)	131 (43.9%)	0.10	0.43	4.4 (3.0-6.3)	7.0 (4.5-10.9)	<0.00001
Constipation	26 (8.7%)	120 (40.3%)	0.08	0.40	4.6 (3.1-6.8)	7.1 (4.4-11.2)	<0.00001
Diarrhea	0 (0%)	14 (4.7%)	0.001	0.04	29.0 (1.7-483.9)	30.4 (1.8-512.4)	<0.00001

Table 3 Variables associated with the development of upper gastrointestinal symptoms.

Variable	Symptom															
	Epigastric burning				Early satiety				Heartburn				Regurgitation			
	OR	95% CI		P	OR	95% CI		p	OR	95% CI		p	OR	95% CI		p
		Min	Max			Min	Max			Min	Max			Min	Max	
Female sex	0.480	0.238	0.968	0.040[a]	2.103	1.113	3.974	0.022[a]	0.295	0.165	0.528	0.000[a]	0.576	0.276	1.200	0.141
Change in diet	2.471	0.706	8.649	0.157	0.687	0.269	1.756	0.433	2.199	0.842	5.744	0.108	1.027	0.335	3.150	0.963
Weight gain	0.807	0.366	1.778	0.595	2.833	1.282	6.258	0.010[a]	1.046	0.540	2.029	0.893	0.598	0.264	1.356	0.218
Weight loss	0.647	0.239	1.756	0.393	4.171	1.586	10.973	0.004[a]	0.464	0.181	1.188	0.110	0.408	0.129	1.293	0.128
Need for PPI use	6.932	2.651	18.128	0.000[a]	5.545	2.256	13.632	0.000[a]	1.063	0.464	2.437	0.885	1.007	0.359	2.820	0.990
Need for antacid use	1.259	0.499	3.177	0.626	1.286	0.527	3.137	0.580	0.446	0.176	1.130	0.089	0.423	0.123	1.457	0.173
Fiber supplements	0.570	0.229	1.421	0.228	1.210	0.603	2.426	0.591	.957	0.486	1.882	0.898	1.209	0.513	2.847	0.664
Other supplements or multivitamins	7.371	2.107	25.786	0.002[a]	1.276	0.399	4.077	0.681	4.166	1.291	13.445	0.017[a]	5.010	1.367	18.369	0.015[a]
PSS-10 $\geq$ 20 points (stress)	1.324	0.493	3.555	0.577	0.774	0.339	1.767	0.544	1.171	0.533	2.572	0.695	0.412	0.172	0.991	0.048[a]
History of COVID-19	0.533	0.153	1.858	0.323	1.108	0.423	2.901	0.835	1.302	0.536	3.163	0.561	2.388	0.871	6.546	0.091
Exercise	0.613	0.199	1.893	0.395	0.109	0.026	0.460	0.003[a]	0.523	0.151	1.812	0.307	0.504	0.096	2.650	0.419
Decrease in physical activity or workplace activity	0.158	0.067	0.374	0.000[a]	0.458	0.235	0.893	0.022[a]	2.108	1.075	4.135	0.030[a]	1.566	0.665	3.687	0.0305[a]

COVID-19: coronavirus disease 2019; PPI: proton pump inhibitor; PSS-10: Perceived Stress Scale-10.
[a] Statistical significance, $p < 0.05$.

Regurgitation: The only risk factor associated with a greater probability of presenting with regurgitation during the pandemic lockdown was self-medication or multivitamin and nutritional supplementation for ''improving health during the pandemic'' (OR = 5.0, 95% CI: 1.4-18.4, p = 0.01) (Table 3).

Abdominal pain: No significant associations related to abdominal pain were found (p = NS for all the factors evaluated).

Bloating: Changes in body weight were related to a higher risk for developing bloating (weight gain: OR = 2.4, 95% CI: 1.2-4.5, p = 0.01; weight loss: OR = 5.4, 95% CI: 2.3-12.5, p < 0.0001). The use of nutritional supplements with a high fiber content was associated with bloating (OR = 5.2, 95% CI: 2.8-9.7, p < 0.0001), whereas the dietary increase of natural fiber or fiber derived from natural foods did not result in a higher frequency of bloating (p = NS) (Table 4).

Diarrhea: Of all the possible factors evaluated, only the use of nutritional supplements with high fiber content was associated with a greater risk for developing diarrhea (OR = 36.9, 95% CI: 3.8-363.7, p = 0.002) (Table 4).

Constipation: Weight gain was significantly associated with a higher risk for constipation (OR = 4.1, 95% CI: 1.4-11.7, p = 0.009). The subjects that developed constipation were more prone to using high-fiber nutritional supplements for improving it (OR = 232.6, 95% CI: 45.4-1191.9, p < 0.0001). The subjects surveyed that reported a decrease in physical activity and exercise had a higher risk for constipation during the lockdown (OR = 4.9, 95% CI: 1.7-14.7, p = 00.4) (Table 4).

Discussion

Physical distancing measures have been widely shown to have a negative impact on the mental health of individuals.[19–22] On the other hand, functional gastrointestinal disorders (FGIDs) have a multifactorial origin, signifying that despite the absence of obvious organic alterations, several gastrointestinal symptoms affect the quality of life of the individuals that present with them.[23] Based on the biopsychosocial model, FGIDs are characterized as bidirectional complex deregulations of gut-brain interaction. Visceral hypersensitivity, abnormal gastrointestinal motility, low-grade intestinal inflammation, an increase in intestinal permeability, immune system activation, microbiome alterations, certain types of dietary components, such as the fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAPs), and psychologic perturbations have been recognized as contributing factors to the pathogenesis of FGIDs.[24]

During the lockdown, the number of individuals in our study that made changes to their diet was very high (88.6%). The majority of them (66.5%) reported negative changes, mainly regarding an increase in industrialized or highly processed foods. Diet has been well established as one of the main modulators of the content of the gut microbiota, through directly influencing the homeostasis of the host and biologic processes, but also through the action of metabolites derived from the microbial fermentation of nutrients, especially short-chain fatty acids.[25,26]

In the present study, we also documented body weight changes in up to 29.9% of the individuals surveyed. The fact that studies have also associated weight change with imbalances in the gut microbiota is important to underline.[27–29]

The COVID-19 pandemic and lockdown measures have increased perceived stress levels in the world population, as demonstrated in studies that, like ours, measured perceived stress utilizing the PSS-10.[30–32] Aslan et al. showed that, as a result of the COVID-19 pandemic, students in Turkey reported a high level of perceived stress, mild generalized anxiety, and a low level of satisfaction with life. More than half of the students met the diagnostic criteria of generalized anxiety disorder (52%) and depression (63%). Female student and students that were physically inactive had higher levels of perceived stress on the PSS-10.[32]

Our study shows that during the pandemic, when the stay-at-home lockdown measures were the strictest, there was a significant increase in the following gastrointestinal symptoms in a population previously classified as healthy: epigastric burning, early satiety, heartburn, regurgitation, constipation, and diarrhea. In a certain manner, our results are consistent with those of other authors, such as the study by Oliviero et al. who found that, during the pandemic lockdown, in persons with a previous diagnosis of a FGID, higher levels of anxiety were associated with a greater risk for worsening chest pain (OR 1.3 [1.1-1.7]), water brash (OR 1.3 [1.0-1.7]), epigastric burning (OR 1.3 [1.0-1.6]), and abdominal pain (OR 1.6 [1.0-2.3]).[33] Nakov et al. also reported a 12.9% increase in the prevalence of gastrointestinal symptoms, compared with the pre-pandemic period in the population studied (p < 0.001).[16] Likewise, Goebel-Stengel et al. found that patients with irritable bowel syndrome presented with significantly higher scores, with respect to the increase in gastrointestinal symptoms during the pandemic (p = 0.007).[34]

It should be pointed out that during the pandemic, both individuals and the medical community, directed their attention toward natural supplements, vitamins, and different medications, in the search for preventive and therapeutic options. However, some of those options could be more harmful than beneficial. For example, oral ascorbic acid has been related to abdominal pain and diarrhea; cholecalciferol can induce hypercalcemia, which can lead to gastric malaise; large doses of zinc taken orally (10-15 times higher than the recommended daily dose) can cause stomach cramps, nausea, and vomiting; and glutathione and N-acetylcysteine can cause stomach cramps, nausea, bloating, and allergic reactions.[35] Our study found an association between the use of several supplements or vitamins ''in the search for improved health'' and the development of various symptoms, such as epigastric burning, bloating, heartburn, and regurgitation. A limitation of our study was the fact that we did not differentiate between the type or class of supplements used by our survey participants. We also found that fiber supplements were associated with bloating and the development of diarrhea but appeared to be useful for alleviating constipation in the individuals surveyed.

In our study, several lifestyle changes due to the lockdown were related to an increase in the frequency

Table 4 Variables associated with the development of lower gastrointestinal symptoms.

Variable	Symptom											
	Abdominal pain				Diarrhea				Constipation			
	OR	95% CI		p	OR	95% CI		p	OR	95% CI		p
		Min	Max			Min	Max			Min	Max	
Female sex	0.961	0.563	1.642	0.884	1.631	0.590	4.509	0.346	1.549	0.688	3.486	0.291
Change in diet	0.446	0.196	1.016	0.055	0.866	0.227	3.299	0.833	2.114	0.546	8.192	0.279
Weight gain	2.363	1.231	4.536	0.010[a]	2.832	0.772	10.390	0.116	4.100	1.433	11.726	0.009[a]
Weight loss	5.415	2.352	12.466	0.000[a]	2.847	0.632	13.277	0.171	1.368	0.397	4.721	0.620
Need for PPI use	1.433	0.633	3.243	0.389	0.511	0.119	2.190	0.366	0.224	0.054	0.922	0.038[a]
Need for antacid use	0.663	0.276	1.592	0.358	0.304	0.051	1.801	0.190	0.956	0.227	4.026	0.951
Fiber supplements	5.212	2.806	9.683	0.000[a]	36.957	3.755	363.727	0.002[a]	232.616	45.398	1191.907	0.000[a]
Other supplements or multivitamins	2.463	0.780	7.776	0.124	5.374	0.526	54.864	0.156	2.093	0.145	30.276	0.588
PSS-10 $\geq$ 20 points (stress)	0.885	0.417	1.879	0.751	2.619	0.397	17.276	0.317	0.873	0.276	2.759	0.817
History of COVID-19	0.514	0.211	1.249	0.142	0.527	0.103	2.705	0.443	0.330	0.077	1.420	0.137
Exercise	0.463	0.176	1.217	0.118	1.240	0.188	8.170	0.823	3.943	0.870	17.867	0.075
Decrease in physical activity or workplace activity	0.946	0.517	1.728	0.856	3.375	0.946	12.040	0.061	4.950	1.667	14.696	0.004[a]

COVID-19: coronavirus disease 2019; PPI: proton pump inhibitor; PSS-10: Perceived Stress Scale-10.
[a] Statistical significance, $p < 0.05$.

of constipation, and the most important associated factors were weight gain and reduced physical activity. In a similar study, Remes-Troche et al. reported an association with reduced physical activity and dietary changes.[14]

Lastly and importantly, as a limitation to our study, there is always a risk for bias, when obtaining information through a survey,[36] especially information bias, resulting from mistakes made in the survey design or errors in applying the questionnaire inherent in the interviewer or attributable to the interviewee. Therefore, our findings should be validated through additional studies.

Conclusions

COVID-19 and its containment measures, such as lockdown, have numerous and heterogeneous consequences. The impact of lifestyle modifications resulting from the lockdown, such as changes in physical activity, diet, and the use of different types of vitamins and supplements, can have a negative effect on the gastrointestinal tract, favoring the development of various gastrointestinal symptoms. Therefore, public health systems should be aware of the need for a multidisciplinary focus on the care of the affected population, one that includes the gastroenterologist, who must be prepared to respond to the needs of those individuals opportunely and with adequate medical care. This is especially true, given that new variants of SARS-CoV-2 that are of clinical interest continue to be discovered and we cannot rule out the possibility that at some point lockdown measures may once again become necessary.

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Conflict of interest

The authors declare that there is no conflict of interest.

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