

# Perceived diet and lifestyle changes during confinement for Covid-19 pandemic in Mexico: ESCAN-COVID19Mx Survey

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# Abstract

**Background:** Confinement measures that were put in place in Mexico to reduce the transmission of the SARS-CoV-2 virus can affect individual's lifestyle and well-being; Therefore, the aim of the study was to assess perceived changes in diet quality, emotional eating, physical activity and lifestyle, in a group of Mexican adults before and during the COVID-19 confinement.

**Methods:** 8289 adults answered an online questionnaire between April and May 2020. Data about diet quality, emotional eating, physical activity and sociodemographic characteristics, weight and height were collected. Before and after confinement differences by sociodemographic characteristics were assessed with Wilcoxon, Anova and linear regression analyses.

**Results:** Most participants were women (80%) between 18 and 38 years old (70%), with a low degree of marginalization (82.8%) and a high educational level (84.2%); 53.1% had a normal weight and 31.4% were overweight. Half (46.8%) of the participants perceived a change in the quality of their diet. Lifestyle changes were present among some of the participants, 6.1% stopped smoking, 12.1% stopped consuming alcohol, 53.3% sleep later, 9% became more sedentary, and increased their screen (43%), sitting and lying down time (81.6%).

**Conclusion:** Mexicans staying at home during the COVID-19 confinement, that completed the ESCAN-COVID19Mx Survey, perceived positive changes in the quality of their diet, and smoking and alcohol consumption, but negative changes in the level of physical activity and quality of sleep.

## Background

Around the world, strict confinement measures were put in place to reduce the transmission of the SARS-CoV-2 virus (Ebrahim et al., 2020). In Mexico, confinement measures included: social distancing, social isolation mainly for the vulnerable population, cancellation of mass events and gatherings, and school closings. Hygiene measures such as social distancing practices, avoiding touching the face, frequent handwashing, and the use proper sneezing and coughing etiquette were also promoted (Diario Oficial de la Federación, 2020). The effect that these measures could have on the wellbeing of the population remain unknown. Social distancing has proved to have a positive impact on the transmission of other contagious diseases. For example, it has shown to reduce the transmission of influenza cases within a range of 1–50%, with the closure of schools and work at home being the two strategies with the best results (Rashid et al., 2015). However, these measures could also have a negative impact on the food security of the population, especially among the most vulnerable groups (Dunn et al., 2020; Power et al., 2020).

Confinement caused changes in human behaviours, services, economy, and food systems (Huff et al., 2015; Hobbs, 2020). Initial surveys from COVID-19 in the US showed that during the COVID-19 pandemic, participants were worried about their health, and had made some lifestyle changes. For example, participants stopped going to the gym (50%) and stocked up on food (74%) (Nelson et al., 2020). During

the COVID-19 pandemic, panic buying and hoarding of food and essential products have been registered, causing shortages of some products (Hobbs, 2020; Nelson et al., 2020; Romano Gutiérrez, 2020). Stockpiled foods included bottled water, milk, rice, frozen food dough and canned foods (Hobbs, 2020; Romano Gutiérrez, 2020; Siche, 2020).

People living in social isolation may be more likely to initiate harmful behaviours such as smoking, excessive alcohol consumption and overeating as a mechanism of psychological relief (Valtorta et al., 2016; Leigh-Hunt et al., 2017). Despite the fact participants from these studies were adults with little social interaction due to causes other than the epidemic, it is possible that the social distancing and anxiety caused by the COVID-19 state of emergency (Losada-Baltar et al., 2020), have similar effects or are more accentuated on the behaviours of the population.

Results from a telephone survey conducted by the Mexican Institute of Public Health (ENSARS-CoV-2) in which data from 1000 Mexicans was collected between May 11th and 30th 2020, showed participants had less diversity in their diet, reduced their level of physical activity, and increased sedentary behaviours and sleeping hours (Shamah-Levy et al., 2020). Therefore, it becomes relevant to document the effects of the pandemic on the population's eating habits and lifestyle, since an individual's nutritional status and poor diet quality may impact on comorbidities and subsequent complications.

Thus, the aim of this study is to describe diet and lifestyle changes during confinement in COVID-19 pandemic in Mexican adults ( $\geq 18$  years) according to sociodemographic characteristics. Our results could help guide actions and strategies on nutrition and health after the contingency.

## Materials And Methods

The aim of this study was to describe diet and lifestyle changes during confinement in COVID-19 pandemic in Mexican adults ( $\geq 18$  years) according to sociodemographic characteristics.

### Study design and sample

For this cross-sectional study, we structured the ESCAN-COVID19Mx survey. The survey was intended to be answered by: a) Mexican adults (aged  $\geq 18$  years); b) of any sex; c) residing in Mexico between March 17 and May 30, 2020; d) that confirmed staying at home during the confinement period; e) with access to an electronic device and to the internet; and f) read the informed consent included in the online instrument and agreed to participate. The ESCAN-COVID19Mx was designed to be self-reported through an electronic platform (Google forms ©), where all responses were compulsory. The study was approved by the Ethics and Research Ethics committees of *Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán* reg GAS- 3376-20-20-1 (INCMNSZ) and the *Instituto Nacional de Salud Pública* CI 1666 (INSP).

The questionnaire was distributed using a snowball sampling technique through social media (WhatsApp, Telegram, Facebook, Twitter) and email. Sample size was estimated at 2401 participants,

hypothesising that a proportion of 50% of the population confined at home would present negative changes in their diet quality, with a margin of error of 2%.

### **ESCAN-COVID19Mx Survey**

The ESCAN-COVID19Mx survey has five components divided as follows: I) Sociodemographic characteristics; II) Diet quality III); Emotional Eating (over and under eating from negative emotions; IV) Physical activity and sedentary behaviour; and V) Lifestyle factors (Quality of life). All the scales used as reference were validated in the Mexican population so that they were self-reported in the ESCAN-COVID19Mx survey and could be answered in less than 15 minutes.

**Sociodemographic characteristics:** We collected information about the participants' sex, age, place of residence, education, marital status, number of children in the household, weight and height. AMAI system 2018 (Asociación Mexicana de Agencias de Inteligencia de Mercado y Opinión Revisión Nivel Socioeconómico, 2018) was used to assess participants' socioeconomic classification, and level of marginalisation was obtained through the participant's postal code.

**Diet quality.** The Mini-Survey to Evaluate the Quality of Food Intake (Mini-ECCA) was included to assess diet quality during and before the COVID-19 confinement. The Mini-ECCA has been validated in healthy Mexican adults (Bernal-Orozco et al., 2018). Participants who perceived changes in their diet during the pandemic were asked to answer the Mini-ECCA twice; once in reference to their diet prior to confinement and the second time in reference to their diet during confinement. **Diet Quality Index (DQI).** The Mini-ECCA was used to obtain an index with a value of 0–12 according to their consumption of water, vegetables, fish, fruit, legumes, sweets, sugar-sweetened beverages, meats, fats, cereal, junk food and eating away from home. Higher values represent a better diet quality.

**Emotional eating.** We used the Spanish version of the Adult Eating Behaviour Questionnaire (AEBQ-Esp) validated in Mexican adults from the original AEBQ (Hunot et al., 2016) to assess emotional eating. We did not assess perceived emotional eating prior to confinement, as appetitive traits show continuity and stability through time (Ashcroft et al., 2008). Two of the seven subscales from the AEBQ-Esp were used: (1) emotional overeating and (2) emotional undereating. Each subscale included 5 items each: "Eat more" or "Eat less" when I am angry, worried, upset, anxious and/or irritated. Each question was answered using a 5-point Likert Scale: "Strongly disagree", "disagree", "neither agree, nor disagree", "agree" and "strongly agree" (Hunot-Alexander *et al.*, 2020).

**Physical activity and sedentary behaviour.** This component was constituted by four questions about the participant's physical activity and sedentary behaviour during and before the contingency period. The questions about physical activity inquire on the days per week that the participant performed 30 minutes or more of intense physical activity. To measure sedentary behaviour, the participants were asked about the hours per day they remain sitting or lying down (Beeken et al., 2012, 2017). The **Physical Activity and Sedentary Behaviour Index (PASBI)** was constructed with the following two scales: a) Vigorous physical activity: participants were assigned a score (0–12) based on the times per week they completed 30 minutes or more of intense physical activity. These scores were distributed as follows: "Did not do any

vigorous physical activity” 0 points, “1–2 times per week” 3 points, “3–4 times per week” 6 points, “5–6 times per week” 9 points, “Every day or several times per day” 12 points. b) Sedentary behaviour: Based on the time per day the participant was sitting down or lying down the participants were. The scores for sedentary behaviour were given as follows: “0 to 2 hours” 12 points, “3 to 6 hours” 8 points, “7 to 10 hours” 4 points, “11 hours or more” 0 points. The PASBI is the result of adding both items, producing an ordinal scale of 18 levels with scores ranging from 0 to 24.

**Lifestyle factors (Quality of life).** For these questions, appearance and content validity was calculated among the research group and three rounds of evaluation were performed per question by consensus. Two rounds of the pilot testing were conducted in 10 and 15 individuals each, with the last approved version in consensus included in the survey. The section was made up of the following aspects: food expenses, health information sources, compliance with confinement, changes in body weight, screen time, smoking, alcohol drinking and sleeping habits. A **Lifestyle quality Index (LSQI)** was calculated which included the following six aspects: Smoking, alcohol consumption and sleeping habits, **LSQI** and the two components of the PASBI. For the **LSQI** and the **PASBI** components, their respective 12-point scores were used. To obtain the smoking, alcohol and sleeping habits scales, a score of 0 to 2 was assigned to the responses issued in each question, where 0 was considered the least recommended behaviour, and a maximum value of 2 to the recommended behaviour. The total score for each component was added and weighted so that each provided the same contribution to the index (12 points). The score of the LSQI obtained was from 4 to 72 on the scale that evaluated lifestyle retrospectively; and from 3 to 72 on the scale that evaluated the lifestyle quality during the contingency. A higher score was considered a better lifestyle quality.

## Statistical Analyses

Sociodemographic characteristics of the participants were described using indicators of central tendency and dispersion for quantitative variables while frequencies and percentages were used for qualitative variables. The **DQI**, **PASBI** and **LSQI** were described with medians and interquartile ranges (IQR 25–75). To investigate whether there were differences in the abovementioned indices before and during confinement, by sociodemographic characteristics and weight category, Wilcoxon's signed ranks test and  $\chi^2$  were used as appropriate. Means for each emotional eating subscale were calculated and linear regressions for both emotional over and under eating with BMI were calculated. Statistical significance was defined as  $p < 0.05$ . All data analyses and statistical tests were performed using R (v.3.6.1).

# Results

## Sample characteristics

Respondents ( $n = 8289$ ) fully completed the ESCAN-Covid19MX survey between April 13th and May 16th. The majority of participants were women (80%), participants were within an age range of 18 to 38 years (70%), living in areas with very low levels of marginalization (82.8%) and higher education level (84.2%).

Based on self-reported weight and height, half of the respondents (53.1%) had a BMI between 18 and 24.9 kg/m<sup>2</sup>, a third had a BMI between 25 and 29.9 kg/m<sup>2</sup> (31.4%), and 13.3% had a BMI ≥ 30 kg/m<sup>2</sup>. Figure 1 shows the response rate by place of residence.

As shown in Table 1, there were significant differences in age, education, place of residence and weight status of participants by gender. A higher proportion of women had low and normal weight, whereas a higher proportion of men had overweight or obesity ( $p < 0.005$ ).

Table 1  
ESCAN-Covid19Mx sample characteristics

Characteristic	Total n = 8289	Female n = 6632	Male n = 1657	p-value
Sex		80%	20%	< 0.001
Age, years (IQR)	34.6 (34.4–34.8)	34.3 (34.1–34.6)	35.5 (34.9–36.1)	0.001
18–28	39.60%	39.70%	39.30%	0.793
29–38	30.40%	31.30%	26.60%	< 0.001
39–48	18.00%	17.90%	18.50%	0.627
49–58	8.90%	8.60%	10.30%	0.03
59–79	3.10%	2.50%	5.30%	< 0.001
Education				
Basic	15.80%	15.40%	17.70%	0.023**
Higher	84.20%	84.60%	82.30%	0.023**
Place of residence				
Mexico City	21.90%	21.70%	22.70%	0.45
Centre of Mexico	45.80%	45.90%	45.30%	0.633
North of Mexico	14.90%	15.60%	12.20%	0.001
South of Mexico	17.40%	16.80%	19.90%	0.005
Level of marginalization				
High	2.10%	2.00%	2.10%	0.999
Medium	3.60%	3.60%	3.90%	0.932
Low	11.50%	11.50%	11.60%	0.819
Very low	82.80%	82.90%	82.40%	0.175
BMI, kg/m <sup>2</sup> (IQR)	24.5 (22.1–27.5)	24.1 (21.8–27.1)	25.9 (23.9–28.7)	< 0.001
≤ 18	2.20%	2.50%	1.30%	0.004

Characteristic	Total n = 8289	Female n = 6632	Male	p-value
			n = 1657	
18.1–24.9	53.10%	57.10%	36.80%	< 0.001
25- 29.9	31.40%	28.30%	44.00%	< 0.001
≥ 30	13.30%	12.00%	18.00%	< 0.001

### Diet quality index (DQI)

Nearly half of the participants (46.8%) perceived a change in the quality of their diet. There was an increase in the consumption of homemade foods (28.4%). The median of the Diet quality Index (DQI) improved by 3 points (-1 to 2,  $p < 0.001$ ) for the full sample. The DQI was higher during confinement in all groups regardless of education level, marginalization level or place of residence ( $p < 0.001$ ). Moreover, there was a positive association between BMI and the DQI ( $p < 0.001$ ). Table 2 shows the changes in the DQI by age, nutritional status, schooling, degree of marginalization and geographic region of residence.

Table 2

Characteristics of the participants according to the Diet quality index (DQI) before and during the COVID-19 confinement

Characteristic	n	Before the confinement, m (IQR)	During the confinement, m (IQR)	p-value
Age, years				
18–28	3282	8 (6–10)	8 (7–10)	< 0.001
29–38	2518	8 (6–9)	9 (7–10)	< 0.001
39–48	1494	8 (6–10)	9 (7–10)	< 0.001
49–58	740	8 (7–10)	9 (8–11)	< 0.001
BMI kg/m <sup>2</sup>				
≤ 18	185	7.5 (6–9)	8 (7–10)	0.011
18.1–24.9	4380	8 (6–10)	9 (7–10)	< 0.001
25–29.9	2595	8 (6–10)	9 (7–10)	< 0.001
≥ 30	1096	8 (6–10)	9 (7–10)	< 0.001
Education				
Basic	1312	7 (5–9)	8 (7–10)	< 0.001
Higher	6977	8 (6–10)	9 (7–10)	< 0.001
Level of marginalization				
High	120	9 (6.5–10.5)	9 (7–11)	< 0.001
Medium	211	8 (6–10)	9 (7–10)	0.218
Low	672	8 (6–10)	9 (7–10)	< 0.001
Very low	4832	8 (6–10)	9 (7–10)	0.277
Place of residence				
m = median, IQR = Interquartile range				

Characteristic	n	Before the confinement, m (IQR)	During the confinement, m (IQR)	p-value
Mexico City	1752	8 (6–10)	9 (7–10)	< 0.001
North of Mexico	1193	8 (6–10)	8 (7–10)	0.001
Centre of Mexico	3663	8 (6–10)	9 (7–10)	< 0.001
South of Mexico	1390	8 (6–9)	9 (7–10)	0.001

m = median, IQR = Interquartile range

Figure 2 shows the change rate in the full sample in the DQI before and during confinement, suggesting a shift to better diet quality.

### Emotional Eating

Our results showed that 70% of the respondents perceived no changes in their emotional eating during confinement. Results from the AEBQ-Esp Scale showed that the emotional overeating subscale mean was 2.63 ( $\pm$  0.88) whereas the mean of emotional undereating subscale was 2.51 ( $\pm$  0.97). Linear regressions between emotional overeating and emotional undereating with BMI showed no significant relationships between either subscales and BMI ( $\beta$  = -0.937,  $p$  = 0.854 and  $\beta$  = -1.19,  $p$  = 0.806 respectively).

### Physical Activity and Sedentary Behaviour Index (PASBI)

Participants who did not engage in any intense physical activity prior to confinement reported engaging on more intense physical activity during confinement, as the rate of people engaging on intense physical activity increased from 31.2–39.9% ( $p$  < 0.001). However, those who reported performing intense physical activity 3–4 times/week prior to confinement decreased from 25 to 18.5% ( $p$  < 0.001). Moreover, Table 3 shows there was a statistically significant reduction in the PASBI score during confinement among all age groups, education levels, marginalization, and place of residence.

Table 3

Characteristics of the participants according to the physical activity and sedentary behaviour index (PASBI) prior and during the COVID-19 confinement

Characteristic	n	Before confinement, m (IQR)	During confinement, m (IQR)	p-value
Age, years				
18–28	3282	9 (5–14)	6 (2–10)	< 0.001
29–38	2518	9 (5–13)	5 (2–10)	< 0.001
39–48	1494	9 (5–14)	7 (3–11)	< 0.001
49–58	740	9 (5–14)	7 (3–11)	< 0.001
59–79	254	9.5 (5–14)	8 (5–12)	< 0.001
BMI kg/m <sup>2</sup>				
≤ 18	185	8 (5–12)	5 (2–9)	< 0.001
18.1–24.9	4380	10 (5–14)	7 (3–11)	< 0.001
25–29.9	2595	9 (5–14)	5 (2–10)	< 0.001
≥ 30	1096	8 (4–11)	5 (2–9)	< 0.001
Education				
Basic	1312	9 (5–13)	5 (2–10)	< 0.001
Higher	6977	9 (5–14)	6 (2–11)	< 0.001
Level of marginalization				
High	120	9 (5–14)	7 (3–11)	< 0.001
Medium	211	9 (5–13.5)	5 (3–9.5)	< 0.001

m = median, IQR = Interquartile range

Characteristic	n	Before confinement, m (IQR)	During confinement, m (IQR)	p-value
Low	672	9 (5–14)	7 (3–11)	< 0.001
Very low	4832	9 (5–14)	6 (3–11)	< 0.001
Place of residence				
Mexico City	1752	9 (5–13)	5 (2–10)	< 0.001
North of Mexico	1193	9 (5–14)	6 (2–10)	< 0.001
Centre of Mexico	3663	9 (5–14)	7 (3–11)	< 0.001
South of Mexico	1390	9 (5–14)	5 (2–11)	< 0.001
m = median, IQR = Interquartile range				

### Lifestyle quality index (LSQI)

Some of the participants (29.2%) of the participants described having gained body weight, 6.1% stopped smoking, and 12.1% stopped consuming alcoholic beverages. However, 3% smoked more, and 10.2% consumed more alcohol. With regards to sleeping habits, 53.3% of the participants reported sleeping later, 27% had interrupted night sleep, and 18% had disturbed sleeping schedules ( $p > 0.001$ ). Nearly half of the participants (47.4%) were concerned about their health.

The sources used by the participants to keep themselves informed about the COVID-19 pandemic were social media (78.8%), leaders and health professionals (73%) and health authorities, government, and health institutions (78.8%). Regarding money spent on food, 38.9% of the participants perceived having a higher food expenditure than usual during confinement, but 47.8% reported having a lower family income. Nearly half of the households (44%) included minors.

Observing physical activity results per week in Table 3, the one performed most frequently among the population was 3 to 4 times per week before and during confinement, but even this category of weekly exercise frequency decreased by 6.3%, being more accentuated in men (6.5%) than in women. In women, weekly exercise was more affected in the category of 5 to 6 times and several times a day it was decreased (-3.2 and -0.3%, respectively).

Regarding lifestyle factors, majority of participants reported that during confinement they would leave their homes only if it was necessary (85.5%), 43% increased their time in front of screens, 81.6% spent more hours sitting or lying down, and 42.3% consumed food in front of screens once a day. The lifestyle

quality index (LSQI) for the general population prior to confinement was 42 points (IQR 35–50) [m = 42.35, 95%CI 42.07–42.94] and 41 points during the confinement (IQR 34–47). As a possible consequence of the changes in the quality of diet and physical activity, the LSQI was also affected.

Table 4  
describes the differences in LSQI by the participant's characteristics

Characteristic	n	Before confinement, m (IQR)	During confinement, m (IQR)	p-value
Age, years				
18–26	3282	43 (35–50)	41 (35–47)	< 0.001
29–36	2518	42 (35–49)	40 (33–46)	< 0.001
39–46	1494	44 (37–51)	42 (35–47)	< 0.001
49–56	740	45 (36–52)	42 (37–48)	< 0.001
59–77	254	46 (40–52)	45 (39–51)	0.535
BMI kg/m <sup>2</sup>				
≤ 16	185	42 (35–48)	40 (35–47)	0.298
18.1–24.7	4380	44 (37–51)	42 (35–48)	< 0.001
25–29.7	2595	43 (34–50)	41 (34–46)	< 0.001
≥ 28	1096	44 (32–47)	40 (33–46)	0.609
Education				
Basic	1312	43 (35–50)	42 (36–48)	0.081**
Higher	6977	43 (35–50)	41 (34–47)	< 0.001**
Level of marginalization				
High	120	42 (36–51)	42 (37–50)	< 0.001
Medium	211	43 (36–51)	43 (37–48)	0.217
Low	672	44 (33–50)	43 (37–48)	0.855
Very low	4832	43 (35–50)	41 (35–47)	0.825
Place of residence				
Mexico City	1752	43 (35–49)	40 (33–46)	< 0.001
North of Mexico	1193	42 (35–49)	41 (34–47)	0.001
Centre of Mexico	3663	43 (35–51)	41 (35–47)	< 0.001
South of Mexico	1390	43 (36–50)	42 (36–49)	0.096
m = median, IQR = Interquartile range				

## Discussion

The ESCAN-COVID19Mx aimed to evaluate the perceived changes in the quality of diet, lifestyle, emotional eating and physical activity of Mexican adults during and prior the COVID-19 pandemic. A total of 8289 Mexicans who reported staying at home during the confinement period, completed the online questionnaire.

Results from our study showed an improvement in the quality of the diet among those who were in an age range of 18 to 59 years, had a normal weight or overweight, higher education level, lived in Mexico City, the north and centre of the country, and who lived in areas of low marginalization.

These results were unexpected since, when registering the hoarding of frozen and canned foods at the beginning of the pandemic (Hobbs, 2020; Romano Gutiérrez, 2020; Siche, 2020), we anticipated a possible increase in the consumption of ultra-processed foods resulting in a lower diet quality of the diet. However, a third of the respondents had greater access to homemade foods and greater consumption of fresh foods during the stage of confinement.

In parallel with our study, results from a survey by National Institute of Public Health in Mexico (ENSARS-CoV-2 ) showed that during the COVID-19 confinement, their participants had a higher consumption of cereals, fresh fruits and vegetables, as well as meat, fish and shellfish, eggs, dairy products, legumes, oils, condiments, coffee and tea. Also, that they increased their consumption of sweetened beverages, sweets and snacks. Unlike our study, their report describes a diet diversity index with an average score of 13.5 (0–18) (Shamah-Levy et al., 2020). In France, results of the Nutri-Net cohort showed a reduction in the consumption of fresh foods and an increase in foods high in sugar at the beginning of the COVID-19 pandemic (Deschasaux-Tanguy et al., 2020). On the contrary, the COVIDiet study in Spain, showed that during confinement, participants showed greater adherence to the Mediterranean diet, which is characterized by the consumption of olive oil, fruits and vegetables and evidence suggests is optimal to prevent non-communicable diseases and preserve good health (Rodríguez-Pérez et al., 2020).

Recent studies in other countries have also investigated emotional eating behaviours during the COVID-19 pandemic reaching conflicting results (Deschasaux-Tanguy et al., 2020; Rodríguez-Pérez et al., 2020; Romeo-Arroyo, Mora and Vázquez-Araújo, 2020; Scarmozzino and Visioli, 2020; Sidor and Rzymiski, 2020). However, to our knowledge, no study has assessed eating behaviour based on emotional over and under eating, that is, the way negative emotions impact on food consumption and their possible impact on body weight (Hunot et al., 2016; Hunot-Alexander *et al.*, 2020). Using the AEBQ-Esp we measured the participants' emotional overeating and emotional undereating during the COVID-19 confinement. During the validation of the AEBQ tool in Mexicans prior to confinement the mean of eating more through emotions was 2.54 ( $\pm$  0.87) and eating less through emotions was 2.79 ( $\pm$  0.88) (Hunot-Alexander *et al.*, 2020). Results from this study showed no associations with either emotional over or undereating and BMI. These results differ with other publications that show that emotional overeating is positively

associated with BMI in adult populations (Hunot et al., 2016; Mallan et al., 2017; Hunot-Alexander *et al.*, 2020). Results from our study suggest that confinement has negatively impacted on the physical activity of the population. Our results are similar to findings from studies in other countries (Deschasaux-Tanguy et al., 2020; Lesser and Nienhuis, 2020) in which they have reported a reduction in physical activity and an increase in sedentary time during the COVID-19 confinement. This reduction in physical activity was expected due to the closure of gyms and recreation centres, as people do less active commuting. It could be possible that reductions in physical activity, could have been due to an excess of activities whilst at home, such as looking after children, home schooling, plus individual home office work. This could partly explain the results obtained in this study and why women reduced their exercise frequency. Reduction in physical activity during confinement is alarming as prior to the pandemic, less than half (42%) of the adults in Mexico, referred doing physical-sports practice in their free time (INEGI, 2020). This reduction could have a long-term impact on lifestyle and could lead to the appearance of type 2 diabetes and metabolic syndrome (Rezende et al., 2014). In this study, we found that sedentary lifestyle increased from 31.3 to 40%, while in the ENSARS-CoV-2 survey, sedentary lifestyle rose from 39.5 to 45% (Shamah-Levy et al., 2020). Again, and as seen with diet quality, the physical activity and sedentary lifestyle indices were different regardless of the degree of marginalization and the region of the country ( $p < 0.001$ ).

The LSQI constructed with information on smoking, alcohol consumption, diet quality, physical activity and sedentary behaviour showed a deterioration in lifestyle factors in both young adults and middle age adults during the COVID-19 confinement, but not in the elderly. However, it is striking that the change was not significant in participants with BMI  $< 18 \text{ kg/m}^2$  ( $p = 0.298$ ),  $\geq 30 \text{ kg/m}^2$  ( $p = 0.609$ ), with a basic education level ( $p = 0.081$ ), medium, low to very low degree of marginalization ( $p = 0.217, 0.855$  and  $0.825$ , respectively) and those who lived in the southern region of Mexico ( $p = 0.096$ ). Studies prior to the COVID-19 pandemic showed that people in social isolation were likely to initiate or increase behaviours such as smoking or alcohol consumption (Leigh-Hunt et al., 2017). Nevertheless, to our knowledge, none of the studies in the context of the COVID-19 pandemic have shown a significant increase in tobacco and alcohol consumption. A study in Spain reported a decrease in the consumption of alcoholic beverages by 57.3% (Rodríguez-Pérez et al., 2020); while in Italy a study showed a significant reduction in smoking (Di Renzo et al., 2020). In our study, some of the participants reported having changes in their smoking and alcohol habits, both positive and negative; however, for the majority these behaviours remained constant as smoking increased by 3%, while alcohol consumption rose to 10.2%. This situation is in contrast with the findings of the ENSARS-CoV-2 where cigarette consumption increased to 21% and alcohol to 12% (Shamah-Levy et al., 2020).

It is possible that the reduction of tobacco and alcohol consumption may have been for health concerns or that participants solely engaged in these behaviours socially. More research is needed to understand the factors that influenced these behaviour changes and whether these changes were permanent. Sleeping habits were affected in more than a quarter of the participants. Our results were similar to those in the ENSARS-CoV-2 (Shamah-Levy et al., 2020). It is worth noting that in our study 45% of the participants had a BMI above  $25 \text{ kg/m}^2$ , when it is known that the prevalence of overweight and obesity

in Mexico is around 75% (Shamah-Levy, Campos-Nonato and Cuevas-Nasu, 2019). This could be related to the socioeconomic level of the population in the study, where marginalization was low and had a higher level of education.

One possible limitation of the ESCAN-COVID19Mx is that the instrument did not collect information on the type of economic activities, household income or food security of the participants. Also, we did not inquire on the reasons for making the behaviour changes and we did not reapply the survey at the end of confinement. Therefore, it is not possible to understand the causality of these changes or whether these were maintained. The recruitment strategy through social networks and snowball methodology meant that there may be groups of Mexicans who were not correctly represented in this survey. Due to the cross-sectional nature of our study, causal inferences should not be made between sociodemographic characteristics and changes in the quality of diet, physical activity, and lifestyle. Likewise, the participants self-reported their weight and height; therefore, it is possible that their BMI could be under or over reported.

The main strength of our study is that this is the first study with a sample size greater than the estimated and obtained responses from all over the country about the changes in the quality of diet, physical activity and lifestyle in Mexicans who stayed home during the COVID-19 confinement. Results from this study show the importance of improving diet quality in people who work from home. A possible reason for this could be that most of the people who participated in this survey continued working from home during lockdown, however in this study we did not collect information about the participant's current working status to confirm this.

The ESCAN-COVID19Mx was carried out before the new frontal warning labelling came into place on the 1st of October 2020 (White and Barquera, 2020); thus, this survey could serve as reference point to evaluate changes in food consumption for this new food regulation.

The COVID-19 pandemic has emphasised the importance of preventing chronic degenerative diseases as evidence suggest that people living with these conditions are at higher risk of developing a more severe condition (Zheng et al., 2020). Therefore, it is important to encourage healthy lifestyle behaviours among the population during and after this time of crisis to prevent the risk of complications due to infectious and chronic degenerative diseases. One of the main challenges that are being faced during the COVID-19 confinement is that there is a lack of resources and programs that help the general population improve their health under these conditions.

## **Conclusions**

The results from this study showed that during the COVID-19 confinement, Mexicans that were staying at home and who had a low degree of marginalization and a higher educational level, increased the quality of their diet by consuming more fresh foods prepared at home, yet they increased the consumption of sugar-sweetened beverages as a general tendency, reduced their physical activity and possibly the quality of their lifestyle decreased.

# List Of Abbreviations

AEBQ-Esp; Adult Eating Behaviour Questionnaire; DQI: Diet Quality Index; ESCAN-COVID19Mx: ; LSQI: Lifestyle quality Index. Mini-ECCA: Mini-Survey to Evaluate the Quality of Food Intake; PASBI: Physical Activity and Sedentary Behaviour Index.

## Declarations

**Ethics approval and consent to participate:** The study was approved by the Ethics and Research Ethics committees of *Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán* GAS- 3376-20-20-1 (INCMNSZ) and the *Instituto Nacional de Salud Pública* CI 1666 (INSP). All participantes gave their consent to participate in the study.

**Consent for publication:** Not applicable.

**Competing interests.** The authors declare no conflict of interest.

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**Author Contributions:** Conceptualization, SEMV, MCR, RPV, CHA, EJNG, CIRS, DKAL, GQO, BELJZ, ACDC, MSHJ, MSO; Methodology, SEMV, MCR, RPV, CHA, EJNG, CIRS, GKO, MKH; Software, SEMV, MCR, DKAL, ACDC; Validation, SEMV, MCR, RPV, CIRS ; Analysis, SEMV, MCR, RPV, CIRS; Research, SEMV, MCR, RPV, CHA, EJNG, CIRS, DKAL, GQO, BELJZ, ACDC, MSHJ, MSO, MKH; Resources, SEMV, MCR, RPV, CHA, EJNG, CIRS, DKAL, GQO, BELJZ, ACDC, MSHJ, MSO, MKH; Data curation, SEMV, RP, IR ; Writing—original draft preparation, SEMV, MCR, RPV, CHA; Writing—review and editing, SEMV, MCR, CHA, MKH; Visualization, SEMV, MCR, CHA, EJNG, MKH; Supervision, SEMV, MCR, CHA, MKH; Project administration, SEMV. All authors have read and agreed to the published version of the manuscript.

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**Data availability.** All data and materials are available upon request.

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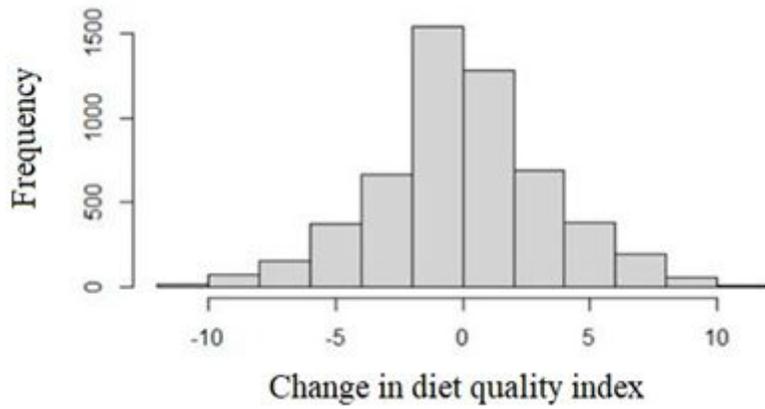
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## Figures



**Figure 1**

Distribution of ESCAN- Covid19Mx responses in Mexico



**Figure 2**

Change in the Diet quality index (DQI) prior and during the confinement

## Supplementary Files

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