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## ORIGINAL ARTICLE

# Influence of the confinement that occurred in Spain due to the SARS-CoV-2 virus outbreak on adherence to the Mediterranean diet<sup>☆</sup>

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## KEYWORDS

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## Abstract

**Introduction:** The Mediterranean diet (MDiet), reduces morbidity and mortality. The lockdown that took place in Spain between the months of March and May 2020 may have led to behavioural changes. The aim of the present study was to assess adherence to the MDiet at the end of the lockdown period and to compare it with the situation prior to it.

**Methods:** Data were obtained by means of two online questionnaires, one at the beginning of lockdown and the other at the end, completed by adults from the Spanish population, who responded anonymously and voluntarily. The assessment of adherence to the MDiet was carried out using two questionnaires: Mediterranean Diet Adherence Screener (MEDAS) and modified PREDIMED, which contained 14 questions each. Other variables included were: age, gender, body mass index (BMI), Autonomous Community of origin, home living conditions, and level of studies achieved. At the end of the lockdown period, the comparison was made using the Student *t* statistic and the McNemar test.

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**Results:** A total of 207 people (137 women) participated, with a mean age  $51.3 \pm 12.4$  years, age range: 20–83 years. After lockdown, BMI remained unchanged (initial  $24.55 \pm 3.7$  kg/m<sup>2</sup> and final  $24.57 \pm 3.7$  kg/m<sup>2</sup>,  $P = .752$ ), as well as fish consumption (initial 51.2%) and 60.9% at the end,  $P = .003$ ) mainly due to the women and adherence to the Mdiet. The mean total score of MEDAS increased with  $10.6 \pm 2.0$  at the beginning, and  $10.57 \pm 2.0$  at the end;  $P = .001$ ). This also occurred with the modified PREDIMED ( $9.47 \pm 2.1$  at the beginning and  $9.93 \pm 2.1$  at the end,  $P < .001$ ). Similarly, the proportion of participants that had a score classified as high at the beginning increased at the end of lockdown: from 80.7% initially in MEDAS to 87.9% at the end,  $P = .021$ , and from 68.6% initially in modified PREDIMED to 75.8% at the end,  $P = .037$ .

**Conclusions:** In the study sample, during lockdown there were no changes in BMI, but there were increases in fish consumption and adherence to the MDiet.

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## PALABRAS CLAVE

SARS-CoV-2;  
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Dieta mediterránea;  
Adherencia;  
Pandemia

## Influencia del confinamiento ocurrido en España debido a la pandemia por el virus SARS-CoV-2 en la adherencia a la dieta mediterránea

### Resumen

**Introducción:** La dieta mediterránea (DMed) reduce la morbimortalidad. El confinamiento ocurrido en España entre los meses de marzo y mayo de 2020 podría generar cambios conductuales, entre ellos la adherencia a la DMed. El objetivo del presente estudio ha sido valorar la citada adherencia al concluir dicho confinamiento y compararla con la situación previa al mismo.

**Métodos:** Los datos se obtuvieron mediante dos cuestionarios en línea uno al comienzo del confinamiento y otro al final, en personas adultas procedentes de población española, las cuales respondieron de forma anónima y voluntaria. La valoración de la adherencia a la DMed se realizó a través de dos cuestionarios: *Mediterranean Diet Adherence Screener* (MEDAS) y PREDIMED modificado, los cuales contenían 14 cuestiones cada uno. Otras variables incluidas fueron: edad, género, índice de masa corporal (IMC), Comunidad Autónoma de procedencia, tipo de convivencia en domicilio y nivel de estudios alcanzado. Al concluir el confinamiento la comparación entre los cambios se realizó con el estadístico *t de Student* y la prueba de McNemar.

**Resultados:** Participaron 207 personas (137 mujeres), edad media de  $51,3 \pm 12,4$  años, intervalo de edad: 20–83 años. Transcurrido el confinamiento el IMC permaneció sin cambios ( $24,55 \pm 3,7$  kg/m<sup>2</sup> inicial y  $24,57 \pm 3,7$  kg/m<sup>2</sup> final,  $p = 0,752$ ), y sí el consumo de pescado (51,2% inicial y 60,9% al final,  $p = 0,003$ ) a expensas fundamentalmente de las mujeres y la adherencia a la DMed, aumentando la puntuación total por término medio tanto en MEDAS ( $10,6 \pm 2,0$  al inicio y  $10,57 \pm 2,0$  al final;  $p = 0,001$ ) como en PREDIMED modificado ( $9,47 \pm 2,1$  al inicio y  $9,93 \pm 2,1$  al final,  $p < 0,001$ ). Igualmente, la proporción de los participantes que tenían una puntuación clasificada como alta al principio, aumentó al final del confinamiento: de 80,7% inicial en MEDAS a 87,9% al final,  $p = 0,021$  y de 68,6% inicial en PREDIMED modificado a 75,8% al final,  $p = 0,037$ .

**Conclusiones:** En la muestra de nuestro estudio, durante el confinamiento no se apreciaron cambios en el IMC y sí aumentos en el consumo de pescado y en la adherencia a la DMed.

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## Introduction

It is well known that the Mediterranean diet (Mdiet) is an essential element of a healthy lifestyle that reduces overall mortality, neurodegenerative diseases, diabetes, cancer incidence and cardiovascular diseases (CVD).<sup>1</sup> The latter cause more than 4 million deaths per year in Europe (2.2 million women and 1.8 million men).<sup>2</sup> Interest in the Mdiet started some time ago, when in February 1952 Ancel Keys, on crossing the Simplon tunnel and leaving Switzerland in win-

ter weather (snow and cold) to enter northern Italy, noticed a remarkable change in the climate to spring weather, blue skies, flowers and birds singing. This made him realise that diet and lifestyle in this region might be important for health,<sup>3</sup> and resulted in the landmark Seven Countries Study.<sup>4</sup> Willett<sup>5</sup> later described the Mediterranean dietary pattern, already known as appetising and to have health-giving effects, as a pyramid. In the same publication, he made positive mention of the ‘siesta’, which he translated as afternoon nap. The popularity of this lifestyle, observed

in the northern Mediterranean countries, led UNESCO in 2010 to declare the Mdiet Intangible Cultural Heritage of Humanity. All that was left was to conduct a clinical, controlled, and randomised trial to provide maximum evidence of its benefits. This came in 2013 with the publication of the PREDIMED (PREvención con Dieta MEDiterránea) study.<sup>6</sup> This study showed that the Mdiet enriched with extra virgin olive oil or nuts reduced the frequency of CVD and CVD-related mortality by 30% compared to the control group that followed a low-fat diet. Adherence to this diet can be measured. This is of great interest, especially as we know that acute behavioural changes occur in people when faced with unexpected and stressful situations such as illness, accidents, etc., which could change their dietary habits in terms of quantity (hypophagia or hyperphagia)<sup>7</sup> or quality (of both foods and their preparation).<sup>8,9</sup> Between March and May 2020, the Spanish population was put into lockdown to combat contagion and the high morbidity and mortality that the SARS-CoV-2 virus was causing in our country and around the world. This lockdown as an exceptional situation that required sudden adaptation to a new way of life, could therefore generate behavioural change and affect adherence to the Mdiet. The aim of the present study was to assess the degree of adherence to the Mdiet immediately before and after lockdown in a Spanish population.

## Material and methods

An observational, analytical, longitudinal, and prospective study that assessed adherence to the Mdiet immediately before and after the lockdown imposed in Spain due to the SARS-CoV-2 pandemic (between March and May 2020).

### Instruments, participants, and variables included in the study

The data were obtained through 2 online questionnaires that monitored adherence to the Mdiet in real time during the SARS-CoV-2 pandemic from the start of lockdown in March 2020 until one week after it had ended. The initial survey was available from 17 March, very shortly after the start of lockdown (15 March), and referred to habits before lockdown. The survey explained to each participant the purpose of the study and how the data would be used. The easy-to-read questionnaires consisted of closed, exhaustive, and mutually exclusive questions. It explained how to answer each question, ensuring they were clear and straightforward, and grouped them by related areas to facilitate the flow of the instrument. The final survey was completed between 11 and 17 May and gathered data from the last week of lockdown.

We used non-probabilistic, convenience sampling to select participants from the adult Spanish population who were able to complete the self-administered questionnaires. Thus, we were able to obtain the desired number of participants in the shortest possible time (an essential condition), and they completed the questionnaires voluntarily and anonymously.

The variables included in the questionnaire that was distributed, self-administered, and answered online, were age,

sex, height, weight, body mass index (BMI) calculated indirectly (weight in kg/height in metres squared [ $\text{kg}/\text{m}^2$ ]), autonomous community of origin, home living conditions and level of education. In terms of BMI score, the participants were classified as normal weight (BMI between 18.5 and  $<25$ ), overweight (BMI: 25–29.9), and obese (BMI  $\geq 30$ ).<sup>10</sup>

### Measuring adherence to the Mediterranean diet

Two questionnaires that measure adherence to the Mdiet were assessed, the Mediterranean Diet Adherence Screener (MEDAS),<sup>11,12</sup> and the PREDIMED<sup>6</sup> questionnaire, which was modified by changing one of the 14 questions referring to the consumption of 7 or more glasses of wine per week. This question was not included in the terms defined by PREDIMED on the understanding that, as the study sample was in lockdown, the question might encourage greater alcohol consumption in general and wine in particular, and this was considered unethical. The question about drinking 3 or more glasses of wine per week, as proposed in MEDAS, was retained as a question in both questionnaires. The maximum score would be 14 points if the answers to the questions were affirmative. A cut-off point  $<9$  points would indicate low adherence and  $\geq 9$ , high adherence.<sup>13</sup>

### Ethical aspects

The participants completed the questionnaire anonymously and therefore their written informed consent was not required. Before they began the questionnaire, the aim of the study was explained to those who decided to participate, and their permission was requested to publish the results. The study was conducted in accordance with the Declaration of Helsinki and the guidelines of the Spanish Personal Data Protection Act (LOPD) 15/1999 were followed to collect the data.

### Sample size

From previous observations,<sup>14</sup> we know that the change in adherence to the Mdiet monitored for 13.6 months was .9 and its standard deviation (SD) was 2.0. With these data, we estimated the standardised effect size by dividing the expected observed change (.9) by the corresponding SD (2.0), i.e., .45. Assuming an accepted risk of making a 5%  $\alpha$  error (bilateral  $\alpha$  of .05), a  $\beta$  error of 1% ( $\beta$  of .01) and, therefore a power for the study of 99%, the minimum number of participants required was 181.<sup>15,16</sup>

### Statistical analysis

SPSS version 24, licensed by the University of Castilla-La Mancha, was used for the data analysis. The data were collected on a computer platform. The necessary variables had to be sorted, coded, and cleansed to be analysed. Two questionnaires were assessed, the Mediterranean Diet Adherence Screener (MEDAS) and the modified PREDIMED questionnaire. Qualitative variables are presented as absolute numbers and percentages. Quantitative variables are presented as means

**Table 1** The participants' level of education, home living conditions and autonomous community of origin during lockdown, overall and stratified by sex.

Variables	Total (n = 207)	Women (n = 137)	Men (n = 70)	p
<i>Level of education</i>				
Primary, secondary, or vocational training	31 (15.0)	19 (13.9)	12 (17.1)	.097
Diploma or degree	135 (65.2)	96 (70.1)	39 (55.7)	
Doctorate	41 (19.8)	22 (16.1)	19 (27.1)	
<i>Home living conditions</i>				
Living alone	31 (15.0)	21 (15.3)	10 (14.3)	.786
With a partner	81 (39.1)	50 (36.5)	31 (44.3)	
With children	26 (12.6)	17 (12.4)	9 (12.9)	
With parents or in-laws	9 (4.3)	7 (5.1)	2 (2.9)	
With flatmates	1 (.5)	1 (.7)	0 (.0)	
Partner + children	53 (25.6)	37 (27.0)	16 (22.9)	
Partner + children + parents or in-laws	1 (.5)	0 (.0)	1 (1.4)	
Partner + parents or in-laws	4 (1.9)	3 (2.2)	1 (1.4)	
Parents or in-laws + flatmates	1 (.5)	1 (.7)	0 (.0)	
<i>Home living conditions grouped</i>				
Living alone	31 (15.0)	21 (15.3)	10 (14.3)	.749
In a couple	81 (39.1)	50 (36.5)	31 (44.3)	
Partner + children	53 (25.6)	37 (27.0)	16 (22.9)	
Other	42 (20.3)	29 (21.2)	13 (18.6)	
<i>Autonomous Communities</i>				
Andalusia	7 (3.4)	3 (2.2)	4 (5.7)	0.024
Aragon	9 (4.3)	3 (2.2)	6 (8.6)	
Canary Islands	2 (1.0)	2 (1.5)	0 (.0)	
Cantabria	1 (.5)	1 (.7)	0 (.0)	
Castilla-La Mancha	54 (26.1)	33 (24.1)	21 (30.0)	
Castilla y León	14 (6.8)	7 (5.1)	7 (10.0)	
Catalonia	64 (30.9)	49 (35.8)	15 (21.4)	
Madrid	14 (6.8)	11 (8.0)	3 (4.3)	
Navarra	1 (.5)	1 (.7)	0 (.0)	
Valencian Community	7 (3.4)	4 (2.9)	3 (4.3)	
Basque Country	14 (6.8)	13 (9.5)	1 (1.4)	
Extremadura	1 (.5)	0 (.0)	1 (1.4)	
Galicia	1 (.5)	1 (.7)	0 (.0)	
Balearic Islands	1 (.5)	0 (.0)	1 (1.4)	
Principality of Asturias	15 (7.2)	9 (6.6)	6 (8.6)	
Region of Murcia	2 (1.0)	0 (.0)	2 (2.9)	
<i>Autonomous Communities grouped</i>				
North	41 (19.8)	28 (20.4)	13 (18.6)	.492
Centre	83 (40.1)	51 (37.2)	32 (45.7)	
Mediterranean coast	83 (40.1)	58 (42.3)	25 (35.7)	

The data are shown as exact number and (percentage). The  $\chi^2$  test was used to compare proportions between women and men. The northern area comprises the following Autonomous Communities: Galicia; Principality of Asturias; Cantabria; Basque Country; Community of Navarra and Aragon. The central area: Extremadura; Castilla y León; Community of Madrid and Castilla-La Mancha. The Mediterranean coastal area: Catalonia; Valencian Community; Region of Murcia; Balearic Islands; Andalusia and Canary Islands. n: number of participants; p: level of significance. A p-value of  $\leq .05$  was considered significant.

and SD. The relationship between qualitative variables was found using the  $\chi^2$  or Fisher's exact test, if more than 20% of the boxes had an expected frequency of less than 5. Comparison between the means of quantitative variables, when they had 2 categories, was made both for independent groups (Student's t or Mann-Whitney U test if the variable's behaviour was not normal) and related groups (paired Student's t or Wilcoxon test, if the variable's behaviour was not normal). If the groups had more than 2 categories, one-way

analysis of variance or the non-parametric Kruskal-Wallis test was used if conditions of normality were not met. If there were significant results, an a posteriori Bonferroni test was applied to establish the groups between which significant differences were found. The participants completed the final survey after 6 weeks. The McNemar test was used to compare between the initial and final results in dichotomous variables. A p-value less than or equal to .05 was considered significant.



## Results

A total of 490 respondents completed the initial questionnaire, of whom less than half (42.2%) also completed the final questionnaire; 207 participants met this criterion and comprise the sample of the present study. Because those who did not take part in the final questionnaire constituted a high loss (57.8%), all the variables were compared between those who completed both surveys (207 people) and those who only completed the first survey (283 people). No statistically significant differences were found, except that those who dropped out were younger ( $47.0 \pm 12.6$  versus  $51.3 \pm 12.4$ ;  $p < .001$ ), and consumed more than 3 servings of commercial sweets and pastries per week (31.4% vs. 21.7%;  $p = .017$ ). Therefore, given that the differences, although significant, were not relevant, we can state that the sample analysed did not differ from the sample that dropped out. [Table 1](#) shows the participants' level of education, their home living conditions and their autonomous community of origin, in the sample as a whole and with their distribution by sex. The high number of graduates (especially among the women) and those with a doctorate is striking, without there being statistically significant differences. Home living conditions varied greatly, most households comprising couples or couples with children. The origin of the individuals is also broad, as it covered 16 autonomous communities; most of the volunteers came from Catalonia, Castilla-La Mancha, Asturias, Castilla y Leon, Madrid, and the Basque Country. As they are grouped into logical geographical regions (north, centre, and Mediterranean coast), no statistical significance by sex was observed. On the other hand, all the variables shown in [Table 2](#) show significant differences by sex: the men were older, had a higher BMI, were more overweight and obese, and scored higher on adherence to the Mdiet, in the MEDAS questionnaire and in the modified PREDIMED. Comparing the questions of the Mdiet adherence questionnaire ([Table 3](#)), we conclude that the men drink significantly more wine per week and consume significantly more pulses than the women. [Table 4](#) shows the relationship between adherence to the Mdiet and the participants being overweight or obese, without showing statistical significance in the comparison of means, in either the total sample or by gender. [Table 4B](#) shows the relationship between the Mdiet and educational level and the detailed significant differences, especially in the total sample and in the MEDAS questionnaire in the men, which in general correspond to a higher score the higher the level of education.

[Table 5](#) shows the data obtained after the Spanish lockdown had come to an end. No changes in weight were observed in the total sample, as on average it remained within the weight considered normal ( $BMI < 25 \text{ kg/m}^2$ ). There were significant changes in the women ( $p = .048$ ), whose mean BMI increased by a very small amount, remaining within normal ranges at the beginning as well as at the end of the study. The same table shows that high adherence to the Mdiet increased significantly in the sample as a whole (MEDAS in the women), tending towards statistical significance in the case of the modified PREDIMED ( $p = .063$ ). To assess whether the changes experienced during lockdown differed between the women and the men in Mdiet adher-

ence score, these increases were compared after the end of the study. They can be seen in [Table 6](#), where an increase in adherence to the Mdiet is observed in all cases, with no significant differences by sex. [Fig. 1](#) clearly illustrates the changes in the Mdiet adherence score. It can be appreciated that in all cases the mean Mdiet adherence scores increase, both in MEDAS and PREDIMED, although statistical significance is reached in the total sample, mainly thanks to the women. The significant changes may be because out of all the PREDIMED questionnaire participants, 103 (49.8%) had an increased score, it remained unchanged in 50 (24.2%), and 54 (26.1%) had a lower score. In the MEDAS questionnaire the changes were similar: 101 (48.8%) improved their score, 50 (24.2%) had no change and 56 (27.1%) had a lower score.

In terms of the evolution of each of the 14 questions comprising both the MEDAS and the modified PREDIMED questionnaires, [Fig. 2](#) shows how, in general, the positive responses resulting in a higher Mdiet adherence score increase, especially the questions on consuming more than 4 tablespoons of olive oil per day and on the intake of fish and seafood: in both cases, levels of statistical significance were reached, both in the total sample and in the women.

## Discussion

The results of the present study show that during lockdown there were no changes in body weight, except for a small increase in the women, and adherence to the Mdiet increased. This is good news as, in addition to lowering the frequency of CVD,<sup>1</sup> it also reduces all-cause mortality in patients who have already had a cardiovascular disease.<sup>17</sup> Like Konieczna et al.,<sup>18</sup> we found no changes in weight. These authors, after a 5-year follow-up, observed a change in BMI from  $30.0 \pm 3.8 \text{ kg/m}^2$  to  $29.9 \pm 3.9 \text{ kg/m}^2$ . The differences from our results are (1) that their initial BMI was obese on average and in our case, weight was normal on average and (2) the duration of the study, as in our case this corresponded to the duration of lockdown.

The same explanation could be offered if compared with the PREDIMED<sup>6</sup> study itself, whose mean scores (between 29.7 and 30.2  $\text{kg/m}^2$ ) were similar to those of Konieczna et al.<sup>18</sup> at the beginning of the study. In contrast, other studies conducted during the pandemic have observed an increase in weight ( $BMI = 25.0 \pm 6.3 \text{ kg/m}^2$  at the start and  $27.0 \pm 5.7 \text{ kg/m}^2$  at the end), albeit in pregnant women.<sup>19</sup>

Di Renzo et al.,<sup>20</sup> at the end of the Italian lockdown, reported that 37% of the participants stated that their weight had remained stable, and had slightly increased in 40.3%. They do not give BMI scores, which makes comparison difficult, but this could well correspond to the discrete weight gain observed in the women in our study.

With slight differences, Sánchez-Sánchez et al.,<sup>21</sup> in their study carried out in Spain during lockdown, found normal weight in 61.3% of the women and 46.6% of the men; our study, in 71.5% of the women and 44.3% of the men; overweight in 22.9% of the women and 41.7% of the men

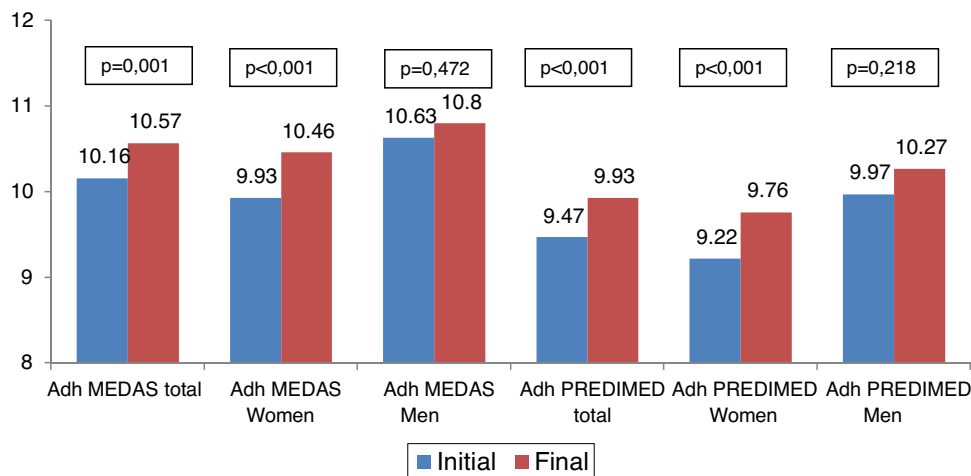
**Table 2** Characteristics of the main variables obtained in the initial sample stratified by sex. Comparison between the women and the men.

	Total (n = 207)	Women (n = 137)	Men (n = 70)	p
Age in years [range]	51.3 (12.4) [20–83]	49.3 (12.3) [20–77]	55.2 (11.5) [26–83]	.001
Weight in kg	68.6 (13.3)	63.6 (11.9)	78.5 (10.1)	<.001
Height in cm	166.8 (8.6)	162.8 (6.6)	174.5 (6.5)	<.001
BMI (kg/m <sup>2</sup> )	24.6 (3.7)	23.9 (4.0)	25.7 (2.9)	<.001
<i>Classification according to BMI:</i>				
<i>n (%)</i>				
Normal weight	129 (62.3)	98 (71.5)	31 (44.3)	
Overweight	59 (28.5)	27 (19.7)	32 (45.7)	.001
Obesity	19 (9.2)	12 (8.8)	7 (10.0)	
Adherence to the Mediterranean diet (MEDAS)	10.16 (2.0)	9.93 (2.0)	10.63 (2.1)	.019
Adherence to the Mediterranean diet (modified PREDIMED)	9.47 (2.1)	9.22 (2.0)	9.97 (2.2)	.015

The data are shown as means and (standard deviation), except for obesity, which is shown as frequencies and percentages. The Student's t-test for independent groups was used to compare between means, after applying Levene's test for Equality of Variances. The obesity variable was compared using the  $\chi^2$  test.

BMI: body mass index; cm: centimetres; kg: kilograms; MEDAS: Mediterranean Diet Adherence Screener; m: meters; n: number of participants; p: level of significance; PREDIMED: Prevention with the Mediterranean diet.

A p-value  $\leq .05$  was considered significant.



**Figure 1** Mean score obtained in adherence to the Mediterranean diet, assessed by both the MEDAS and modified PREDIMED questionnaires. There was a total of 207 participants, of whom 137 (66.2%) were women and 70 (33.8%) men. The Student's t-test for paired groups was used to compare means.

Adh: adherence.

compared to 19.7% of the women and 45.7% of the men in our study, these figures show more similarities than differences, which could well be explained by the origin and characteristics of the sample. Because theirs was a cross-sectional study, it was not possible to assess how weight evolved, although they report that 47.3% of the participants stated that their weight had not changed during lockdown and 37.3% reported a weight gain of between 1 kg and 3 kg.

Regarding the score obtained at the start of the study in Mdieta adherence, Tobias et al.<sup>13</sup> observed a mean score of

8.9 ± 2.7 points in patients with ischaemic heart disease, half a point lower than our score (9.47 ± 2.1 points). This difference might be explained by our group's modification to the PREDIMED questionnaire in the question referring to wine consumption and by the characteristics of the population assessed. The same explanation could be given when comparing the percentage obtained in the patients classified as high-scoring, slightly higher in our study sample (68.6%) compared to the score obtained by the patients with ischaemic heart disease (63%).

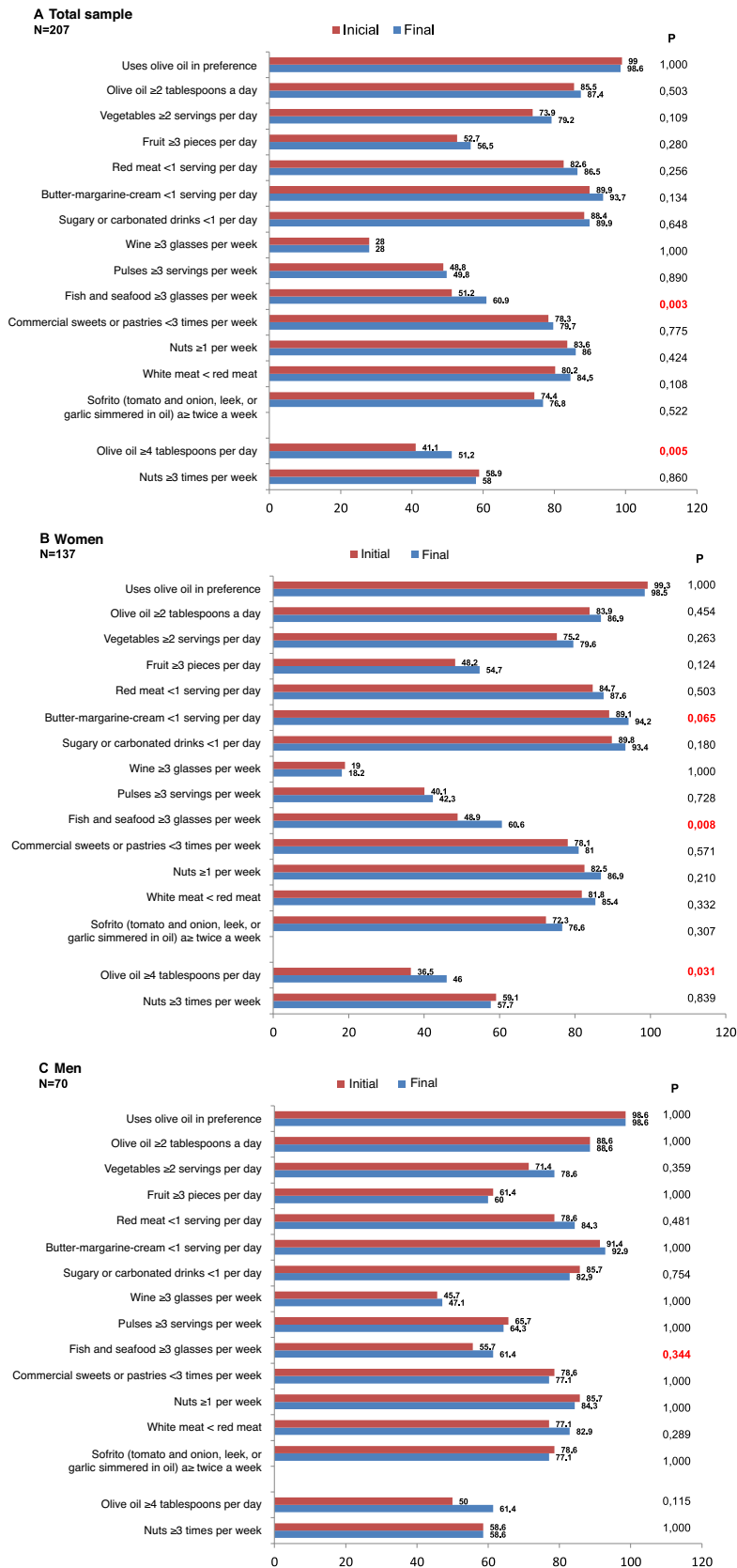
**Table 3** Questions and affirmative answers required to calculate adherence to the Mediterranean diet. Qualitative comparison of adherence between the men and the women.

	Total (n = 207)	Women (n = 137)	Men (n = 70)	p
<i>Mdiet adherence (assessed by MEDAS)</i>				
Do you use olive oil as the principal source of fat for cooking?	205 (99.0)	136 (99.3)	69 (98.6)	.627
Do you consume 2 or more tablespoons of olive oil a day?	177 (85.5)	115 (83.9)	62 (88.6)	.371
Do you consume 2 or more servings of vegetables a day?	153 (73.9)	103 (75.2)	50 (71.4)	.561
Do you consume 3 or more pieces of fruit a day?	109 (52.7)	66 (48.2)	43 (61.4)	.071
Less than one serving a day of red or processed meat?	171 (82.6)	116 (84.7)	55 (78.6)	.273
Less than one serving a day of butter, margarine, or cream?	186 (89.9)	122 (89.1)	64 (91.4)	.592
Less than one carbonated or sugary drink a day?	183 (88.4)	123 (89.8)	60 (85.7)	.387
Do you drink 3 or more glasses of wine a week?	58 (28.0)	26 (19.0)	32 (45.7)	< .001
Do you eat 3 or more servings of pulses a week?	101 (48.8)	55 (40.1)	46 (65.7)	< .001
Do you eat 3 or more servings of fish or seafood a week?	106 (51.2)	67 (48.9)	39 (55.7)	.354
Do you consume commercial sweets or pastries less than 3 times a week?	162 (78.3)	107 (78.1)	55 (78.6)	.938
Do you consume nuts once a week or more?	173 (83.6)	113 (82.5)	60 (85.7)	.553
Do you prefer to eat white meat rather than red?	166 (80.2)	112 (81.8)	54 (77.1)	.431
Do you eat <i>sofrito</i> twice a week or more?	154 (74.4)	99 (72.3)	55 (78.6)	.325
<i>Mdiet adherence (modified PREDIMED)</i>				
Do you consume 4 or more tablespoons of olive oil a day?	85 (41.1)	50 (36.5)	35 (50.0)	.062
Do you eat nuts 3 or more times a week?	122 (58.9)	81 (59.1)	41 (58.6)	.939
<i>Mdiet adherence (MEDAS)</i>				
Low-moderate	40 (19.3)	29 (21.2)	11 (12.9)	.347
High	167 (80.7)	108 (78.8)	59 (84.3)	
<i>Adherence to the Mediterranean diet (modified PREDIMED)</i>				
Low	65 (31.4)	48 (35.0)	17 (24.3)	
High	142 (68.6)	89 (65.0)	53 (75.7)	.115

The data are shown as exact number and (percentage). The  $\chi^2$  test was used to compare proportions between the women and the men. *Mdiet*: The Mediterranean diet; *MEDAS*: Mediterranean Diet Adherence Screener; n: number of participants; p: level of significance; *PREDIMED*: Prevention with the Mediterranean diet.

A p-value  $\leq .05$  was considered significant.





**Figure 2** Frequency of consumption of foods that formed part of the questions included in the assessment of adherence to the Mediterranean diet, before and after lockdown. The McNemar test was used to compare between proportions. (A) Total participants. (B) Women. (C) Men.

**Table 4** A. Relationship between adherence to the Mediterranean diet and weight distribution measured by BMI in the initial sample as a whole and differentiated by sex.

Total (n = 207)	Normal weight (n = 129)	Overweight (n = 59)	Obesity (n = 19)	p
MEDAS	10.13 (2.2)	10.37 (1.9)	9.74 (1.4)	.479
Modified PREDIMED	9.53 (2.2)	9.51 (2.1)	9.00 (1.5)	.593
Women (n = 137)	98	27	12	
MEDAS	9.98 (2.2)	10.07 (1.0)	9.17 (1.5)	.369
Modified PREDIMED	9.37 (2.2)	9.00 (1.4)	8.50 (1.6)	.318
Men (n = 70)	31	32	7	
MEDAS	10.61 (2.1)	10.63 (2.4)	10.71 (0.76)	.994
Modified PREDIMED	10.03 (2.1)	9.94 (2.5)	9.86 (1.1)	.975

B. Relationship between adherence to the Mediterranean diet and level of education in the initial sample as a whole and differentiated by sex

Total (n = 207)	Primary, secondary, or vocational training (n = 31)	Diploma or degree (n = 135)	Doctorate (n = 41)	p
MEDAS	9.65 (2.5)	10.02 (1.9)	11.02 (1.9)	.006 <sup>a</sup>
Modified PREDIMED	9.00 (2.4)	9.36 (2.0)	10.20 (2.1)	.034 <sup>b</sup>
Women (n = 137)	19	96	22	
MEDAS	9.79 (2.2)	9.78 (1.9)	10.68 (1.9)	.146
Modified PREDIMED	9.16 (2.2)	9.09 (2.0)	9.82 (2.2)	.325
Men (n = 70)	12	39	19	
MEDAS	9.42 (3.0)	10.62 (1.8)	11.42 (1.7)	.034 <sup>c</sup>
Modified PREDIMED	8.75 (2.7)	10.03 (2.0)	10.63 (2.0)	.060

The data are shown as means and standard deviation (SD). One-way analysis of variance was used to compare between means. MEDAS: Mediterranean Diet Adherence Screener; n: number of participants; p: level of significance; PREDIMED: Prevention with the Mediterranean diet.

A p-value ≤ .05 was considered significant.

<sup>a</sup> After applying an a posteriori Bonferroni test, significant differences were found between the means of participants educated to primary level and doctorate level, on the one hand (p = .013) and between those with a diploma and doctorate (p = .016) on the other.

<sup>b</sup> Significant differences were found between the participants educated to primary level and those with a doctorate (p = .05).

<sup>c</sup> Significant differences were found between the participants educated to primary level and those with a doctorate (p = .029).

**Table 5** Changes in adherence to the Mediterranean diet and in BMI at the end of lockdown.

	Total (n = 207)			Women (n = 137)			Men (n = 70)		
	Initial	Final	p	Initial	Final	p	Initial	Final	p
<i>MEDAS adherence</i>	10.16 (2.0)	10.57 (2.0)	.001	9.93 (2.0)	10.46 (1.7)	<.001	10.63 (2.1)	10.80 (2.4)	.472
<i>PREDIMED adherence</i>	9.47 (2.1)	9.93 (2.1)	<.001	9.22 (2.0)	9.76 (1.9)	<.001	9.97 (2.1)	10.27 (2.5)	.218
<i>BMI<sup>a</sup></i>	24.55 (3.7)	24.57 (3.7)	.752	23.94 (4.0)	24.06 (4.1)	.048	25.75 (2.9)	25.57 (2.7)	.093
<i>MEDAS<sup>b</sup></i>									
Low-moderate	40 (19.3)	25 (12.1)		29 (21.2)	14 (10.2)		11 (15.7)	11 (15.7)	
High	167 (80.7)	182 (87.9)	.021	108 (78.8)	123 (89.8)	.003	59 (84.3)	59 (84.3)	1.000
<i>PREDIMED<sup>b</sup></i>									
Low	65 (31.4)	50 (24.2)		48 (35.0)	37 (27.0)		17 (24.3)	13 (18.6)	
High	142 (68.6)	157 (75.8)	.037	89 (65.0)	100 (73.0)	.063	53 (75.7)	57 (81.4)	.454

BMI: body mass index; MEDAS: Mediterranean Diet Adherence Screener; n: number of participants; p: level of significance; PREDIMED (modified): Prevention with the Mediterranean diet.

A p-value ≤ .05 was considered significant.

<sup>a</sup> The data are shown as means and standard deviation. The Student's t-test for paired groups was used to compare between means.

<sup>b</sup> The data are shown as exact number and (percentage). The McNemar test was used to compare between proportions.

**Table 6** Evolution of the increase in the Mediterranean diet adherence score and its comparison between the women and the men at the end of lockdown.

Increase in adherence to the Mediterranean diet	Total (n = 207) Δ final-initial	Women (n = 137) Δ final-initial	Men (n = 70) Δ final-initial	p
MEDAS	.41 (1.8)	.53 (1.7)	.17 (2.0)	.169
Modified PREDIMED	.46 (1.8)	.54 (1.7)	.30 (2.0)	.369

The data are shown as means and (standard deviation). The Student's t-test for independent groups was used to compare means between the women and the men. Δ: increase.

MEDAS: Mediterranean Diet Adherence Screener.

n: number of participants.

p: level of significance.

PREDIMED: Prevention with the Mediterranean diet.

A p-value  $\leq .05$  was considered significant.

In terms of the components of the questions defining adherence to the Mdiet, the data that we obtained for the sample as a whole at the start of the study are higher than those found by Di Renzo et al.,<sup>20</sup> except that they report that their population consumes more than 4 tablespoons of olive oil (51.7%) and more pulses (51.7%) than ours (41.1% and 48.8%, respectively). In Spain, Sánchez-Sánchez et al.,<sup>21</sup> with a study design similar to ours, also scored higher on the following items: consumption of more than 4 tablespoons of olive oil (47.1%; ours 41.1%), consumption of less than one serving per day of red meat (87.1%; ours 82.6%), consumption of less than one serving per day of butter (96.5%; ours 89.9%) and consumption of more white meat than red meat (81.2%; ours 80.2%). When comparing the questions measuring Mdiet adherence before and after lockdown, we observed the changes shown in Figs. 1 and 2. These changes are favourable in almost all the questions, where the increase stands out significantly in those consuming more than 4 tablespoons of olive per day ( $p = .005$ ) and those consuming fish or seafood ( $p = .003$ ), especially the women ( $p = .031$  and  $p = .008$ , respectively). Our data agree in terms of evolution, not percentage, with those observed by Sánchez-Sánchez et al.<sup>21</sup>: in their study, consumption of more than 4 tablespoons of olive oil per day increased to 52.9% ( $p < .001$ ), very similar to us (51.2%;  $p = .005$ ). They also observed increases in fish consumption (from 23.9% to 28.4%;  $p < .001$ ), a lower percentage than we observed in both periods (from 51.2% to 60.9%;  $p = .003$ ). They observed significant changes in the rest of the questions, we did not.

Similarly, Pérez-Rodrigo et al.,<sup>22</sup> although they did not assess adherence to the Mdiet, reported a 20% increase in fish consumption. They also reported that women consumed more healthy foods than men, similar to our group's finding.

It is also worth mentioning that our study sample significantly increased their fish consumption, as the concept of the pescos-Mediterranean diet (which emphasises the consumption of fish and seafood as the main source of protein) has recently become established as the cardioprotective diet of choice.<sup>23</sup> In fact, ethyl eicosapentanoic acid, a highly purified and stable derivative of eicosapentaenoic acid, has been shown to reduce CVD, including cardiovascular

mortality.<sup>24</sup> The score we obtained both at the beginning and at the end of lockdown, starting from a high score, increased even further on average (Fig. 1). Rodríguez-Pérez et al.<sup>25</sup> found an increase in mean score of .8 points ( $6.5 \pm 2.0$  before and  $7.3 \pm 1.9$  after lockdown;  $p < .001$ ), higher than that obtained by us: .46 points ( $9.47 \pm 2.1$  initial and  $9.93 \pm 2.1$  final;  $p < .001$ ), although our mean values were higher. This increase in score is very similar to that observed by Medrano et al.<sup>26</sup> ( $.5 \pm 2.2$ ), but admittedly these figures cannot be compared, as they are from the paediatric population ( $12.1 \pm 2.9$  years) and use a different Mdiet adherence table (KIDMED). With this last mention, we wanted to show that the results found during lockdown tend to increase the mean Mdiet adherence score in different populations, except in pregnant women, where no changes were found.<sup>19</sup>

## Strengths and limitations

We believe that the main limitations of the study are its participant sampling type (convenience) and the questionnaire (completed at home), which could lead to errors in completing it as it may encourage bias towards socially accepted responses. On the positive side, however, privacy could increase the validity of responses. However, these limitations are difficult to resolve, as lockdown at home was limiting and therefore interviews were not possible, yet this, again in a positive sense, eliminates interviewer bias. These assumptions are like those of other authors who conducted studies during lockdown. Another limitation was not including physical activity during lockdown in the questionnaire, but we chose this because, on the one hand, our main objective was to assess adherence to the Mdiet and, on the other, we sought a tool that was simple and uncomplicated to complete, since the nature of the study was not cross-sectional but longitudinal and a long or complicated questionnaire could result in many losses. Another strength was how rapidly the design, method and online platform were completed in real time during the height of the pandemic and therefore of lockdown, which minimised any errors that could occur had it been a distant memory.

## Conclusions

We only observed changes in BMI in our study in the women. Adherence to the Mdiel increased in both the MEDAS and the modified PREDIMED questionnaire, as did fish consumption. The proportion classified as high adherence to the Mdiel also increased.

## Conflict of interests

The authors have no conflict of interests to declare.

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