

Impact on the Nutritional and Functional Status of Older Mexican Adults in the Absence of Recreational Activities due to COVID-19: A Longitudinal Study From 2018 to 2021

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Abstract

A longitudinal study, from 2018 to 2021, identified impacts on the nutritional and functional status of older adults when face-to-face activities at a social assistance center in Mexico were suspended due to the COVID-19 pandemic. A total of 71 older adults were evaluated at three different periods: 18 months prior, three months before the pandemic, and 12 months after the onset of the pandemic. Seventy-one older adults completed follow up. Anthropometric measurements, dietary intake, physical tests, and health screening for malnutrition, dependence, and physical frailty, were evaluated. There was a significant decrease in lean body mass and body water in the older adults assessed, in addition to a significant reduction in the frailty scale and gait speed. Finally, a significant reduction in ingested energy and several nutrients such as protein, and carbohydrates, was found, yet an increase in sugar and cholesterol intake was noted.

Keywords

older adults, COVID-19, nutritional status, functional status

What this paper adds

- Eighteen and 3 months before, and 12 months after the quarantine due to COVID-19 pandemic onset, the Mexican older adults had significant variations in their musculoskeletal health status; there was a significant decrease of the lean body mass and body water; a decrease in the handgrip strength and a higher score of the physical frailty.
- A significant reduction in the energy consumption was found, especially when comparison was in the 3 months before vs. 12 months after the pandemic onset; in macronutrients, there was a tendency to reduce the protein consumption.

Applications of study findings

- This study demonstrates the need to create public policies for the vulnerable population that require the supply of foods, such as vegetables, that help to reduce the impacts of the isolation they experience due to the cessation of activities because of a pandemic onset.
- These findings reinforce the use of rapid and inexpensive tests that can identify patients at the risk to loss their mobility.
- This study allows to increase the understanding of the state of health in the population with unfavorable socio-demographic characteristics.

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Introduction

Older adults belong to an age group that is classified as highly vulnerable due to the multiple physical, social, and psychological changes that make the aging process heterogeneous (Mitnitski et al., 2017); and which the COVID-19 pandemic has focused more attention on, especially regarding social isolation (Berg-Weger & Morley, 2020). In Mexico, face-to-face activities where crowds gathered were completely suspended by the authorities since March 2020 (Ibarra-Nava et al., 2020), and recreational centers for older adults were no exception; affecting their health, education, physical movement, nutritional supplementation provided by free breakfasts, and the support of Gerontology professionals.

The promotion of essential capacities in older adults is part of the recommendations for active aging (Bernstein & Munoz, 2012; Briggs & Araujo de Carvalho, 2018). It is known that the absence of physical movement may lead to an involuntary loss of muscle mass, strength, bone mass, and an increase in fat mass (Batsis & Villareal, 2018; Walston, 2012). Furthermore, based on the World Health Survey (2002–2004), there was a reported loss of mobility in 39% of older adults through the measurement of gait speed and handgrip strength (Mitra & Sambamoorthi, 2014).

In addition, sensory impairments such as the loss of smell and taste caused by the aging process (Sergi et al., 2017), combined with limited social contact in older adults, are factors related to the presence of malnutrition (Sahyoun & Zhang, 2005). Older adults who do not have sufficient protein intake are at risk of developing sarcopenia, osteoporosis, or immunosuppression (World Health Organization [WHO], 2019).

Due to the COVID-19 pandemic, limited commercial activities coupled with the stressful situations due to the period of social quarantine, have decreased the quality of dietary intake, and increased the ingestion of ultra-processed foods, considered immunosuppressants (Vergara-Castañeda et al., 2020). Additionally, scarce variety in the diet has been linked with frailty in older adults including during the period of COVID-19 restrictions (Otaki et al., 2021). In particular, older adults with low muscle mass are more likely to have severe conditions from COVID-19 (Ma et al., 2021).

The objective of this longitudinal study was to identify the impact that the suspension of face-to-face activities at a social assistance center had on the nutritional status of older adults during the COVID-19 pandemic, evaluated by anthropometric, clinical, and dietary parameters at 18 months prior, 3 months before the pandemic, and 12 months after the pandemic onset, in the city of Colima, Mexico.

The authors hypothesized that a decrease in motor and nutritional capacity after the period of quarantine caused by COVID-19 would lead to pathological aging; and that this would be manifested by a dietary pattern with reduced intake of energy, proteins, and micronutrients. Furthermore, clinical parameters related to protein status, such as lean body mass, gait speed, and hand strength, might also be reduced due to

the influence of not having the stimulus of physical activities, leisure, and socialization at the recreational center they had formerly been attending.

Materials and Methods

The study was carried out at a social assistance day center for older adults in the city of Colima, located in the western region of Mexico. Since 2018, nutritional and functional evaluations were performed voluntarily, and free of charge, on 256 participating older adults; and these evaluations were made part of a longitudinal study to establish health patterns linked to pathological aging. There were three evaluation moments: period 1—pre-pandemic: 18 months before the start of social restrictions/quarantine due to COVID-19 (September 2018), on 169 older adults; period 2—pre-pandemic: 3 months before the onset of the pandemic (December 2019), on 169 older adults; and period 3—post-quarantine: 12 months after the onset of the quarantine put in place due to the pandemic (March 2021), on 155 older adults. Only 71 older adults had complete assessments of all the variables for the three consecutive periods and were analyzed in the present study. The comparison of these three different periods was made to corroborate that the change in variables was linked to the absence of social and recreational activities, and thus exclude the regular aging process.

Since the measurements were carried out voluntarily, only those older adults who underwent a full evaluation over the 3 years of the study were included in the analysis. Included, were males and females over 60 years of age who were attendees at the recreational geriatric center and part of their evaluations. The authors did not include participants who had a major neurocognitive disorder, since that would bias the quality of the dietary pattern recording; and participants who used a wheelchair, were not included, nor those who had a metal prosthesis or limb, as this would result in biased anthropometric evaluations.

The evaluations were carried out by a registered dietician, individually for each older adult, and in consultation rooms, between the hours of 7:00 and 10:00a.m. The same measurement techniques and instruments were used at all three evaluation periods.

In 2021, for safety reasons, and for the health integrity of the participants and researchers, numerous regulations for hygiene and sanitation were established, which included sanitary measures for the spaces (open, ventilated, and sanitized), as well as for the evaluators and the study participants (use of face masks, access to disinfectants, no presentation of respiratory symptoms or risk of COVID-19 contact; fever, or physical contact during the evaluation). No infection was reported throughout the study period. As complementary data, each older adult participant was asked their perception on whether the absence of activities at the geriatric recreational center affected their general health status.

Anthropometric Evaluations

For the anthropometric evaluation, each participant was asked to wear light clothing and remove any object that would affect the measurements such as a coat, belt, cellphone, wallet, and metallic accessories; and, in addition, their footwear and socks were completely removed. The anthropometric evaluation was based on the ISAK criteria (Ganhão-Arranhado et al., 2018), and consisted of measuring height with a stadiometer (SECA 213). In addition, the scale that measures body composition in segments through electrical bioimpedance at 50 Hz (Tanita BC-568) was used for the evaluation of weight (kg), fat mass (%), lean mass (kg), and body water (%). Body adiposity was based on the National Institutes of Health/WHO guidelines, where fat mass percentage was considered elevated at 36% in females, and 25% in males (Gallagher et al., 2000). Body mass index (BMI) was calculated by dividing the participant's weight in kg by their height in square meters, with the cut-off points of BMI as: low weight <23 kg/m²; normal weight 23.1–27.9 kg/m²; overweight 28–31.9 kg/m²; and obesity ≥32 kg/m² (Conroy-Ferreccio, 2017).

Clinical Evaluations

A battery of geriatric tests associated with the nutritional status of older adults was used. The first test was the Mini Nutritional Assessment (MNA) test, which is a scale to identify malnutrition in older adults: the MNA includes anthropometric evaluations and the perception of health indicators reported by the participant; where the maximum score is 30 points, and the lower the score the greater the risk of malnutrition, with cut-off points to establish a condition of malnutrition at 17 points (Vellas et al., 2006).

Subsequently, the Barthel scale was applied to establish independence, or the level of functional dependence, which is evaluated by identifying the autonomy to carry out 10 activities of daily living: the maximum score is 100 points and is equivalent to the functional independence in older adults, and the lower scores establish different degrees of dependence (Mahoney & Barthel, 1965).

The last stage of the clinical evaluation was a physical test which included the measurement of handgrip strength in both arms using a hand dynamometer (Camry). The participant was asked to place the device horizontally with their arm outstretched, and to squeeze with all their strength with the hand they were using. The test was performed in duplicate in both arms, while only verbal supports were used for the test. The normal cut-off points for older adults were >20 kg for women and >30 kg for men (Patrizio et al., 2021). Afterward, a gait speed test was carried out, which instructed the participant to walk in a straight line 4 meters long, without obstacles, at a normal pace, and the participant was asked to perform the walk four times in a row. The evaluator recorded the time it took to cross the distance, and the time it took them to travel was divided by 4, so their four attempts were averaged. The gait

speed was considered abnormal at < .8 m/s (Peel et al., 2013). Finally, the SHARE-FI test was applied to assess frailty in older adults, which is a test that analyzes the strength of the arms and asks questions about several physical activities. The data was recorded in a dataset created by the authors, with a score that classifies the older adults as not frail, pre-frail, or frail (Romero-Ortuno et al., 2011). The gait and frailty test were recorded only in period 2—pre-pandemic, and period 3—post-quarantine; and since 2019, the authorities of the geriatric center permitted more time allocated for the evaluation of each older adult.

Dietary Evaluations

The dietary evaluations were made based on a 24-hour food intake recall, which is a validated test to quantify energy, and macro and micronutrient intake. Through a direct interview with the older adults, they were asked about all the foods and beverages that they had consumed the day before. A second interview was conducted by telephone with each participant to average the consumption over the 2 days. The *nutre.in* software was used to quantify the diet based on the Mexican equivalent food system, which is a validated method for measuring food consumption in Mexico (Bricio-Barrios et al., 2020). In the case that participants mentioned that dietary recall was not part of their usual routine, their registry would be replaced with a new one made over the telephone.

Ethical Aspects

The ethical principles of the project were based on and in agreement with the Declaration of Helsinki and were fully compliant with the General Law for Health Research in Mexico.

The study was considered minimal risk. For those older adults who were invited to participate in the study, evaluations were free of charge and there was no monetary benefit perceived by being part of the assessments.

Yearly, those who agreed to participate were asked to sign a letter of informed consent, and a copy was given to each participant, where, in the informed consent letter, they agreed to the use of their information for complementary purposes of the study if the ethical principles were respected and it was used for scientific purposes only. The information obtained was managed with absolute confidentiality, and the evaluators registered each participant by assigning them a unique number.

Each participant in the three evaluation periods was given an individual and confidential report with the main results and interpretations of their nutritional status; in addition, and as compensation to the geriatric center, three reports were delivered with the main general results of the older adults evaluated.

Statistical Analysis

Descriptive data were recorded with frequencies and numbers and the mean and standard deviation were used since the data

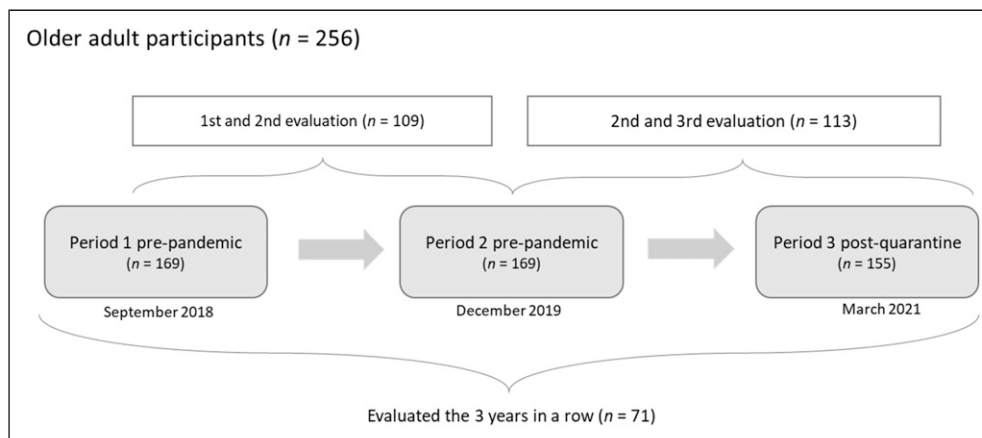


Figure 1. Structure of the longitudinal study.

distribution was parametric. For inferential statistics, the paired t-test (for related groups) was used when two different years were compared, and for the comparison of the three evaluation periods, repeated measures ANOVA (for parametric data) or the Friedman test (for non-parametric data) was used; as a *post hoc* analysis, estimated marginal means with Šidák correction was applied, and the Tukey (parametric data) or Wilcoxon test (non-parametric data) was used. To compare the frequencies between evaluation periods, the McNemar test was used. Finally, relative risk was calculated with a 95% confidence interval to assess for development of the event after exposure, over time. A value of $p \leq .05$ was considered statistically significant. Analyses were performed using the IBM SPSS v.22 (IBM Corp, Armonk, NY, USA) software package.

Results

From 2018 to 2021, 256 older adults were evaluated, yet a total of 71 older adults were included in the study sample (Figure 1) because they fulfilled all the evaluations in the three periods. The mean age of study participants based of their last evaluation was 71.7 ± 5.8 years: 80.3% ($n = 57$) were females, and the rest ($n = 14$) were males. The participants evaluated at period 3—post-quarantine, 91.6% ($n = 142$), perceived that the lack of activities at the social assistance center had had a negative impact on their general health.

After comparing body weight over the years there was a statistically significant difference noted in the study participants; specifically, there was a significant decrease in body weight and BMI when comparing previous months, and at 1 year after the suspension of recreational activities. In 2021, 33.8% of the participants had normal weight, and 56.3% had excess weight (39.4% overweight and 16.9% obesity). Regarding body adiposity, 76.1% were classified as having elevated adiposity; and while there were variations over the years, there was a significant decrease in lean body mass and body water percentage, especially from period 2—pre-pandemic vs. period 3—post-quarantine period (Table 1).

Regarding clinical evaluations (Figure 2), there was a slight decrease in the MNA scale from 2018 to 2021, where only 15.9% were identified as having a risk for malnutrition. In the Barthel scale, there was no statistically significant reduction in the three evaluation periods ($p = .069$), with mean scores of 99.2 ± 2.75 points in 2018, 97.8 ± 4.3 points in 2019, and 98.3 ± 3.7 points in 2021. The fragility indicators were only registered in period 2—pre-pandemic and period 3—post-quarantine; and a significant increase in the SHARE-FI scale score was observed, where the higher the score, the greater the risk of fragility. In the gait speed test, the present study showed that older adults had a statistically significant reduction in gait speed, with 7.3% being classified as having gait problems in 2019, to 20.7% in 2021. As complementary data, older adults who had a 20% or more decrease in caloric intake had a relative risk of 1.86 (95% CI, 1.021–3.198; $p = .019$) for progressing from non-frailty to frailty. Regarding dominant handgrip strength, the low strength rating progressed from 37.8% at the period of the first measurement, to 53.7% in 2021.

Concerning the dietary pattern, from 2019 to 2021 there was an evident decrease in energy consumption (Table 2): in macronutrients, there was a tendency to reduce consumption of carbohydrates and proteins; there was a pattern of significant variation in sugar and cholesterol showed a reduction from 2018 to 2019 (only significant in sugar intake), but a significant increase from 2019 to 2021.

In the case of fiber and micronutrients, there was a significant trend in reduction of fiber consumption in the participants; furthermore, the mean values of vitamins and minerals presented did not cover the recommended daily intake for an older adult in any of the three evaluations carried out.

Discussion

This longitudinal study evaluated the anthropometric, clinical, and dietary changes in older adults who attended a recreational center in the city of Colima, Mexico. Evaluations were made at 18 months prior, 3 months before the pandemic, and 12 months

Table 1. Anthropometric evaluation in older adults.

	Period 1 pre-pandemic (n = 71)	Period 2 pre-pandemic (n = 71)	Period 3 post-quarantine (n = 71)	p
Height (cm)	154.7 ± 7.3	154.5 ± 7.5	154 (11) ^{b,**}	.041 ^F
Weight (kg)	70.4 ± 12	70.5 ± 12	69.6 ± 12.6 ^{a,b,*}	.011 ^A
BMI (kg/m ²)	29.3 ± 4.1	29 (4.8)	28.5(4.10) ^{b,**}	<.0001 ^F
Fat mass (%)	35.9 ± 6.3	36.4 ± 6.3	36.7 ± 7	.080 ^A
Lean mass (kg)	40.9 (8.9)	40.8 (11.4)	40.1(9.40) ^{a,b,**}	<.0001 ^F
Water mass (%)	46.3 ± 4.3	46 ± 4.3	44.8(6.3) ^{a,c}	.002 ^F

Note. BMI = Body Mass Index.

Data presented as mean ± standard deviation or median and interquartile range.

^A Significance determined using repeated measures ANOVA; ^F Significance determined using Friedman test.

^a Compared period 1 pre-pandemic vs period 2 pre-pandemic.

^b = compared period 2 pre-pandemic vs period 3 post-quarantine.

p < .05; **p < .0001; significance determined using Tukey or Wilcoxon test.

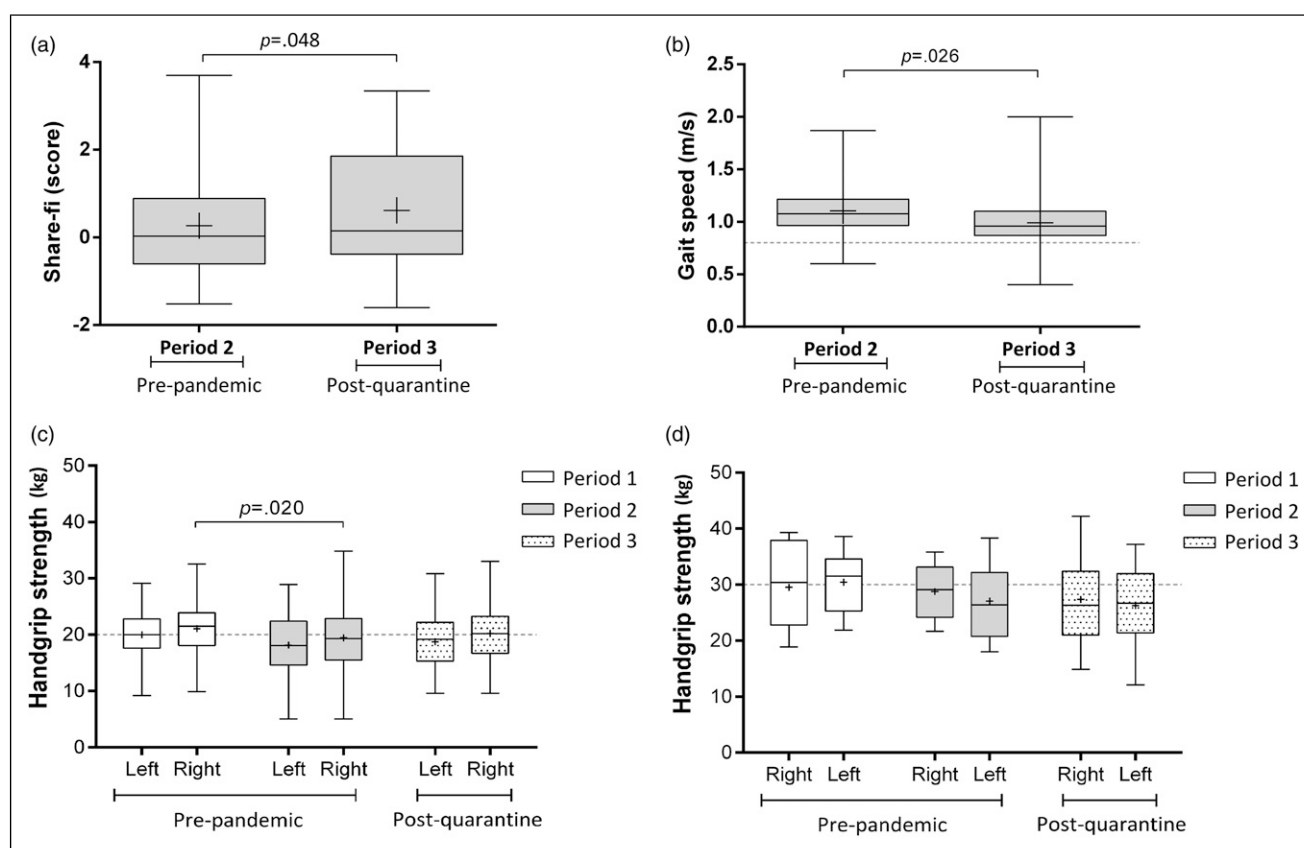


Figure 2. Dietary and clinical comparison between evaluation periods of older adults. The graphs represent the comparison of (A) frailty score, (B) gait speed and handgrip strength in females (C) and males (D) in the study participants. Dotted line represents the normal cut-off points for older adults. Data are presented as median and quartiles. Significance determined using Wilcoxon test.

after the start of quarantine put in place because of the COVID-19 pandemic. The present study did not find an increase in body weight or BMI, and adiposity showed minor variations. An increase in body weight after quarantine was reported by a study in Italy, finding that 48.6% of their assessed population had increased body weight (Di Renzo et al., 2020). In the present study, 57.7% ($n = 41$) of participants had excess body weight in period 1 and 2 pre-pandemic, and that decreased to

56.3% ($n = 40$) in period 3—post-quarantine. Obesity generates a chronic pro-inflammatory state that influences the innate and adaptive immune system (Green & Beck, 2017; Rogero & Calder, 2018); therefore, obesity contributes to immunosuppression and carries a higher risk of serious complications after infection with the SARS-CoV-2 virus (Xu et al., 2020).

An anthropometric finding that was statistically significant was height (despite having a similar average value); which

Table 2. Dietary evaluations of older adults.

	Period 1 pre-pandemic (n = 71)	Period 2 pre-pandemic (n = 71)	Period 3 post-quarantine (n = 71)	p
Energy (kcal)	1496.1 ±408.8	1392.4 ±387.9	1243.0 ± 349.0 ^{b*}	<.0001
Carbohydrates (g)	221.3 ±62.7	200.8 ±61.6	176.4 ±50.8 ^{b*}	<.0001
Sugar (g)	36.0 ±2.5	21.9 ±3.4 ^{a**}	37.2 ±3.8 ^{b**}	<.0001
Proteins (g)	64.5 ±20.9	55.3 ±17.8 ^{a**}	50.4 ±15.8 ^{b**}	<.0001
Lipids (g)	43.3 ±15.7	41.1 ±19.3	39.2 ±17.2	.358
Cholesterol (mg)	123.0 ±11.64	89.8 ±16.0	158.8 ±16.7 ^{b*}	.023
Fiber (g)	28.4 ±14.2	20.0 ±11.0 ^{a**}	18.1 ±11.0	<.0001
Calcium (mg)	726.8 ±364.6	579.1 ±334.5 ^{a*}	637.7 ±360.4	.023
Sodium (mg)	1200.9 ±743.6	405.7 ±620.9 ^{a**}	825.3 ±459.7 ^{b**}	<.0001
Vitamin A (UI)	692.9 ±401.1	355.4 ±247.6 ^{a**}	428.4 ±411.2	<.0001
Vitamin B9 (µg)	127.9 ±401.5	101.2 ±82.7	107.5 ±79.4	.206

Data presented as mean ± standard deviation.

Significance determined using repeated measures ANOVA.

^aCompared period 1 pre-pandemic vs period 2 pre-pandemic.

^b= compared period 2 pre-pandemic vs period 3 post-quarantine.

*p < .05; **p < .0001; significance determined using Tukey test.

can be explained by the slight variations characteristic of the aging process caused by the posture of older adults.

In the present study, there was a significant decrease noted in lean body mass and body water, especially between second vs. third evaluation periods, which assumes a significant gradual decrease in muscle mass in the study participants. Within the clinical parameters evaluated through screening and functional tests focused on older adults, a slight trend was shown in the Barthel test, although these changes are not significant enough for participants to be classified as having some degree of functional dependency. Most of the study participants, being part of the physical and social recreational groups, have sufficient autonomy to carry out their day-to-day activities; thus, the slight decrease is likely due to the aging process itself. This is similar with the MNA scale, where the score, although considered adequate, shows a significant tendency to decrease. In a nursing home in Croatia, 84 participants were evaluated and showed a high prevalence of osteosarcopenic adiposity syndrome accompanied by a poor energy intake; and, they had a higher risk of becoming infected with COVID-19 (Keser et al., 2021). In addition, the dietary pattern (deficient) in that study showed a nutrient intake like reports from the present study.

Considering the functional tests, the decrease in handgrip strength presented a higher score of physical frailty as evaluated by the SHARE-FI scale, and participants gait speed was also significantly slower, which is an alarming parameter for older adults. We hypothesized that, after a year-long absence of morning recreational activities a clear reduction in movement would be influenced, and, with it, a decrease in lean body mass. In a cohort study in Wuhan that analyzed 114 older adults hospitalized for COVID-19, they showed that those who were most at risk for sarcopenia could be an early warning for the risk of severe pneumonia; these findings reinforce the proposal that suggest that the use of rapid and

inexpensive tests can identify patients at risk in time (Ma et al., 2021).

We found a significant reduction in energy consumption, especially comparing 3 months before vs. 12 months after the onset of the pandemic; specifically, 54% of the older adults evaluated had more than a 10% decrease in their dietary pattern, with a negative balance of 7% when including all the participants. Despite the results found at the beginning of the quarantine period in Europe (Deschasaux-Tanguy et al., 2020), in the case of Mexico, and based on the National Health and Nutrition Survey on COVID-19, 43.1% of adults decreased their food consumption and 61.7% decreased physical activity (Shamah-Levy T et al., 2021). These findings may result from the absence of nutritional recommendations that were part of the nutritional education process implemented at the recreation center, as well as having a lower incentive to have a full breakfast since they did not have daily morning activities to perform; but, above all, no longer having the subsidized breakfast program made available (they only had monthly support from a basic pantry with non-perishable foods). The reduction in energy consumption in this study may be linked to various situations in the lifestyle of older adults, which, due to the start of the health contingency period because of COVID-19, may have been magnified. In addition, as reported in other studies, mental health during a pandemic also influences eating behavior such as feelings of stress and boredom (Marty et al., 2020), which could have an impact on appetite related to the presence of depressive symptoms (Jacka et al., 2010). The trend of change in eating patterns has also been reflected in Latin American countries such as Argentina, where increased consumption of foods such as sweets and soft drinks, and reduced consumption of fruits and vegetables (Sudriá et al., 2020), as well as the consumption of snacks during the night (Ammar et al., 2020), were reported. A study carried out on

253 women older adults in Japan demonstrated the link between the variety of the diet (identified with the search for 10 basic foods) and physical frailty; however, the study was cross-sectional so there is no evidence of the real influence of the quarantine period (Otaki et al., 2021).

Optimal protein intake along with physical exercise could maintain, or improve, muscle mass and function (Maeda & Akagi, 2016). If physical exercise is resorted to, the loss of capacity in musculoskeletal health will keep slowing down, which, in turn, could be a protective element against COVID-19, as demonstrated by a study carried out in Peru; where they detected a higher risk of contracting pneumonia in patients with sarcopenia (Altuna-Venegas et al., 2019).

Although this study does not report data on the consumption of fruits and vegetables, a reduction in their consumption can be noted due to the significant reduction in dietary fiber, which is accompanied by a significant reduction in vitamin A intake and maintaining a trend of low consumption of folic acid, covering between 25.2 and 31.7% of the daily requirement. Another nutrient studied as a protector against COVID-19 is calcium, which had significant variations in the three evaluation periods, making it certain that the daily intake requirement of 1200 mg/day was not met (Chávez-Villasana et al., 2013).

A critical nutrient that requires more attention is sugar intake since there was a statistically significant variation between the study periods. Based on total carbohydrates, at period 1—pre-pandemic the average consumption of sugar contributed to 16.2%, in period 2—pre-pandemic it reduced to 10.9%, and for period 3—post-quarantine it increased to 21.0%. It is likely that the ingestion of ultra-processed products increased, specifically the consumption of sugary drinks, since, if it had been desserts, the consumption of total fats would have also been higher. In addition, the per-capita consumption of soft drinks in Mexicans is 162 liters per year (Colchero et al., 2015).

The suspension of face-to-face activities at a social assistance center for older adults affected 9 out of 10 participants in their general health, since they later mentioned that they had perceived a negative impact on their lives after the COVID-19 pandemic. The alteration in mental health is recognized as a risk factor for an unhealthy diet (Jacka et al., 2010; Sánchez-Villegas et al., 2009). The recreational day center is a space for movement, adequate nutrition, leisure, and social inclusion; while despite attempts at using technology to include older adults, they comment that it is inadequate. Control of the COVID-19 pandemic is needed to prevent social and health lags in this age category.

The main strength of this study is its longitudinal nature, and the evaluations were carried out with the same instruments, in the same location, by the same trained professionals. In addition, a 15-month period is taken as a reference point between each evaluation, which coincided with the beginning of the health contingency period due to the health

pandemic. The measurements of the first vs. second evaluation periods allowed us to determine if changes noted in the study could be justified as part of the aging process, while the comparison of the second vs. third evaluation periods permitted us to discern the impact of the pandemic on nutritional indicators.

One of the limitations of this study was a reduced participation of males. This could be due to social factors such as the low participation of males in recreational activities; but also, due to biological factors such as life expectancy. Another limitation of the study was the evaluation process during a global health emergency, since evaluations depended on decisions of the health authorities; while fortunately, evaluations in 2021 were made amidst a shorter period of infections by COVID-19 in Mexico. In addition, the analysis of social parameters that occurred due to the suspension of face-to-face activities due to the COVID-19 pandemic were not reported (for example, if they had support to carry out safe social and recreational activities).

The generalizability of our results is low; but it allows for greater understanding on the state of health in a vulnerable population with unfavorable sociodemographic characteristics. One attribute of this study, is the analysis of the diet with quantitative techniques, being that, for practicality, in large sample sizes semi-quantitative methods are usually used to understand dietary patterns (Otaki et al., 2021). In addition, in this longitudinal study, the older adults evaluated were already familiar with the techniques used.

More studies are required to analyze the influence that COVID-19 has on various social and cultural determinants that need to be further analyzed. Additionally, further analysis of the impact on the perception of various dimensions regarding their own health in older adults who were diagnosed with COVID-19, in combination with their personal medical history, is needed; as well as analysis of social stressors related to COVID-19 (Polenick et al., 2021). Integrated care strategies for older adults need to be included in the action plans of public policies to achieve the established goals, and to attend this vulnerable age group to promote active and healthy aging.

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Institutional Review Board Statement

The project has the approval of the Bioethics Committee of an institute that verified by the National Bioethics Commission in Mexico in 2018 to 2020 (CEICANCL131216-BIOALZR-11) and from 2021 to 2024 (CEICANCL08012021-MARCOGP-01)

Declaration of Conflicting Interests

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