Changes in Nutritional Behaviours During the COVID-19 Lockdown and the Impact on the Potential Inflammatory Effects of Diet.

María del Pilar Montero López (pilar.montero@uam.es)
Universidad Autonoma de Madrid - Campus de Cantoblanco: Universidad Autonoma de Madrid https://orcid.org/0000-0003-4033-2731
Ana Isabel Mora Urda
Universidad Autonoma de Madrid - Campus de Cantoblanco: Universidad Autonoma de Madrid
Francisco Javier Martin Almena
UCAVILA: Universidad Catolica de Avila
Oscar Geovanny Enríquez Martínez
Universidade Federal do Espirito Santo

Research

Keywords: COVID-19, nutritional behavior, lockdown, anti-inflammatory diet, gender.

Posted Date: January 18th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1244027/v1

Abstract

Background: This cross-sectional study compares eating behaviours before and during the COVID-19 lockdown that was decreed in Spain on March 14, 2020.

Methods: The sample was made up of 1,177 people aged 18 years or older who responded during the month of June to a questionnaire designed in Google Forms. Information was collected on the frequency of food consumption before and during lockdown. A dietary inflammatory index (DII) was created with positive or negative values depending on the inflammatory potential of different foods, vegetables, fruits, nuts, legumes, meat, fish, eggs, yogurt, milk, cheese, industrial pastries, salty snacks, fast food, soft drinks and alcoholic beverages. The scores from before and during confinement were compared.

Results: Most of the people in the sample maintained their eating pattern during lockdown. Among those who changed, the majority increased their consumption of healthy foods, which resulted in a decrease in the inflammatory potential of the diet; this was particularly the case in men.

Conclusions: The improvement in the quality of the diet contributed to a significant decrease in DII during confinement, especially in men.

Background

At the end of 2019, cases of pneumonia of unknown origin were detected in Wuhan, China and spread very quickly. After some research, certain similarities were found with previous epidemics, such as severe acute respiratory syndrome (SARS-CoV) in 2003 and Middle East Respiratory Syndrome (MERS) in 2012. The virus identified in 2019 was called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), and the disease was called coronavirus disease 2019 (COVID-19).

The World Health Organization (WHO) decreed COVID-19 as a pandemic on March 11, 2020 due to the rapid and progressive worldwide spread of the virus and asked political leaders of countries to adopt prevention measures. Since the declaration of a global health emergency by the WHO, each government has managed the situation using different strategies.The measures adopted included mandating total confinement, maintaining normality to obtain so-called “collective immunity”, going through selective quarantines for part of the population, and encouraging total confinement for vulnerable people (the elderly and/or people with underlying diseases).

In Spain, on March 13, 2020, the government declared a state of emergency, which was enforced on March 14th and led to home confinement in the entire country to stop the transmission of COVID-19. The Royal Decree limited the freedom of movement of people during the period of the state of emergency. Citizens could use public thoroughfare to purchase necessities, attend a health or service centre, work if essential activities that could not be carried out electronically, and return to their habitual residence [1]. These measures were maintained for the first wave of the pandemic from March 14th to June 21st, 2020.

The practices of total or partial confinement and physical social distancing have been and continue to be very important to prevent the collapse of the health system, but they undoubtedly affect many aspects of daily life, including the eating habits and lifestyles of individuals, families and populations. These changes in the habitual behaviour of the population, both in food consumption and in physical activity, can affect people's health.

In addition to the quantity, it is important to consider the quality of the food. In this sense, healthy eating patterns are associated with lower circulating concentrations of inflammatory markers [2].

A proinflammatory diet is one that favours increased levels of proinflammatory biomarkers, such as C-Reactive protein (CRP), interleukins 6 and 8 (IL-6 and IL-8, respectively) and tumour necrosis factor alpha (TNF-αa). CRP is a key inflammatory marker that is produced in the local epithelium and the liver in response to certain cytokines and induces inflammatory processes by recruiting monocytes, mediating the absorption of low-density lipoproteins by endothelial macrophages or increasing the concentration of molecules involved in cell adhesion [3]. A proinflammatory diet is characterized by high levels of saturated fatty acids and simple sugars, which are present in certain food groups, such as meats, processed foods and sugary drinks [4].

The opposite effect is produced by foods classified as "anti-inflammatory" such as fish, fruits, vegetables and legumes, which are rich in unsaturated fatty acids, fibre, vitamin C and micronutrients such as calcium, phosphorus and magnesium. An anti-inflammatory diet is associated with high levels of the anti-inflammatory markers interleukin 10 (IL-10) and tumour necrosis factor beta (TNF-β) [2], [5–7]. A dietary inflammatory index (DII) was developed by Cavicchia et al. (2011) [8] to quantify the proinflammatory or anti-inflammatory potential of the diet. High positive scores indicate a mostly proinflammatory diet, and negative scores indicate a mostly anti-inflammatory diet. A proinflammatory diet can have negative consequences on health, such as increasing the risk of obesity, hypertension, diabetes, and hypercholesterolemia [2, 5, 6].

This work will present some of the results obtained from the ALVIMED project regarding the impact of confinement on diet quality in men and women.

Our working hypothesis was that confinement would lead people to consume less healthy foods, thereby reducing the quality of their diet and increasing its inflammatory potential.

The objectives of this study were as follows:

To determine the impact of the COVID-19-related total and partial confinement between March and June 2020 on diet and lifestyle in a Spanish sample with a medium-high level of studies.

To describe the changes in eating behaviour during confinement.

To assess the effect of this change on the proinflammatory or anti-inflammatory properties of the diet.

All these objectives were intended to be achieved separately according to gender.

Methods

It is a cross-sectional study, developed from April 1 to June 30, 2020, time of social distancing and restrictions caused by the first wave of COVID-19. The participants were adults over 18 years, residents in Madrid-Spain. An online questionnaire with closed questions was created, evaluating sociodemographic variables, eating habits before and during confinement, habits and lifestyle, anthropometric indicators, COVID Health.

In June 2020, the questionnaire was sent by the members of the research team to students, faculty, and the administration and services staff of the University Autónoma de Madrid, who in turn distributed it to at least 10 people in their close social circle. All participants participated voluntarily; they agreed to participate before starting to complete the survey.

The protocol was approved by the Research Ethics Committee of the Autonomous University of Madrid (Ref: CEI-106-2082).

Sample

A non-probabilistic sampling was used in this study, the link to the questionnaire was released for personal and institutional e-mail. Those who agreed to participate in the study completed an online structured questionnaire using the Google Formsweb survey platform. A total of 1,177 people 18 years of age or older responded to the questionnaire: 854 women (72.56%), 320 men (27.19%) and 3 individuals who did not specify their gender (0.25%). People under 18 years old and without residence in Spain were excluded.

Variables

Information on the following variables was collected in the survey:

Sociodemographics: Sex, age, educational level (primary, secondary, middle and higher studies).

Eating habits before and during confinement: Number of daily meals before and during lockdown (breakfast, mid-morning, noon, snack, dinner) and frequency of daily or weekly consumption of vegetables, fruit, legumes, nuts, meat, fish, eggs, milk, yogurt,

cheese, industrial pastries, salty snacks, fast food, soft drinks, beer and distilled alcohol before and during confinement. The questionnaire was based on the validated FFQ in a sample with similar characteristics[9]

Frequency of food consumption:

• 0: Never
• 1: 1-2 times a week
• 2: 3-4 times a week

• 3: 5-6 times a week

• 4: Once a day

• 5: Two or more times a day

Dietary inflammatory index (DII)

A dietary inflammatory index was calculated following the indications of Cavicchia et al. (2009) [10] that determined the 'inflammatory potential' of different food and beverage components according to their predicted effects on C-reactive protein (CRP), a known biomarker of inflammation. Negative or positive values of 0, 1 or 2 were assigned to the consumption frequencies of each food. A negative sign indicates an anti-inflammatory effect, and a positive sign indicates a proinflammatory effect. To assign values to the different categories of food consumption, those proposed by Davis et al. 2019 [11] were used.

Anti-inflammatory foods

Vegetables, fruits, legumes, nuts, and fish. The values assigned to each frequency of consumption were as follows

0 = never or sporadically

-1 = 3 - 6 times/week

-2 = 7 or more times/week.

Proinflammatory foods

Eggs, dairy products, industrial pastries, salty snacks, fast food, soft drinks and alcohol. The values assigned to each frequency of consumption of these foods were as follows

0 = never or sporadically

+ 1 = 3 - 6 times/week

+ 2 = 7 or more times/week.

A total DII score was calculated by adding the values of the inflammatory potential of each food according to the frequency of consumption. A total DII score was calculated for consumption before lockdown and another score was calculated for consumption during lockdown. In this way, both results could be compared to determine if they exhibited any variation.

Habits and lifestyle: Engaging in physical activity at home or not.

Anthropometric measures: Self-reported weight (kg) and self-reported height (m), with which the body mass index was calculated (BMI = weight (kg) / height^2 (m)).

COVID Health: It was also asked whether or not the person had suffered from COVID-19 and, if so, whether or not she or he was hospitalized for it.

Statistical methods

With all these variables, a database was created that was statistically analysed with the IBM Statistical Package for the Social Sciences 26.0. Before describing the variables and applying the statistical tests, the normal distribution of the quantitative variables was verified with the Kolmogorov-Smirnoff test. The only variables that did not fit the normal distribution were the kilograms gained and lost during lockdown.

The association between qualitative variables was analysed with the chi-square test. The frequencies of consumption of the different types of food before and during lockdown were compared for women and men.

The concordance between frequencies of food consumption before and during lockdown (for the total sample and in women and men separately) was assessed using Cohen's kappa test. This statistical test measures the agreement between responses for qualitative variables with the same number of categories.

According to the value of k, different levels of agreement strength are distinguished: poor if k is less than 0.20; weak if k is between 0.21 and 0.40; moderate if k is between 0.41 and 0.60; good if k is between 0.61 and 0.80; and very good if k is greater than 0.81 [10]. For this test, the null hypothesis is that there is no agreement, so p values lower than 0.05 would indicate that there is agreement between the responses obtained.

The comparison of the DII between men and women was carried out with Student’s t-test for independent samples. Then, the comparison of the DII before and during lockdown was carried out using Student’s t-test for related samples in men and in women separately.

In all analyses, the level of statistical significance was $p < 0.05$.

Results

The characteristics of the sample are shown in Table 1.

Table 1
Sample description.

Variables	Women	Men	Total	
	Mean (std)	Mean (std)	Media (std)	Student's t-test
Age	39.1 (17.0)	40.27 (18.9)	40.24 (17.0)	p < 0.001
Height (m)	1.64 (0.06)	1.76 (0.07)	1.67 (0.08)	p < 0.001
Weight (kg) in June	62.90 (12.00)	79.1 (12.85)	67.4 (14.2)	p < 0.001
BMI (Weight/Height) in June	23.19 (4.98)	25.4 (4.25)	23.8 (4.9)	p < 0.001
Hours of physical activity during lockdown/ week	4.3 (2.07)	4.75 (2.00)	4.43 (2.05)	p = 0.007
	%	%	%	Chi-square
Physical activity during lockdown (%) Yes	69.8	69.6	69.8	p = 0.936
Not	30.2	30.4	30.2	
Educational level(%)				
High school or less	9.3	10.2	9.5	
College	21.8	25.4	22.8	p = 0.522
Graduate	68.9	64.4	67.7	
Affected by COVID 19	13.9	11.6	13.2	p = 0.317
Hospitalized for COVID 19	1.1	0.3	0.9	p = 0.218

The studied sample had a medium-high level of education. Most of the subjects in the sample had college or high school education. Almost 70% reported doing some type of physical activity at home. With regard to BMI, at the time they responded to the questionnaire, women had mean values corresponding to normal weight, and men had mean values situated in the lower limit of overweight.

The prevalence of those affected by COVID-19 was approximately 13%, but only approximately 1% had to be hospitalized.

Eating behaviour

Table 2 shows the results of the comparison of the frequency of consumption of vegetables, fruits, pulses and dry fruits between men and women before and during lockdown.

The most common frequency of vegetable consumption both before and during lockdown was between 1 and 2 times and 3 or 4 times a week. Statistically significant differences were observed between women and men in the consumption of vegetables. In the categories of higher consumption (5 to 6 times/week and 1 or more times a day), there were more women than men both before and during lockdown. However, as seen in the table, men increased the frequency of consumption of vegetables during lockdown.

With regard to fruit, before confinement, most of the people consumed fruit 1 or 2 times/day. During lockdown, the majority remained in this category, but the percentage of people who consumed fruit more than 2 times per day increased.

Similar results were obtained for legumes; most people consumed them 1 or 2 times/week. However, during lockdown, the percentage of people who consumed them 3-4 times/week increased.

Table 2
Frequency of consumption of vegetables. Fruits. Pulses and dry fruits before and during lockdown by gender.

BEFORE LOCKDOWN					DURING LOCKDOWN				BEFORE/DURING (Kappa Test)		
Vegetables	**Women N (%)**	**Men N (%)**	**Total N (%)**	**Chi-square**	**Women N (%)**	**Men N (%)**	**Total N (%)**	**Chi square**	**Women**	**Men**	**Total**
Never	9 (1.1)	7 (2.2)	16 (1.4)	χ^2 = 17.91	14 (1.6)	9 (2.7)	23 (1.9)	χ^2 = 13.266	K= 0.613	K= 0.578	K= 0.607
1-twice/week	387 (44.1)	161 (47.0)	548 (44.9)	**p=0.003**	356 (40.2)	150 (44.2)	506 (41.3)	**p= 0.021**	p < 0.001	p < 0.001	p < 0.001
3-4 times/week	193 (22.0)	99 (28.8)	292 (23.9)		201 (22.7)	92 (27.1)	293 (23.9)				
5-6 times/week	96 (11.0)	30 (8.8)	126 (10.4)		105 (11.9)	37 (10.9)	142 (11.6)				
Once/day	98 (10.8)	25 (7.5)	123 (9.9)		105 (11.9)	24 (7.1)	129 (10.5)				
Twice or more/day	94 (11.0)	18 (5.6)	112 (9.6)		104 (11.8)	27 (8.0)	131 (10.7)				
Fruits				χ^2 = 5.544				χ^2 = 2.108	K= 0.634	K= 0.631	K= 0.631
Never	34 (4.0)	11 (3.5)	45 (3.9)	p= 0.353	34 (3.9)	17 (5.0)	51 (4.2)	P= 0.834	p < 0.001	p < 0.001	p < 0.001
1-twice/week	325 (38.4)	106 (33.9)	431 (37.2)		308 (35.0)	121 (35.8)	429 (35.3)				
3-4 times/week	110 (13.0)	49 (15.7)	159 (13.7)		124 (14.1)	42 (12.4)	166 (13.6)				
5-6 times/week	62 (7.3)	33 (10.5)	95 (8.2)		78 (8.9)	30 (8.9)	108 (8.9)				
Once/day	131 (15.5)	48 (15.3)	179 (15.4)		130 (14.8)	44 (13.0)	174 (14.3)				
Twice or more/day	185 (21.8)	66 (21.1)	251 (21.6)		205 (23.3)	84 (24.9)	289 (23.7)				
Pulses				χ^2 = 6.735				χ^2 = 8.177	K= 0.490	K= 0.552	K= 0.509
Never	40 (4.6)	14 (4.2)	54 (4.5)	p= 0.241	42 (4.8)	19 (5.7)	61 (5.0)	p= 0.147	p < 0.001	p < 0.001	p < 0.001
1-twice/week	679 (77.3)	244 (72.8)	923 (76.1)		589 (66.9)	204 (61.1)	793 (65.3)				
3-4 times/week	126 (14.4)	62 (18.5)	188 (15.5)		196 (22.2)	96 (28.7)	292 (24.0)				
5-6 times/week	24 (2.7)	12 (3.6)	36 (3.0)		39 (4.4)	11 (3.3)	50 (4.1)				
Once/day	4 (0.5)	3 (0.9)	7 (0.6)		11 (1.2)	4 (1.2)	15 (1.2)				
Twice or more/day	5 (0.6)	0 (0.0)	5 (0.4)		4 (0.5)	0 (0.0)	4 (0.3)				
Nuts				χ^2 = 7.343				χ^2 = 3.307	K= 0.487	K= 0.530	K= 0.503
Never	231 (26.4)	64 (19.6)	295 (24.5)	p= 0.196	198 (22.7)	65 (19.5)	263 (21.8)	p= 0.653	p < 0.001	p < 0.001	p < 0.001

BEFORE LOCKDOWN				DURING LOCKDOWN			BEFORE/DURING (Kappa Test)
1-twice/week	423 (48.3)	174 (53.2)	597 (49.7)	405 (46.4)	162 (48.5)	567 (47.0)	
3-4 times/week	106 (12.1)	48 (14.7)	154 (12.8)	130 (14.9)	47 (14.1)	177 (14.7)	
5-6 times/week	34 (3.9)	13 (4.0)	47 (3.9)	48 (5.5)	25 (7.5)	73 (6.0)	
Once/day	65 (7.4)	21 (6.4)	86 (7.2)	77 (8.8)	28 (8.4)	105 (8.7)	
Twice or more/day	16 (1.8)	7 (2.1)	23 (1.9)	15 (1.7)	7 (2.1)	22 (1.8)	

Regarding the consumption of nuts, the highest percentage was found in the 1-2 times/week category, but during lockdown, the percentage of people who consumed nuts

3-4 times/week, 5-6 times/week and even 1 time per day increased.

For the consumption of fruits, legumes and nuts, no statistically significant differences were observed between men and women.

Regarding the concordance between the frequency of consumption before and during lockdown, the kappa coefficient values indicate moderate to good concordance; that is, the consumption pattern was largely maintained for all the foods listed in the table.

Table 3 shows the results of the frequency of consumption of foods of animal origin, the comparison between women and men and the comparison before and during confinement.

Most of the people ate meat between 1-2 times and 3-4 times/week. The frequencies before and during lockdown were similar.

The same was found for the consumption of fish, except that during confinement, the percentage of people who never consumed it increased and the percentage of people who consumed it 5-6 times/week increased as well.

During lockdown, the percentage of people who consumed eggs 5-6 times/week and once a day increased.

Statistically significant differences were observed between men and women only for the consumption of eggs. Before lockdown, there was a higher percentage of men than women who ate eggs once a day or more. For meat and fish, no statistically significant differences were observed between men and women.

Again, regarding the concordance between the frequency of consumption before and during lockdown, the Kappa coefficient showed moderate-to-good agreement, which indicates that the consumption pattern was maintained. This was found for all foods in the table.

Table 3
Frequency of consumption of foods of animal origin before and during lockdown by gender.

BEFORE LOCKDOWN					DURING LOCKDOWN				BEFORE/DURING (Kappa Test)		
Meat	**Women N (%)**	**Men N (%)**	**Total N (%)**	**Chi square**	**Women N (%)**	**Men N (%)**	**Total N (%)**	**Chi square**	**Women**	**Men**	**Total**
Never	47 (5.3)	12 (3.6)	59 (4.9)	χ^2 = 3.996	44 (5.0)	15 (4.5)	59 (4.9)	χ^2 = 5.946	K= 0.675	K= 0.718	K= 0.686
1-twice/week	355 (40.2)	134 (40.1)	489 (40.2)	p= 0.550	356 (40.6)	122 (36.2)	478 (39.4)	p= 0.312	p < 0.001	p < 0.001	p < 0.001
3-4 times/week	290 (32.9)	123 (36.8)	413 (34.0)		282 (32.2)	124 (36.8)	406 (33.4)				
5-6 times/week	125 (14.2)	39 (11.7)	164 (13.5)		127 (14.5)	41 (12.2)	168 (13.8)				
Once/day	55 (6.2)	21 (6.3)	76 (6.3)		56 (6.4)	28 (8.3)	84 (6.9)				
Twice or more/day	10 (1.1)	5 (1.5)	15 (1.2)		12 (1.4)	7 (2.1)	19 (1.6)				
Fish				χ^2 = 1.241				χ^2 = 5.237	K= 0.612	K= 0.602	K= 0.604
Never	67 (7.6)	25 (7.4)	92 (7.5)	p= 0.941	79 (9.0)	26 (7.7)	105 (8.6)	p= 0.388	p < 0.001	p < 0.001	p < 0.001
1-twice/week	558 (63.3)	214 (63.5)	772 (63.3)		513 (58.3)	203 (59.9)	716 (58.7)				
3-4 times/week	209 (23.7)	84 (24.9)	293 (24.0)		223 (25.3)	90 (26.5)	313 (25.7)				
5-6 times/week	36 (4.1)	11 (3.3)	47 (3.9)		52 (5.9)	17 (5.0)	69 (5.7)				
Once/day	11 (1.2)	3 (0.9)	14 (1.1)		13 (1.5)	2 (0.6)	15 (1.2)				
Twice or more/day	1 (0.1)	0 (0.0)	1 (0.1)		0 (0.0)	1 (0.3)	1 (0.1)				
Eggs				χ^2 = 11.634				χ^2 = 18.329	K= 0.671	K= 0.663	K= 0.664
Never	14 (1.6)	7 (2.1)	21 (1.7)	p= 0.040	18 (2.0)	8 (2.4)	26 (2.1)	p= 0.003	p < 0.001	p < 0.001	p < 0.001
1-twice/week	518 (59.2)	205 (61.6)	723 (59.9)		484 (54.9)	175 (51.6)	659 (54.0)				
3-4 times/week	269 (30.7)	84 (25.2)	353 (29.2)		256 (29.0)	121 (35.7)	377 (30.9)				
5-6 times/week	63 (7.2)	24 (7.2)	87 (7.2)		98 (11.1)	18 (5.3)	116 (9.5)				
Once/day	9 (1.0)	11 (3.3)	20 (1.7)		24 (2.7)	13 (3.8)	37 (3.0)				
Twice or more/day	2 (0.2)	2 (0.6)	4 (0.3)		2 (0.2)	4 (1.2)	6 (0.5)				

Table 4
Frequency of consumption of dairy products before and during confinement by gender.

BEFORE LOCKDOWN					DURING LOCKDOWN				BEFORE/DURING (Kappa Test)		
Milk	**Women N (%)**	**Men N (%)**	**Total N (%)**	**Chi-square**	**Women N (%)**	**Men N (%)**	**Total N (%)**	**Chi square**	**Women**	**Men**	**Total**
Never	90 (10.4)	38 (11.3)	128 (10.6)	χ^2 = 3.726	96 (11.0)	42 (12.4)	138 (11.4)	χ^2 = 2.252	K= 0.753	K= 0.780	K=0.759
1-twice/week	270 (31.1)	97 (29.0)	367 (30.5)	p= 0.590	264 (30.2)	93 (27.4)	357 (29.4)	p= 0.813	p < 0.001	p < 0.001	p < 0.001
3-4 times/week	57 (6.6)	24 (7.2)	81 (6.7)		60 (6.9)	25 (7.4)	85 (7.0)				
5-6 times/week	48 (5.5)	27 (8.1)	75 (6.2)		56 (6.4)	26 (7.7)	82 (6.8)				
Once/day	268 (30.9)	103 (30.7)	371 (30.8)		261 (29.8)	105 (31.0)	366 (30.1)				
Twice or more/day	135 (15.6)	46 (13.7)	181 (15.0)		138 (15.8)	48 (14.2)	186 (15.3)				
Yoghurt				χ^2 = 9.266				χ^2 = 7.166	K= 0.702	K= 0.650	K= 0.689
Never	151 (17.4)	51 (15.7)	202 (17.0)	p= 0.099	154(17.8)	56 (16.9)	210 (17.6)	p= 0.209	p < 0.001	p < 0.001	p < 0.001
1-twice/week	356 (41.1)	124 (38.2)	480 (40.3)		323(37.4)	120 (36.3)	443 (37.1)				
3-4 times/week	88 (10.2)	49 (15.1)	137 (11.5)		104(12.1)	47 (14.2)	151 (12.6)				
5-6 times/week	58 (6.7)	29 (8.9)	87 (7.3)		63 (7.3)	29 (8.8)	92 (7.7)				
Once/day	161 (18.6)	59 (18.2)	220 (18.5)		157(18.2)	67 (20.2)	224 (18.8)				
Twice or more/day	52 (6.0)	13 (4.0)	65 (5.5)		62 (7.2)	12 (3.6)	74 (6.2)				
Cheese				χ^2 = 13.397				χ^2 = 10.205	K= 0.615	K= 0.683	K= 0.636
Never	98 (11.3)	25 (7.6)	123 (10.3)	p= 0.020	101(11.7)	37 (11.1)	138 (11.5)	p= 0.070	p < 0.001	p < 0.001	p < 0.001
1-twice/week	402 (46.3)	149 (45.6)	551 (46.1)		376(43.6)	139 (41.7)	515 (43.1)				
3-4 times/week	168 (19.3)	75 (22.9)	243 (20.3)		159(18.4)	72 (21.6)	231 (19.3)				
5-6 times/week	84 (9.7)	46 (14.1)	130 (10.9)		91 (10.6)	46 (13.8)	137 (11.5)				
Once/day	97 (11.2)	30 (9.2)	127 (10.6)		104(12.1)	36 (10.8)	140 (11.7)				
Twice or more/day	20 (2.3)	2 (0.6)	22 (1.8)		31 (3.6)	3 (0.9)	34 (2.8)				

Table 4 shows the results of the frequency of consumption of dairy products and the comparison between women and men before and during lockdown.

Regarding milk, the highest percentages of consumption were found for the 1-2 times/week and once a day categories, remaining similar before and during lockdown.

Most people consumed yogurt 1-2 times/week. During lockdown, the percentage of people who consumed it 3-4 times/week increased. The percentage of people who consumed it more than 2 times a day and who never consumed it also increased slightly.

Almost half of the people in the sample consumed cheese 1-2 times/week prior to the lockdown, but during lockdown, this percentage decreased somewhat. In addition, the percentage of people who never consumed cheese and of those who consumed it more than 5-6 times/week increased. The percentage of people who consumed cheese 3-4 times/week decreased.

Between women and men, there were significant differences in the consumption of cheese, with a higher frequency of women who consumed cheese once a day or more, both before and during lockdown. During lockdown, the percentage of people who consumed it at this frequency increased for both genders, but women continued to consume more. For the consumption of milk and yogurt, no statistically significant differences were observed between men and women.

Regarding the concordance between the frequency of consumption before and during lockdown, the concordance was good, which indicates that the consumption pattern was maintained for all the foods in the table. The frequencies of consumption of processed and industrial foods are shown in Table 5. More than 55% of the sample consumed fast food before lockdown, while during lockdown, the percentage of people who never consumed it increased. The same finding was obtained for industrial pastries. No statistically significant differences were observed between men and women for any of the foods included in this table, neither before nor during lockdown.

Table 5
Frequency of consumption of processed and industrial foods before and during lockdown by gender.

BEFORE LOCKDOWN					DURING LOCKDOWN				BEFORE/DURING (Kappa Test)		
Industrial pastries	**Women N (%)**	**Men N (%)**	**Total N(%)**	**Chi square**	**Women N (%)**	**Men N (%)**	**Total N (%)**	**Chi square**	**Women**	**Men**	**Total**
Never	433(51.5)	153 (47.5)	586 (50.4)	χ^2 = 9.391	455 (54.1)	174 (53.9)	629 (54.0)	χ^2 = 2.360	K= 0.459	K= 0.487	K= 0.476
1-twice/week	311(37.0)	115 (35.7)	426 (36.7)	p= 0.094	265 (31.5)	97 (30.0)	362 (31.1)	p= 0.797	p < 0.001	p < 0.001	p < 0.001
3-4 times/week	57 (6.8)	33 (10.2)	90 (7.7)		67 (8.0)	34 (10.5)	101 (8.7)				
5-6 times/week	15 (1.8)	12 (3.7)	27 (2.3)		24 (2.9)	7 (2.2)	31 (2.7)				
Once/day	17 (2.0)	8 (2.5)	25 (2.2)		22 (2.6)	8 (2.5)	30 (2.6)				
Twice or more/day	7 (0.8)	1 (0.3)	8 (0.7)		8 (1.0)	3 (0.9)	11 (0.9)				
Salty snacks				χ^2 = 1.458				χ^2 = 8.665	K= 0.389	K= 0.477	K= 0.415
Never	275(32.2)	110 (34.3)	385 (32.8)	p= 0.918	256 (29.9)	125 (38.3)	381 (32.2)	p= 0.123	p < 0.001	p < 0.001	p < 0.001
1-twice/week	450(52.7)	161 (50.2)	611 (52.0)		398 (46.5)	131 (40.2)	529 (44.8)				
3-4 times/week	90 (10.5)	33 (10.3)	123 (10.5)		131 (15.3)	43 (13.2)	174 (14.7)				
5-6 times/week	26 (3.0)	10 (3.1)	36 (3.1)		40 (4.7)	17 (5.2)	57 (4.8)				
Once/day	12 (1.4)	6 (1.9)	18 (1.5)		27 (3.2)	8 (2.5)	35 (3.0)				
Twice or more/day	1 (0.1)	1 (0.3)	2 (0.2)		4 (0.5)	2 (0.6)	6 (0.5)				
Fast-food				χ^2 = 2.298				χ^2 = 1.100	K= 0.387	K= 0.464	K= 0.408
Never	305 (36.4)	105 (32.9)	410 (35.4)	p= 0.807	436 (51.7)	164 (51.1)	600 (51.5)	p= 0.954	p < 0.001	p < 0.001	p < 0.001
1-twice/week	471 (56.2)	187 (58.6)	658 (56.9)		339 (40.2)	129 (40.2)	468 (40.2)				
3-4 times/week	50 (6.0)	22 (6.9)	72 (6.2)		49 (5.8)	21 (6.5)	70 (6.0)				
5-6 times/week	7 (0.8)	4 (1.3)	11 (1.0)		14 (1.7)	5 (1.6)	19 (1.6)				
Once/day	4 (0.5)	1 (0.3)	5 (0.4)		4 (0.5)	2 (0.6)	6 (0.5)				
Twice or more/day	1 (0.1)	0 (0.0)	1 (0.1)		2 (0.2)	0 (0.0)	2 (0.2)				

Regarding the agreement between the frequency of consumption before and during lockdown, the Kappa coefficient was rather low, which indicates that the consumption pattern was not maintained, especially for salty snacks, the consumption of which increased significantly, especially in women.

Table 6 shows the results of the consumption of soft drinks and alcohol. The most frequent consumption category for both fermented and distilled alcohol was once or twice a week before lockdown and never during lockdown. There were significant differences between men and women in the consumption of beer/wine and distilled alcohol. Before lockdown, men consumed both types of alcohol more frequently than women, and this pattern was maintained during lockdown. For soft drinks, a decrease was also seen, increasing the number of people who never drank them during confinement. No statistically significant differences were observed between men and women either before or during lockdown.

Table 6
Frequency of consumption of soft drinks and alcohol before and during lockdown by gender.

BEFORE LOCKDOWN					DURING LOCKDOWN				BEFORE/DURING (Kappa Test)		
Soft drinks	**Women N (%)**	**Men N (%)**	**Total N (%)**	**Chi square**	**Women N (%)**	**Men N (%)**	**Total N (%)**	**Chi square**	**Women**	**Men**	**Total**
Never	396(46.9)	134 (42.0)	530 (45.6)	χ^2 = 6.497	440 (51.6)	150 (46.4)	590 (50.2)	χ^2 = 4.942	K= 0.512	K= 0.589	K= 0.534
1-twice/week	335(39.7)	126 (39.5)	461 (39.6)	p= 0.261	265 (31.1)	105 (32.5)	370 (31.5)	p= 0.423	p < 0.001	p < 0.001	p < 0.001
3-4 times/week	63 (7.5)	31 (9.7)	94 (8.1)		81 (9.5)	39 (12.1)	120 (10.2)				
5-6 times/week	20 (2.4)	11 (3.4)	31 (2.7)		32 (3.8)	12 (3.7)	44 (3.7)				
Once/day	19 (2.3)	13 (4.1)	32 (2.8)		19 (2.2)	12 (3.7)	31 (2.6)				
Twice or more/day	11 (1.3)	4 (1.3)	15 (1.3)		15 (1.8)	5 (1.5)	20 (1.7)				
Beer/wine				χ^2 = 25.743				χ^2 = 15.023	K= 0.478	K= 0.517	K= 0.501
Never	317(37.6)	88 (27.6)	405 (34.9)	p= 0.000	400 (46.7)	125 (38.5)	525 (44.4)	p= 0.010	p < 0.001	p < 0.001	p < 0.001
1-twice/week	376(44.6)	138 (43.3)	514 (44.2)		295 (34.4)	108 (33.2)	403 (34.1)				
3-4 times/week	82 (9.7)	44 (13.8)	126 (10.8)		67 (7.8)	40 (12.3)	107 (9.1)				
5-6 times/week	30 (3.6)	17 (5.3)	47 (4.0)		28 (3.3)	16 (4.9)	44 (3.7)				
Once/day	30 (3.6)	21 (6.6)	51 (4.4)		50 (5.8)	23 (7.1)	73 (6.2)				
Twice or more/day	8 (0.9)	11 (3.4)	19 (1.6)		17 (2.0)	13 (4.0)	30 (2.5)				
Distilled alcohol				χ^2 = 32.248				χ^2 = 19.599	K= 0.354	K= 0.462	K= 0.404
Never	644(78.2)	193 (62.9)	837 (74.0)	p= 0.000	713 (86.0)	236 (75.2)	949 (83.0)	p= 0.001	p < 0.001	p < 0.001	p < 0.001
1-twice/week	165 (20.0)	101 (32.9)	266 (23.5)		97 (11.7)	63 (20.1)	160 (14.0)				
3-4 times/week	12 (1.5)	9 (2.9)	21 (1.9)		12 (1.4)	10 (3.2)	22 (1.9)				
5-6 times/week	2 (0.2)	2 (0.7)	4 (0.4)		5 (0.6)	3 (1.0)	8 (0.7)				
Once/day	0 (0.0)	2 (0.7)	2 (0.2)		2 (0.2)	2 (0.6)	4 (0.3)				
Twice or more/day	1 (0.1)	0 (0.0)	1 (0.1)		0 (0.0)	0 (0.0)	0 (0.0)				

A moderate concordance was observed in general between consumption before and during lockdown, which indicates that the pattern was maintained. This concordance was found for both soft drinks and alcohol. Only in the case of distilled alcohol in women was the concordance rather low, which indicates that the consumption of distilled alcohol in women changed, and the

percentage of women who never consumed distilled alcohol increased. The percentage of those who consumed it 5-6 times a week and once a day also increased very slightly.

Dietary Inflammatory Index (DII)

Table 7 shows the results of the DII values before and during lockdown. On the one hand, there were differences between women and men, and on the other hand, there were differences between the values before and during confinement.

The mean value of the DII both before and during lockdown in both sexes presented a negative value, which indicates an anti-inflammatory characteristic of the diet.

Before lockdown, the DII was considerably more negative among women than among men; that is, in general, women followed a more anti-inflammatory diet than men. During lockdown, the DII became more negative for both genders, which reflects that the consumption of foods with anti-inflammatory potential increased, and the difference between the genders decreased.

Comparison of the total mean value of DII before and during confinement shows that it decreased during lockdown, especially in men.

In women, no significant differences were observed for the total score between the two periods, but differences were observed for the values of some foods. During lockdown, the consumption of fruit, nuts, eggs, cheese and salty snacks increased; however, that of soft drinks and fast food decreased.

Table 7
Inflammatory index of the diet before and during lockdown by gender.

BEFORE LOCKDOWN				DURING LOCKDOWN			BEFORE/DURING		
	Women	Men	T-student	Women	Men	T-student	T-student for related samples		
	Mean (std)	Mean (std)		Mean (std)	Mean (std)		Women	Men	Total
Legumes	-1.33 (0.49)	-1.20 (0.45)	T=-4.421 p < 0.001	-1.34 (0.51)	-1.24 (0.48)	T= -3.229 p= 0.001	T= 1.145 p= 0.253	T= 2.074 p= 0.039	T= 2.044 p= 0.041
Fruits	-0.67 (0.82)	-0.69 (0.81)	T= 0.345 p= 0.730	-0.71 (0.83)	-0.73 (0.84)	T= 0.236 p= 0.814	T= 2.445 p= 0.015	T= 1.177 p= 0.240	T= 2.682 p= 0.007
Pulses	-1.00 (0.30)	-1.02 (0.32)	T= 0.929 p= 0.353	-1.02 (0.34)	-1.01 (0.35)	T= -0.529 p= 0.597	T= 1.670 p= 0.095	T= -0.648 p= 0.517	T= 1.053 p= 0.293
Nuts	-0.37 (0.67)	-0.43 (0.70)	T= 1.309 p= 0.191	-0.44 (0.70)	-0.46 (0.70)	T= 0.399 p= 0.690	T= 4.067 p< 0.001	T= 1.074 p= 0.284	T= 3.993 p< 0.001
Meat	0.63 (0.63)	0.67 (0.65)	T= -1.066 p= 0.287	0.64 (0.64)	0.71 (0.66)	T= -1.842 p= 0.066	T= -0.845 p= 0.398	T= -1.961 p= 0.051	T= -1.774 p= 0.076
Fish	-0.98 (0.37)	-0.98 (0.36)	T= -0.204 p= 0.838	-0.99 (0.41)	-0.99 (0.38)	T= -0.150 p= 0.881	T= 0.703 p= 0.482	T= 0.522 p= 0.602	T= 0.870 p= 0.384
Eggs	0.11 (0.36)	0.16 (0.44)	T= -1.811 p= 0.071	0.15 (0.38)	0.13 (0.38)	T= 1.119 p= 0.264	T= -3.250 p= 0.001	T= 1.607 p= 0.109	T= -1.790 p= 0.074
Milk	0.65 (0.76)	0.61 (0.74)	T= 0.882 p= 0.378	0.63 (0.76)	0.60 (0.73)	T= 0.656 p= 0.512	T= 1.182 p= 0.237	T= 0.239 p= 0.811	T= 1.119 p= 0.264
Yoghurt	0.35 (0.63)	0.34 (0.63)	T= 0.075 p= 0.940	0.37 (0.65)	0.33 (0.59)	T= 1.169 p= 0.243	T= -1.709 p= 0.088	T= 0.750 p= 0.454	T= -1.055 p= 0.292
Cheese	0.20 (0.49)	0.18 (0.49)	T= 0.421 p= 0.674	0.24 (0.56)	0.17 (0.45)	T= 2.376 p= 0.018	T= -2.945 p= 0.003	T= 0.478 p= 0.633	T= -2.314 p= 0.021

BEFORE LOCKDOWN				DURING LOCKDOWN			BEFORE/DURING		
Industrial pastries	0.18 (0.55)	0.20 (0.57)	T= -0.630 p= 0.529	0.20 (0.58)	0.19 (0.58)	T= 0.213 p= 0.831	T= -1.290 p= 0.197	T= 0.341 p= 0.733	T= -0.933 p= 0.351
Salty snacks	0.26 (0.60)	0.31 (0.66)	T= -1.221 p= 0.222	0.38 (0.68)	0.37 (0.69)	T= 0.120 p= 0.904	T= -5.495 p< 0.001	T= -1.707 p= 0.089	T= -5.549 p< 0.001
Soft drinks	0.64 (0.63)	0.72 (0.66)	T= -2.107 p= 0.035	0.58 (0.63)	0.66 (0.66)	T= -1.991 p= 0.047	T= 3.140 p= 0.002	T= 2.030 p= 0.043	T= 3.729 p< 0.001
Fast food	0.78 (0.65)	0.84 (0.65)	T= -1.315 p= 0.189	0.63 (0.70)	0.66 (0.71)	T= -0.562 p= 0.574	T= 6.674 p< 0.001	T= 5.437 p< 0.001	T= 8.488 p< 0.001
Total score	-0.57 (2.85)	-0.28 (2.73)	T= -1.590 p= 0.112	-0.68 (3.02)	-0.60 (2.89)	T= -0.417 p= 0.677	T= 1.499 p= 0.134	T= 2.548 p= 0.011	T= 2.642 p= 0.008

During confinement, men increased their consumption of vegetables and decreased their consumption of soft drinks and fast food, which made the inflammatory potential of their diet decrease, and the mean score was lower, indicating that their diet changed to a more anti-inflammatory and healthy diet.

Overall, significant changes were observed in the consumption of vegetables, fruit, nuts, cheese, salty snacks, soft drinks and fast food, with increases in the consumption of vegetables, fruit, nuts and cheese during lockdown. The consumption of soft drinks and fast food decreased.

Discussion

There has been a great deal of interest in the effects that restricted mobility may have on the eating behaviour and lifestyle of the population worldwide. For this reason, in the last year, numerous investigations have been carried out on this subject in different countries and population groups.

In this sample, made up of people with a medium-high educational level, the results regarding changes in eating behaviour were similar to those found in other other works conducted with samples similar to the one studied [10–15].

In general, most people did not change their eating behaviour, but a large part of those who did improved their diet, with an increase in the consumption of healthier foods such as vegetables and fruits, along with a decrease in the consumption of less-healthy foods such as industrial pastries and alcoholic beverages. In other words, during lockdown, the quality of the diet increased. These results coincide with those of studies carried out with samples of medium-high education level, both in Europe and in other Latin American countries [16–18].

Therefore, our initial hypothesis is not fulfilled.

There are many possible reasons for this improvement; on the one hand, during confinement, families spent more time cooking, and as a consequence, there was a decrease in the consumption of processed foods. On the other hand, not being able to leave home could contribute to a decrease in consumption of fast food and alcohol, as was also observed in the results of other similar investigations [2, 17–19].

The decrease in DII during confinement is related to the lower consumption of foods with proinflammatory potential, such as industrial and processed foods and alcohol. The DII decreased significantly, especially in men. Before confinement, the diet of men was of poorer quality than that of women, so the change was more evident, thus resulting in gender differences.

Women consumed more vegetables than men, which is in agreement with the results of Ruiz-Roso et al. (2020) [21]. However, no significant gender differences were observed for fruit consumption, while in the study by Ruíz-Roso et al. (2020) [21], gender differences were observed, with women consuming significantly more fruit during confinement. Another difference was found in higher soda consumption in men.

That is, gender differences were observed in the pattern of consumption of food and beverages; in general, women had healthier eating patterns, both before and during confinement.

The main limitation of our study is the lack of representativeness of the population sample. Moreover, all data collected are self-reported and this could make them not completely reliable. However, the special conditions in which the work was carried out must be considered, in Spain there was a total lockdown for 4 months between March and June 2020.

The results of our study support the idea, expressed by other authors, that this period of confinement could have been an opportunity to clearly show that it is possible to change eating habits and that it had a beneficial impact on health in general and on immunity. However, we must not forget disadvantaged population groups for whom the pandemic resulted in a loss or reduction in work activity. In a short time, COVID-19 has magnified already existing disparities in access to food in general and to healthy food in particular in low-income individuals and households [22].

Conclusions

No great change in eating behaviour was observed, and most of the people in the sample maintained their eating pattern during lockdown.

In the people whose diets changed, the shift was mostly towards a healthier eating pattern, with a decrease in the consumption of fast food, soft drinks and alcoholic beverages and an increase in the consumption of vegetables and fruits.

The decrease in the consumption of fast food, soft drinks and alcoholic beverages may be related to a “social consumption” of these foods and beverages that was reduced by mobility restrictions and social gatherings.

The improvement in the quality of the diet contributed to a significant decrease in DII during confinement, especially in men.

Men had a more anti-inflammatory diet during confinement compared to pre-confinement.

Declarations

Ethics approval and consent to participate:

The study was approved by the Ethics Committee for Research of UAM (CEI 106- 2082; 06.15.20) and conducted according to the guidelines of the Declaration of Helsinki, and

Informed consent was obtained from all subjects involved in the study.

Consent for publication: Not applicable

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interest.

Funding:

Agence Universitaire de la Francophonie. ALVIMED project (Analysis of the food consumption of families due to confinement following the COVID 19 pandemic in the countries of the North and South of the Mediterranean basin and its impact on nutritional status). Ref: DREO-AAP-COVID- n°2310-524968 -Convention-A2-Madrid-721.

Comunidad de Madrid/Unión Europea (FEDER). Project 'Population, family and migration in contemporary societies' (Ref: H2019/HUM-5802).

Author Contributions:

Conceptualization, Montero López MP.

Methodology, Montero López MP and Mora Urda AI.

Statistical analysis, Montero López MP and Mora Urda AI.

Data curation, Mora Urda AI and Martín Almena FJ.

Writing-original draft preparation, Montero López MP.

Writing-review and editing, Montero López MP, Mora Urda AI, Martin Almena FJ, Enríquez-Martínez O.

Visualization, Montero López MP; Mora Urda AI and Martín Almena FJ, Enríquez-Martínez O.

Supervision, Montero López MP and Enríquez-Martínez O.

Funding acquisition and project administration, Montero López M.

All authors have read and agreed to the published version of the manuscript.

Acknowledgements:

To l'Agence Universitaire de la Francophonie for funding the ALVIMED project (Analysis of the food consumption of families due to confinement following the COVID 19 pandemic in the countries of the North and South of the Mediterranean basin and its impact on nutritional status). Ref: DREO-AAP-COVID- n°2310-524968 -Convention-A2-Madrid-721.

To Comunidad de Madrid/Unión Europea (FEDER) for funding the project 'Population, family and migration in contemporary societies' (Ref: H2019/HUM-5802).

References

1. España. Real Decreto 463/2020, de 14 de marzo, por el que se declara el estado de alarma para la gestión de la situación de crisis sanitaria ocasionada por el COVID-19. Boletín Of. del Estado 2020, 67, 25390–25400. 2020;2507:1–9.
2. Calder PC, Ahluwalia N, Brouns F, Buetler T, Clement K, Cunningham K, et al. Dietary factors and low-grade inflammation in relation to overweight and obesity. Br J Nutr England. 2011;106(Suppl):5–78.
3. King DE. Dietary fiber, inflammation, and cardiovascular disease. Mol Nutr Food Res Germany. 2005;49:594–600.
4. Da Silva MS, Rudkowska I. Dairy nutrients and their effect on inflammatory profile in molecular studies. Mol Nutr Food Res Germany. 2015;59:1249–63.
5. Davis A, Liu R, Kerr JA, Wake M, Grobler A, Juonala M, et al. Inflammatory diet and preclinical cardiovascular phenotypes in 11-12 year-olds and mid-life adults: A cross-sectional population-based study. Atherosclerosis Ireland. 2019;285:93–101.
6. Antunes R, Frontini R, Amaro N, Salvador R, Matos R, Morouço P, et al. Exploring Lifestyle Habits, Physical Activity, Anxiety and Basic Psychological Needs in a Sample of Portuguese Adults during COVID-19. Int J Environ Res Public Health [Internet]. MDPI AG; 2020;17:4360. Available from: http://10.0.13.62/ijerph17124360.

7. Barbaresko J, Koch M, Schulze MB, Nöthlings U. Dietary pattern analysis and biomarkers of low-grade inflammation: a systematic literature review. Nutr Rev United States. 2013;71:511–27.
8. Cavicchia PP, Steck SE, Hurley TG, Hussey JR, Ma Y, Ockene IS, et al. A new dietary inflammatory index predicts interval changes in serum high-sensitivity C-reactive protein. J Nutr. 2009;139:2365–72.
9. González Carrascosa R, Bayo Montó JL, Meneu Barreira T, García Segovia P, Martínez-Monzó J. Design of a self-administered online food frequency questionnaire (FFQ) to assess dietary intake among university population. Nutr Hosp [Internet]. 2011;26:1440–6. Available from: https://www.redalyc.org/articulo.oa?id=309226774035.
10. Martinez-Ferran M, de la Guía-Galipienso F, Sanchis-Gomar F, Pareja-Galeano H. Metabolic Impacts of Confinement during the COVID-19 Pandemic Due to Modified Diet and Physical Activity Habits. Nutrients. 2020;12.
11. Davis A, Liu R, Kerr JA, Wake M, Grobler A, Juonala M, Liu M, Baur L, Burgner D, Lycett K. Inflammatory diet and preclinical cardiovascular phenotypes in 11–12-year-old and mid-life adults: A cross-sectional population-based study. Atherosclerosis. 2019;285:93–101.
12. Hamer M, Kivimäki M, Gale CR, Batty GD. Lifestyle risk factors, inflammatory mechanisms, and COVID-19 hospitalization: A community-based cohort study of 387,109 adults in UK. Brain Behav Immun. 2020;87:184–7.
13. Górnicka M, Drywień ME, Zielinska MA, Hamułka J. Dietary and Lifestyle Changes During COVID-19 and the Subsequent Lockdowns among Polish Adults: A Cross-Sectional Online Survey PLifeCOVID-19 Study. Nutrients. 2020;12.
14. Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, et al. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. J Transl Med. 2020;18:229.
15. López deU, Galparsoro I, Pita Fernández S. Medidas de concordancia: el índice de Kappa. Available online: https://fisterra.com/mbe/investiga/kappa/kappa2.pdf (accessed on 5th May 2021). 2021;2021.
16. Enriquez-Martinez OG, Martins MCT, Pereira TSS, Pacheco SOS, Pacheco FJ, Lopez KV, et al. Diet and Lifestyle Changes During the COVID-19 Pandemic in Ibero-American Countries: Argentina, Brazil, Mexico, Peru, and Spain. Front Nutr [Internet]. Frontiers Media SA; 2021;8. Available from: http://10.0.13.61/fnut.2021.671004.
17. Ruiz-Roso MB, de Carvalho Padilha P, Mantilla-Escalante DC, Ulloa N, Brun P, Acevedo-Correa D, et al. Covid-19 Confinement and Changes of Adolescent's Dietary Trends in Italy, Spain, Chile, Colombia and Brazil. Nutrients [Internet]. 2020;12. Available from: https://europepmc.org/articles/PMC7353171.
18. Zupo R, Castellana F, Sardone R, Sila A, Giagulli VA, Triggiani V, et al. Preliminary Trajectories in Dietary Behaviors during the COVID-19 Pandemic: A Public Health Call to Action to Face Obesity. Int J Environ Res Public Health. 2020;17.
19. Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, et al. Eating habits and lifestyle changes during COVID-19 lockdown: An Italian survey. J Transl Med [Internet]. BioMed Central; 2020;18:1–15. Available from: https://doi.org/10.1186/s12967-020-02399-5.
20. Górnicka M, Drywień ME, Zielinska MA, Hamułka J. Dietary and Lifestyle Changes During COVID-19 and the Subsequent Lockdowns among Polish Adults: A Cross-Sectional Online Survey PLifeCOVID-19 Study. Nutrients [Internet]. MDPI AG; 2020;12:2324. Available from: http://10.0.13.62/nu12082324.
21. Ruiz-Roso MB, De Carvalho Padilha P, Mantilla-Escalante DC, Ulloa N, Brun P, Acevedo-Correa D, et al. Covid-19 Confinement and Changes of Adolescent's Dietary Trends in Italy, Spain, Chile, Colombia and Brazil. Nutrients [Internet]. MDPI AG; 2020;12:1807. Available from: http://10.0.13.62/nu12061807.
22. Wolfson JA, Leung CW. Food Insecurity and COVID-19: Disparities in Early Effects for US Adults. Nutrients [Internet]. MDPI AG; 2020;12:1648. Available from: http://10.0.13.62/nu12061648.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- STROBEchecklistv4combined.pdf