frontiers | Frontiers in Sustainable Food Systems

TYPE Original Research
PUBLISHED 03 November 2022
DOI 10.3389/fsufs.2022.961908

OPEN ACCESS

EDITED BY
Kathleen L. Hefferon,
Cornell University, United States

REVIEWED BY
Taher Babaee,
Iran University of Medical Sciences, Iran
Bughin Jacques,
Université Libre de Bruxelles, Belgium

*CORRESPONDENCE
Rodrigo Perez-Silva
rodrigo.perez@umayor.cl

SPECIALTY SECTION
This article was submitted to Nutrition and Sustainable Diets, a section of the journal Frontiers in Sustainable Food Systems

RECEIVED 05 June 2022
ACCEPTED 03 October 2022
PUBLISHED 03 November 2022

CITATION
Tiboni-Oschilewski O, Perez-Silva R, Biasini B and Scazzina F (2022) Dietary habits during the COVID-19 pandemic. Are work environments part of the problem?
Front. Sustain. Food Syst. 6:961908.
doi: 10.3389/fsufs.2022.961908

Dietary habits during the COVID-19 pandemic. Are work environments part of the problem?

Ornella Tiboni-Oschilewski[1], Rodrigo Perez-Silva[2]*, Beatrice Biasini[1] and Francesca Scazzina[1]

[1]Department of Food and Drug, University of Parma, Parma, Italy, [2]Center for Economics and Social Policy, Universidad Mayor, Las Condes, Chile

The COVID-19 pandemic pushed a large number of workers out of their offices and to their homes for a significant period of time for teleworking. However, some workers continued to work in their offices and others went home only partially. This arguably exogenous shock to the way in which workers performed their jobs opened the opportunity to evaluate whether work environments are ideal for promoting healthier diets and reducing overweight among office workers. We explore the results of two consecutive surveys (pre- and during-COVID-19) to examine whether workers working from home perceived their situation as more favorable in terms of healthy eating habits and weight gains. Our results show that workers did perceive their homes as places where they can follow healthier eating habits, but this was not accompanied by weight loss. On the contrary, workers fully teleworking were more likely to perceive weight gains and diet-related health problems than their in-office counterparts. Among teleworkers, those only partially teleworking were the most affected. This study opens many questions about food environments at work that remain unanswered. More studies in this area are needed to understand how the food at work affects the worker's health.

KEYWORDS

healthy eating habits, teleworking, food environments, COVID-19, food at work

Introduction

In 2020, over 3.1 billion people could not afford healthy diets, as they are estimated to be five times more expensive than those that only satisfy calorie requirements (FAO, 2022). Unhealthy diets are often based on cheap food products rich in simple carbohydrates and fat, and many include high percentages of ultra-processed foods high in calories and critical nutrients, such as sodium, sugars, and trans-fat. High calorie intake coupled with the absence of nutritious foods (rich in micronutrients, fiber, and phytochemicals) often leads to overweight and/or obesity and dietary related chronic diseases such as diabetes, cancer, or cardiovascular diseases. The costs produced by diet-related morbidity and mortality of mainly non-communicable diseases are projected to globally surpass USD 1.3 trillion per year by 2030 (OECD, 2019). Furthermore,

unhealthy diets not only have repercussions on health and are an important economic burden, but also generate other hidden costs related to different Sustainable Development Goals (SDGs), such as climate change (Lang and Pamela, 2018). For instance, diet-related greenhouse gas (GHG) emissions are estimated to surpass USD 1.7 trillion by 2030 (FAQ, 2020).

In Chile, 28% of adults are obese, and up to 80% of the deaths in Chile are attributable to diet-related diseases (FAO, 2019) that, in 30 years, are estimated to be responsible for an expected decrease of 3.5 years in the life expectancy (OECD, 2019). Probably many of these deaths will correlate with an increase in mortality in working-age adults, as reported for the United States in a report by the National Academies of Sciences, with a negative effect on the US workforce, productivity and competitiveness of their businesses, economy, and even national defense (National Academies of Sciences Engineering, 2021). An increase in mortality in working-age adults also impacts health care costs for both government and employers.

The Chilean workforce represents almost 60% of the population (INE, 2020), and workplaces are an important feeding context because people spend most of their day working. Chile has ratified the International Labor Organization (ILO) Convention No. 187 (2006) on the promotional framework for safety and health (International Labour Organization, 2012) and even though there are good examples related to improving food at work and costs seem to not be a barrier for employees (only stated as such by 13% of the companies (International Labour Organization, 2012), many employees do not benefit from access to healthy food at work. The Chilean Supreme Decree N° 594 (1999), which complements Law 16.744 establishes a minimum requirement on nutrition for workplaces referred to as providing a safe place to eat and ensuring at least 30 min for meal consumption (International Labour Organization, 2012). However, many companies, especially smaller companies, and those with a predominantly female workforce do not achieve even one of these obligations. The larger the company, the more likely it is to comply with these minimum requirements and to have a canteen, which is the food benefit preferred by workers (International Labour Organization, 2012). Nonetheless, only 30% of people work in companies with more than 200 employees, while the vast majority (43% of men and 51% of women) work in companies smaller than five people (INE, 2020). As a result, almost a quarter of the workers do not even have a place to eat. These situations are exacerbated within informal jobs. In a Colombian study of informal work, an average daily working time of 10 h was estimated, and more than half of the respondents declared to not have established eating hours during the working time (Duque et al., 2019).

The global work force experiences unequal access to healthy food, time for eating, and the possibility to eat at their workplaces (Wanjek, 2005). The access to adequate food within workplaces in Chile is also related to income: income is positively correlated with more time to eat, more options of places to eat, more probability to include fruits and vegetables at lunch and to receive food-related benefits, which were received by 61% of the workers, as stated by the same study (Wanjek, 2005).

The main causes mentioned for skipping lunch in Chile were lack of time and money, leading to up to 30% of workers skipping lunch on a regular basis (International Labour Organization, 2012). This leads to fatigue, headache, lower concentration, and irritability, among other symptoms, which in turn impact productivity at work. A direct relationship can be found between productivity, labor safety, and a healthy diet. Wanjek (2005) found that adequate nutrition could improve productivity by up to 20%, while iron deficiency lowers work capacity and performance by up to 30%. Therefore, improving food at work not only impacts the individual health, but also the companies' economy: obese workers are twice more likely to show absenteeism (International Labour Organization, 2012), have higher risks of work accidents (Hoffmeister et al., 2014) and cost the company up to 6 times more than a non-obese worker (Ávila, 2015).

The COVID-19 pandemic has had important impacts on living and eating habits worldwide. Weight gains of 10% modify the brain, causing personality impairments leading to impulsiveness and lesser resistance to desires (Navarro-Cruz et al., 2021). Due to at least temporary lockdowns and teleworking, for many people eating has shifted from at work canteens and restaurants to home cooking or food delivery (Ferrante et al., 2021). Thus, the COVID-19 pandemic has changed and exacerbated many social inequities, eating habits being one of them.

In France, an increased snacking and consumption of sweets, biscuits, and cakes accompanied by a decreased consumption of fresh products such as fruits and fish was found, leading to weight gain in 35% of adults participating in a national survey (Deschasaux-Tanguy et al., 2021). A review studied the dietary habits due to the lockdown, and even though there are some people that improve their dietary habits, those who worsened them were associated with other detrimental lifestyle changes, such as mental health issues, weight gain, and less physical activity (Bennett et al., 2021). Furthermore, another review found that every socioeconomic group increased their caloric intake, estimating that 2 years after the pandemic offset, adults would increase by five percentual points in overweight (O'Connell et al., 2022).

On the other hand, positive changes were also reported in the same study in France: about a quarter (23%) of interviewees lost weight, 40% increased home cooking and 19% increased physical activity (Deschasaux-Tanguy et al., 2021). In an Italian study weight loss was also found in almost 60% of participants (Izzo et al., 2021). As shown in a Canadian study (Carroll et al., 2020), families with children were found to eat more food, more snacks, especially among mothers, and fewer fast food and takeout, showing a preference for at-home cooking, and also

involving the children more in the process. Furthermore, an observational study carried out in 38 countries, found increased planning, selecting, and preparing of healthy foods, leading to an improved food literacy related to confinement and perception of more time availability (De Backer et al., 2021).

The pandemic has also changed the diet in Chile. A sub-national study that surveyed students, administrative officials, and teachers of the University of Bio-Bio found the pandemic to be positive in relation to higher adherence to the Mediterranean diet (Navarro-Cruz et al., 2021), therefore, the confinement led in some cases to healthier dietary habits. One study carried out on a total of 700 adults found that increased cooking was higher in women compared to men, and more than a half responded to eating more than before the pandemic, including junk and fried food up to two times a week by 63% of respondents (Reyes-Olavarría et al., 2020). The same study found associations between weight gain with many factors, including cooking less. The authors also found longer quarantines to be associated with a greater desire for pleasant foods. On the other hand, an increase in fruit and vegetable cooking was associated with weight loss (Navarro-Cruz et al., 2021), whereas weight gain was associated with lifestyle deterioration during confinement and not due to emotional influence. As said before, women cooked more during the pandemic, and this could be related to significantly higher healthy eating index scores in female compared to male workers (Schifferli-Castro et al., 2020).

While some employees continued to work in person, many were partially or totally teleworking during the pandemic. This change in working conditions then represents an important opportunity to test whether work environments affect eating habits and specifically whether they are associated with healthier or worse eating habits compared to the pre-COVID-19 situation.

Although the described evidence is not conclusive in terms of the effects of the lockdowns on eating habits and weight loss, the aim of the study is to explore if there were any differences between dietary habits when teleworking compared to working from the office and if these differences had impacts on participants' perceived weight.

Data and methods

Two nationwide online surveys on the work environment in relation to food intake and dietary patterns were conducted during September 2019 (pre-COVID-19 survey) and between November 2020 and early January 2021 (COVID-19 survey). The google forms survey was sent by mail to every person who contacted the Job Portal Laborum (https://www.laborum.cl/), which is an open well-known website to look up for jobs vacant in any field and apply, mostly for professionals. The two questionnaires covered some similar questions ($n = 20$), but the COVID-19 survey had 13 more questions regarding the status of teleworking and its changes. The questions were related to socio-demographic dimension (e.g., gender, age, educational level, current employment status); work modality (full presence, half-teleworking, full teleworking – in the COVID-19-survey); eating at home/office; food provision by employers; if the employer should be responsible for nutrition during working hours; which food benefit is the most valued by workers; if they spend more/less money on food during teleworking compared to working at the office (in the COVID-19-survey); an approximation of the money spent in food at work; mandatory food pauses; healthiness of their food (subjectively answered, and if improved or worsened during the pandemic); the understanding of healthy diet; if there is a place to eat at the office; and eventual weight variations (perception about gaining or losing weight – in the COVID-19-survey) among others (refer to Supplementary material). In particular, the survey included a question investigating the presence of possible diet-related health problems since the beginning of the pandemic in terms of high cholesterol, diabetes, weight loss, overweight, gastritis, arterial hypertension, and "other" as the last option. The full questionnaire used for the two surveys can be found in the Supplementary material.

From the pre-COVID-19 survey, a total of 1,962 responses were obtained. However, after excluding participants providing incomplete survey forms and those who were unemployed for more than 2 months, 1,732 cases were considered for the analysis. From the COVID-19 survey, 757 responses were obtained, 520 out of which were used for the analysis, after applying the same exclusion criteria as the pre-COVID-19 survey.

Data analysis

We estimated the association between the place of working (teleworking or at the office) and several diet-related outcomes. These are changes in food habits, overweight, weight reduction, and diet-related problems as reported by the individuals included in the surveys.

Let Y_{ij} be the outcome of interest, such as overweight for individual i working under condition j (fully teleworking, partially teleworking, in the office), we estimate a logit model as follows:

$$Y_{ij} = \alpha + \beta W_{ij} + \gamma X_{ij} + \varepsilon_{ij} \quad (1)$$

Here, Y_{ij} is a dichotomous variable at the individual level indicating whether the individual considers him or herself as being overweight, W_{ij} is a categorial variable identifying whether the individual works at the office, partially from home, or fully from home. X_{ij} is a vector of control variables, such as age, sex, and schooling.

We then estimated the same logit model for other outcome variables, such as having experienced weight reduction, diet-related problems, and perceived changes in food habits, which were applied as dichotomous variables, therefore suitable to run logit models. We report the results of all these models in the respective section.

As mentioned in all cases, the outcome variable is dichotomous, with value one when the perceived problem occurs (and zero if not), and the main independent variable of interest is a categorical variable indicating the working place, with mutually exclusive alternatives (in office, partially teleworking or fully teleworking).

Results

Participants characteristics

The characteristics of the participants are listed in Table 1. A large share (85%) of the total sample works in the office (n = 1,909), while only 13% is fully teleworking (n = 284) and less than 3% of the sample partially teleworks (n = 59).

As reported in Table 1, having healthier eating habits is more likely among fully teleworking workers, as declared by almost 65% of them. Lower proportions have been reported instead for workers fully working in the office (57%), and for those partially teleworking (56%).

Nonetheless, fully teleworking people are more prone to experience overweight (29%) and to experience diet-related health problems (46%) than fully in-office workers (19% and 36%, respectively). However, workers who partially teleworking are the ones with the highest declaration of overweight (36%) and diet-related health issues (68%).

Workers operating from home, either partially or fully, are on average older than those working from the office. This is noticeable when looking at the percentage of workers over 45 years old, which is 34% for workers fully teleworking, and 39% for those partially teleworking. On the other hand, around 22% of the workers working in the office are over 45 years old.

Women are more common among workers either in the office (60%) or fully teleworking (62%) compared to workers partially teleworking (49%). With respect to education, more educated workers are either partially teleworking (93%) or fully teleworking (89%), but a large share of them is working from the office as well (64%; Table 2).

It is worth noting that despite almost 9% of respondents working in administration or administrative related jobs and 10% of workers in sales, there is not a clear occupation or work area that stands out in relation to the others. As an example, 5% of workers work in technology, 6% in education, almost 4% in engineering, and above 3% in medicine, construction, and finance. Unfortunately, we could not properly characterize around 38% of the sample because almost 23% of it did not provide a response, and above 15% stated that his/her work was in the "other" area, without providing any specification.

TABLE 1 Descriptive statistics of the sample.

	In-office working (n = 1,909)	Partially teleworking (n = 59)	Fully teleworking (n = 284)
Participants	84.8	2.6	12.6
Gender			
Women	60.3	49.2	61.9
Men	39.7	50.9	38.0
Age range			
18–24 years	7.4	1.7	5.3
25–34 years	39.1	32.2	34.2
35–44 years	31.1	27.1	26.8
> 45 years	22.5	38.9	33.8
Education			
High school or less	9.1	3.4	1.1
Technical school	26.6	3.4	9.9
College or more	64.3	93.2	89.1
Experiencing weight increase			
No	8.1	64.4	7.8
Yes	18.9	35.6	29.2
Experiencing weight loss			
No	98.3	96.6	97.5
Yes	1.7	3.4	2.5
Healthier eating during the pandemic	56.6	56.0	64.8
Diet-related health problems	36.4	67.8	46.5
Gastritis	8.2	10.2	3.2
High blood pressure	1.4	0.0	0.7
Diabetes	0.8	0.0	1.1
High cholesterol	1.3	1.7	1.8

Data are expressed as number (%).

From the obtained results 59% of the respondents in both surveys reported that a healthy diet is one low in sugar, salt, and fats; 18% considered healthy diets those with no processed and packaged food, 14% believed healthy diets are those with no fast/*junk* food; 12% selected the option related to the inclusion of food having no front of package nutritional "high in…" signs.

A share of 34% of the participants receives a food "benefit" from their employers, of which 74% are food that is given from the employer (voucher, canteen, or extra money in the salary for food expenses). A low percentage (12%) of the participants think the employer should be responsible for their food during working hours, while among those who partially teleworking,

10.3389/fsufs.2022.961908

TABLE 2 Respondents' work areas.

Work area	Number ($n = 2,252$)	%
No response	516	22.9
Other	338	15
Sales	274	12.2
Administration	223	10
Mathematic	210	12
Education	131	5.8
Medicine	74	3.3
Construction	72	3.2
Logistics	64	2.9
Communications	58	2.6
Gastronomy	51	2.2
Human Resources	48	2.1
Mining	41	1.9
Law	40	1.8
Insurance	22	1.0
International trade	21	0.9
Design	9	0.4

For this table, we grouped: engineering, technology, and finance sector into mathematical; marketing and communications into communications; sales and callcenter into sale; and administration and secretary into administration.

only 3% (a quarter of who agreed with this statement) still believed it when only teleworking. More than half of the sample (63%) think it is a shared responsibility and 26% think it is their own responsibility. In addition, 22% of the respondents preferred a food benefit a food voucher, 19% preferred the canteen at work, while 18% preferred extra money in the salary.

Considering the expenses related to food at work, 4% declare spending more than CLP$6000, 8% between CLP$4000 and CLP$6000, 43% between CLP$2000 and CLP$4000, and 9% less than CLP$2000. Half of the respondents declared not to spend money on food at work, of which 36% because they were given food at work, and the remaining because they brought their own food which in 23% of the cases was cooked by somebody else and only 24% cooked by themselves. Less than 20% of the COVID-survey respondents stated they were spending less money during the pandemic on food, while 43% reported spending more money.

Regarding the regulated mandatory pauses of eating at work, 91 and 6% declared to have lunch and only snacks, respectively, while 5% included breakfast as a mandatory pause, and 2% selected dinner. Multiple options could be selected, however, showing different combinations. Most of the sample (65%) of the sample had 1 h to eat, 25% had half an hour, and 8% had 1 h and a half. The same percentage (18%) declare to have increased and lowered the time spent eating during the pandemic. For those partially teleworking, 29% declared to spend 30 min eating at home, while in the office it increased to 58%. Finally, 61% mentioned having a canteen, 11% were not functioning during the pandemic, while almost one quarter (24%) of respondents declared eating at their workstation.

Associations between healthy eating habits, place of work, socio-demographic characteristics, healthy eating habits, body weight change, and health-related conditions

We present three sets of results from the regression analysis. The first set (Table 3) deals with the association between the working place and changes in eating habits, the second set (Table 4) shows the results of the association between the working place and perception of being overweight, and finally (Table 5) the third set presents the results for the association between working place and perceived diet-related problems.

In Table 3, we present three different models for the association between place of work and eating habits. The first column (1) is our baseline model, with no controls. The second model (2) includes demographic characteristics, such as gender, age, and education. The final model, in column (3), adds controls for health problems declared by the individual. All presented estimates are coefficients from the logit regression, but the interpretation is given in terms of odds ratios ($e^{(\hat{\beta})}$).

As shown in Table 3, in all regression models, the coefficients showed that the impact of being fully teleworking on healthy eating habits is significantly positive, both when univariate (1) and multivariate models are considered (2, 3).

When looking at the fully specified model in column (3), we observe that being fully working from home is associated with a 45% increase in the likelihood of having a healthy eating habits (with a point estimate of 0.378). Thus, workers who work from home are 1.5 times more likely to declare that they eat healthy than those who work in the office.

It is worth noting that the significant associations between the workplace and perceiving eating healthier only appear when comparing workers who are fully working from home with respect to those fully in the office. Workers who are partially teleworking do not perceive themselves as having healthier eating habits.

Regarding control variables, there are no differences between men and women in terms of healthy eating habits, but older workers tend to have healthier eating habits. Workers aged 35–44 years, for instance, are almost two times more likely to declare eating healthier (point estimate of 0.641 in the fully specified model) with respect to their younger counterparts (18–24 years). Also, more educated workers tend to have healthier eating habits than those workers who did not attend technical or college education. As was the case with age, the likelihood of declaring having healthier eating habits increased with education, with point estimates of 0.607 for workers who

10.3389/fsufs.2022.961908

TABLE 3 Regression analysis for having healthy eating habits by considering 3 sub-sets of variables: place of work (Logit model 1), place of work, age and education level (Logit model 2), place of work, age, education, weight status, and health conditions (Logit model 3).

	Logit regression model		
	1	2	3
Dep. Variable: Healthy eating habits	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)
Intercept	0.264** (0.0462)	−0.787** (0.221)	−0.661** (0.227)
Place of work			
In office	−1-	−1-	−1-
Partially teleworking	−0.0261 (0.266)	−0.229 (0.272)	0.0944 (0.286)
Fully teleworking	0.345*** (0.133)	0.196 (0.137)	0.378*** (0.145)
Gender			
Males		−1-	−1-
Females		0.00921 (0.0903)	0.102 (0.0949)
Age range (years)			
18–24		−1-	−1-
25–34		0.326* (0.177)	0.491*** (0.183)
35–44		0.452** (0.181)	0.641*** (0.187)
> 45		1.048*** (0.189)	1.221***
Education level			
Secondary education level or less		−1-	−1-
Technical education		0.504*** (0.178)	0.607*** (0.184)
Tertiary education		0.649*** (0.165)	0.711*** (0.171)
Experiencing overweight			
No			−1-
Yes			−1.403*** (0.117)
Experiencing weight reduction			
No			−1-
Yes			−0.709** (0.322)
Experiencing gastritis			
No			−1-
Yes			−0.590*** (0.137)
Having high blood pressure			
No			−1-
Yes			−1.852*** (0.428)
Having diabetes			
No			−1-
Yes			−1.243** (0.485)
Having high cholesterol			
No			−1-
Yes			−1.386*** (0.394)

Considers only employed workers at the time of each survey. Number of observations: 2,252; SE: standard error; $^{*}p < 0.1$ $^{**}p < 0.05$, $^{***}p < 0.01$.

TABLE 4 Regression analysis of experiencing overweight by considering 2 sub-sets of variables: place of work (Logit model 1); place of work, age, and education level (Logit model 2).

	Logit regression models	
	1	2
	Coeff. (SE)	Coeff. (SE)
Intercept	−1.459** (0.0585)	−2.355** (0.313)
Place of work		
In office	−1-	−1-
Partially teleworking	0.866** (0.278)	0.936** (0.283)
Fully teleworking	0.575** (0.143)	0.597** (0.148)
Gender		
Males		−1-
Females		0.275* (0.112)
Age range (years)		
18–24		−1-
25–34		0.595* (0.251)
35–44		0.635* (0.254)
> 45		0.236 (0.265)
Education level		
Secondary education level or less		−1-
Technical education		0.288 (0.237)
Tertiary education		0.232 (0.222)

Considers only employed workers at the time of each survey. Standard errors in parentheses; SE, standard error; $^{*}p < 0.05$, $^{**}p < 0.01$.

graduated from technical education, and 0.711 for workers who graduated from college.

Finally, all diet-related health problems, such as overweight and high blood pressure, are negatively correlated with healthy eating habits. Notice that this does not mean that workers eat unhealthier *because* they are overweight. This association, and all the others related to health problems, act as controls for the main variable of interest and should only be interpreted as correlations.

Associations between experiencing weight change, place of work, and socio-demographic characteristics

Table 4 provides an interesting picture when compared with the results of Table 3. In our previous results, it seems that workers perceive themselves as eating healthier because of their time working from home. However, all workers who are teleworking, either partially or fully, think that they have gained weight since working from home. For instance, workers fully teleworking are 82% more likely to perceive themselves as overweight than those fully working in an office. Interestingly, workers only partially teleworking are those who declare being overweight the most.

TABLE 5 Regression analysis of experiencing diet-related health issues by considering 2 sub-sets of variables: place of work (Logit model 1); place of work, age, and education level (Logit model 2).

	Logit regression model	
	1	2
	Coeff. (SE)	Coeff. (SE)
Intercept	−0.560** (0.0476)	−1.350** (0.236)
Place of work		
In office	−1-	−1-
Partially teleworking	1.304** (0.283)	1.446** (0.288)
Fully teleworking	0.419** (0.128)	0.474** (0.133)
Gender		
Males		−1-
Females		0.463** (0.0929)
Age range (years)		
18–24		−1-
25–34		0.524** (0.191)
35–44		0.506** (0.195)
> 45		0.290 (0.201)
Age 25–34 years old (Ref. 18–24)		
Education level		
Secondary education level or less		−1-
Technical education		0.247 (0.183)
Tertiary education		0.007 (0.171)

Considers only employed workers at the time of each survey. Number of observations: 2,252; Standard errors in parentheses. **p < 0.01, *p < 0.05.

Associations between experiencing diet-related health issues, place of work, and socio-demographic characteristics

Finally, in Table 5 we present the results for the association between diet-related health problems and teleworking in univariate and multivariate models. As before, our dependent variable is dichotomous, taking the value of one if the worker presents any diet-related health problem (and zero otherwise). This includes having weight gain or loss since the change in their place of work, and/or gastritis, high-blood pressure, diabetes, or high cholesterol.

Discussion

We tested whether the place of work is perceived as a part of the problem when it comes to healthier diets. To do this, we used two online surveys conducted before (2019) and during (2020-2021) the COVID-19 pandemic, directed to workers in different economic sectors and with heterogenous responses to lockdowns. Since lockdowns were imposed exogenously on workers, they were forced to either work from home or to continue working in the office. Among those who were sent home, some of them did it only partially, providing variation in responses to changes in diets and weight gain, among other diet-related issues.

We performed several analyses attempting to first show whether changes in working conditions (moving from in-office to at-home work) modify workers' eating habits and whether it influenced the possibility of experiencing weight gain, including overweight.

Methodological constraints

It is important to note that we do not include year dummies, because in the first wave of the survey no question was asked regarding the place of work. Given that, we assume that all workers in the first wave were working from their offices, which was common in Chile before the COVID-19 pandemic, but that prevents us from using year dummies as there is no variation in terms of places of work within one of the years. Similarly, it is relevant to note that the surveys were voluntary and self-administered, so there is a potential issue regarding the validity of the answers, which could then in turn affect the estimates and results. This is if the motives for taking the survey are related to health, eating habits, or concern for overweight (say, those with healthier eating habits are more interested in answering the survey than their counterparts), then that could affect the estimates by mostly capturing the answers of one specific type of worker. However, since the topic covered in the survey is work environments without a direct and explicit link to eating habits, we do not have a good reason to believe that respondents are more prone to be healthier or have more/less concern for weight gain/loss than they would if the survey was randomly assigned.

Moreover, given that we are using two consecutive online surveys, even if that is true, that should not be a relevant problem as we are not interested in estimating levels in these variables for each specific year, but changes in these conditions over time. To the extent that the potential bias is highly relevant to be constant over time, then the estimation of these changes should be unbiased.

We are, however, aware that our sample is more educated and richer than the local population, and that could have an impact on the outcome variables, mainly in relation to the perception of being overweight, places of work, and eating habits. Our interest is to estimate changes in those conditions that should be unbiased, as the primary outcomes are not levels *per se*. Nevertheless, our results should be interpreted as being representative of a subsample of the Chilean population, which is on average more educated, have access to the internet, and perform white collar jobs usually in offices.

Individual perceptions and sociodemographic aspects

Respondents believe a healthy diet is those low in critical nutrients (sugar, salt, fat), selected by 59% of the sample, which is interesting as probably the easiest way to classify food is related to the front of package nutritional "high in…" signs, but this option was selected only by 12% of the respondents. This could suggest that people in Chile base their general food choices on these nutrients as a result of the educational campaign and the labeling of food packages in the country, as they are the same nutrients as in the stop signs.

Only one in three people received a food "benefit", which leaves two-thirds of the sample with no support for their diet during work hours. The most common benefit is having free meals provided by the employer (74%), which is the most preferred form (41%). Interestingly, for respondents that did believe the employer was responsible for their food at work, only a quarter of them still believed the same if they were teleworking, which could be interpreted as a feeling of independence from the employer, lack of supervision, and less support.

Despite the economical constraints were not an objective of this study, the results showed a tendency to not spend money on food at work, mostly by employees that bring their own food from home. This could be related to the fact that money is one of the most important drivers of what to eat, and people prefer to save money by bringing their own food, which could be especially easier for the quarter of respondents that somebody else cooked for them.

Even though for almost all of the respondents' lunch was the most common mandatory pause to eat, 6% of the respondents declared to have no main meal pause possibility at work, leaving them only with the possibility to have snacks, which could contribute to worse nutrient intake. One quarter of the sample declare having only half an hour to eat at work. For those with hybrid modalities (in office and teleworking), having less time to eat at home versus at work was a common finding. Even worse, a quarter declared to eat at their workstation. This means no social interaction, a break full of distractions instead of being focused on the meal, and probably not a proper break at all. During the pandemic, for those living alone probably this was the most common scenario to eat.

It was interesting to note that the more educated the respondent, the more chances to be fully teleworking or partially teleworking. It is clear that the sample of respondents is skewed to the right in terms of the skill distribution with respect to the Chilean population, which is not a representative sample of the Chilean population. This is similar to other surveys, that also found that the more educated had a higher chance to telework (O'Connell et al., 2022). Also related to this, the same study found that being at home increased the chances of increasing the calories, although we did not observe significant associations with education level. In our study, we noticed that the perception of being overweight is more likely among older workers. This is something we should expect, as metabolism and physical activity decay with age. However, we do not see differences between workers at both ends of the age distribution regarding their perception of being overweight. Workers who are partially teleworking do not perceive themselves as having healthier eating habits. Whereas this is an interesting finding, it is also expected as workers who are partially teleworking probably also eat out of home, or even if they do eat at home, they probably have less time to cook a healthier meal.

Together, these results suggest that, since teleworking started massively during the COVID-19 pandemic, weight gain could be related to a reduction in the number of days/hours dedicated to exercise, an increase in alcohol consumption, snacking, and stress, among other factors (Bennett et al., 2021; Fukushima et al., 2021). It is worth noting that the lockdowns in Chile were very strict so a reduction in physical activity is certainly possible during the pandemic. To that extent, it is not surprising that even though workers were eating healthier, they would still gain weight. This could be consistent with other studies, that have found an increase in the purchase of calories mostly from ingredients, that is, food to cook at home that could be healthier than eating out but still represent an increase in the calories consumed (O'Connell et al., 2022). However, we cannot rule out the possibility that the perceptions regarding healthy eating habits are somewhat misaligned with the actual eating habits workers were having.

Workers who were either fully or partially teleworking were significantly more likely to experience diet-related health problems than in-office workers. In particular, workers fully teleworking were 60% more likely to experience a diet-related health problem than those working in the office. What is interesting is that workers only partially teleworking are far more likely to experience these problems than their in-office counterparts, but also than their peers fully teleworking. As mentioned, one potential reason for these results is that workers only partially teleworking experience the "worst of both worlds". That is, they do not have the time to cook and prepare healthier meals, but at the same time, they only go out to work. Therefore, lack of exercise and an increase in snacking or alcohol consumption could be also a factor here, with the addition of not having the time to actually make changes in the diets. This is consistent with our initial results, in which we see that workers only partially teleworking do not think that they are eating healthier than those working from the office.

It is important to mention that this survey was carried out during the first period of the pandemic, therefore, the results could be different from those that could arise in the later stages of the pandemic. Another important aspect to consider is that eating unhealthy and lack of well being (or *vice versa*) could be a vicious circle, i.e., people tend to eat less healthy when experiencing anxiety or stress, while it could also be true that the well being could also affect the healthiness of the diet (Xiao et al., 2021). More studies are needed to understand how the work environments -either in the office or at home- affect the diet

and health outcomes of the workers. Surprisingly, most of the studies in the literature during the pandemic and teleworking reported more mental health than physical health, a tendency that was contradictory with the research prior to the pandemic (Oakman et al., 2020), therefore our results are difficult to compare with as we assessed primarily the dietary habits. Finally, most of the evidence is from the global north showing a lack of data and evidence in the global south (Islam, 2022), where the sociodemographic characteristics such as education level and social protection policies could be very different.

Conclusion

Our results showed that workers perceive an improvement in their eating habits, transitioning to healthier diets as a consequence of working from home. However, despite workers eating healthier, working from home was associated with weight increase and diet-related health problems, probably due to an excessive caloric intake and lack of physical exercise. Taken together, these results suggest that working conditions are suboptimal for Chilean workers, who perceive that their chances of eating healthy decrease when they have to do in-office work.

As mentioned, our results also suggest that those who only partially teleworking are the most affected. We believe this is because they experience an overall worse situation regarding the adoption of healthier diets since they still have to move to and from the office, but at the same time were forced to stay home for other activities, potentially related to physical activity and other aspects of a healthy life, such as snacking and an increase in alcohol consumption.

Our study is limited in the sense that it stems from two voluntary online surveys, mostly responded to by white collar, educated workers in Chile. We expect these results would be even more alarming for those less educated workers. A broader and potentially more alarming result could be found if we had access to information on the consumption of healthy diets and diet-related health problems for blue collar workers. However, we believe our results are informative of the changes in eating habits and the consequences of the COVID-19 pandemic on physical health.

Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Ethics statement

Ethical review and approval/written informed consent was not required as per local legislation and institutional requirements.

Author contributions

OT-O and RP-S: conceptualization, methodology, validation, formal analysis, and investigation. RP-S: software. OT-O: data curation. OT-O, RP-S, BB, and FS: writing—original draft preparation, writing—review and editing, and visualization. RP-S and FS: supervision. FS: project administration. All authors contributed to the article and approved the submitted version.

Acknowledgments

We thank Ms. María Jesus García-Huidobro from Laborum for providing the data used to carry out this study.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2022.961908/full#supplementary-material

References

Ávila, J. A. T. (2015). Brecha en los costos laborales debido a la obesidad de los trabajadores. *Contaduria Univ. Antioquia* 67, 21–44. Available online at: http://www.scielo.org.ar/scielo.php?script=sci_arttext&pid=S1851-30342019000200040&lng=es

Bennett, G., Young, E., Butler, I., and Coe, S. (2021). The impact of lockdown during the COVID-19 outbreak on dietary habits in various population groups: a scoping review. *Front. Nutr.* 8, 626432. doi: 10.3389/fnut.2021.626432

Carroll, N., Sadowski, A., Laila, A., Hruska, V., Nixon, M., Ma, D. W., et al. (2020). The impact of COVID-19 on health behavior, stress, financial and food security among middle to high income Canadian families with young children. *Nutrients* 12, 2352. doi: 10.3390/nu12082352

De Backer, C., Teunissen, L., Cuykx, I., Decorte, P., Pabian, S., Gerritsen, S., et al. (2021). An evaluation of the COVID-19 pandemic and perceived social distancing policies in relation to planning, selecting, and preparing healthy meals: an observational study in 38 countries worldwide. *Front. Nutrition* 7, 621726. doi: 10.3389/fnut.2020.621726

Deschasaux-Tanguy, M., Druesne-Pecollo, N., Esseddik, Y., De Edelenyi, F. S., Allès, B., Andreeva, V. A., et al. (2021). Diet and physical activity during the coronavirus disease 2019 (COVID-19) lockdown (March–May 2020): Results from the French NutriNet-Santé cohort study. *Am. J. Clin. Nutr.* 113, 924–938. doi: 10.1093/ajcn/nqaa336

Duque, M. O., Cardona-Arango, M. D., Segura-Cardona, A. M., Rodríguez-Ospina, F. L., Molina, C. F., and Ochoa, D. A. (2019). Influencia de los hábitos alimentarios y condiciones de trabajo en la prevalencia de sobrepeso y obesidad de trabajadores informales de la ciudad de Medellín. *Rev. Arg. Endocrinol. Metabolism.* 56, 40–49.

FAO (2019). *Panorama de la Seguridad Alimentaria y Nutricional en America Latina y el Caribe 2019: Hacia. entornos alimentarios mas Saludables Que Hagan Fre. Place of publication not identified: Food and Agriculture Org.*

FAO, IFAD, UNICEF, WFP, and WHO. (2020). *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets*. Rome: FAO. Available online at: https://doi.org/10.4060/CA9692EN (accessed September 6, 2021).

FAO, IFAD, UNICEF, WFP and WHO. (2022). *The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable*. Rome: FAO. Available online at: https://doi.org/10.4060/cc0639en

Ferrante, M. J., Goldsmith, J., Tauriello, S., Epstein, L. H., Leone, L. A., and Anzman-Frasca, S. (2021). Food acquisition and daily life for US families with 4-to 8-year-old children during COVID-19: findings from a nationally representative survey. *Int. J. Environ. Res. Pub. Health* 18, 1734. doi: 10.3390/ijerph18041734

Fukushima, N., Machida, M., Kikuchi, H., Amagasa, S., Hayashi, T., Odagiri, Y., et al. (2021). Associations of working from home with occupational physical activity and sedentary behavior under the COVID-19 pandemic. *J. Occup. Health* 63, e12212. doi: 10.1002/1348-9585.12212

Hoffmeister, L., Vidal, C., Vallebuona, C., Ferrer, N., Vásquez, P., and Núñez, G. (2014). Factores asociados a accidentes, enfermedades y ausentismo laboral: análisis de una cohorte de trabajadores formales en Chile. *Ciencia Trabajo*16, 21–27. doi: 10.4067/S0718-24492014000100005

INE. (2020). Boletín Estadístico: Empleo Trimestral[1]. Available online at: https://www.ine.cl/docs/default-source/ocupacion-y-desocupacion/boletines/2020/pa%C3%ADs/bolet%C3%ADn-empleo-nacional-trimestre-m%C3%B3vil-octubre-noviembre-diciembre-2020.pdf?sfvrsn=32560e06_4 (accessed June 5, 2022).

International Labour Organization. (2012). *A Comprehensive Approach to Improving Nutrition at the Workplace: A Survey of Chilean Companies and Tailored Recommendations*. Santiago: International Labour Organization. Available online at: https://www.ilo.org/wcmsp5/groups/public/---americas/---ro-lima/---sro-santiago/documents/publication/wcms_201151.pdf

Islam, A. (2022). Work-from/at/for-home: COVID-19 and the future of work – a critical review. *Geoforum* 128, 33–36. doi: 10.1016/j.geoforum.2021.11.018

Izzo, L., Santonastaso, A., Cotticelli, G., Federico, A., Pacifico, S., Castaldo, L., et al. (2021). An Italian survey on dietary habits and changes during the COVID-19 lockdown. *Nutrients* 13, 1197. doi: 10.3390/nu13041197

Lang, T., and Pamela, M. (2018). Sustainable diet policy development: implications of multi-criteria and other approaches, 2008-2017. *Proc. Nutr. Soc.* 77, 331–346. doi: 10.1017/S0029665117004074

National Academies of Sciences Engineering (2021). *High and Rising Mortality Rates Among Working-Age Adults*. Washington, DC: The National Academies Press. doi: 10.17226/25976

Navarro-Cruz, A. R., Kammar-García, A., Mancilla-Galindo, J., Quezada-Figueroa, G., Tlalpa-Prisco, M., and Vera-López, O. (2021). *Changes in Dietary Behaviours and Lifestyle as Risk Factors for Weight Gain during the Covid-19 Lockdown in Chile: A Cross-Sectional Study*, Cambridge Open Engage. doi: 10.33774/coe-2021-119px

Oakman, J., Kinsman, N., Stuckey, R., Graham, M., and Weale, V. (2020). A rapid review of mental and physical health effects of working at home: how do we optimise health?. *BMC Pub. Health* 20, 1–13. doi: 10.1186/s12889-020-09875-z

O'Connell, M., Smith, K., and Stroud, R. (2022). The dietary impact of the COVID-19 pandemic. *J. Health Econ.* 84, 102641. doi: 10.1016/j.jhealeco.2022.102641

OECD (2019). The Heavy Burden of Obesity: The Economics of Prevention | En | OECD." Available online at: https://www.oecd.org/health/the-heavy-burden-of-obesity-67450d67-en.html (accessed June 5, 2022).

Reyes-Olavarría, D., Latorre-Román, P. Á., Guzmán-Guzmán, I. P., Jerez-Mayorga, D., Caamaño-Navarrete, F., and Delgado-Floody, P. (2020). Positive and negative changes in food habits, physical activity patterns, and weight status during COVID-19 confinement: associated factors in the Chilean population. *Int. J. Environ. Res. Pub. Health* 17, 5431. doi: 10.3390/ijerph17155431

Schifferli-Castro, I., Cofré-Jara, S., Soto-Rodríguez, F., Soto-Rodríguez, L., and Vargas-Nuñez, K. (2020). Measuring diet quality in health personnel of a Chilean hospital using the Healthy Eating Index. *Rev. Facultad Med.* 68, 512–516. doi: 10.15446/revfacmed.v68n4.76500

Wanjek, C. (2005). *Food at Work: Workplace Solutions for Malnutrition, Obesity and Chronic Diseases*. Geneva: ILO.

Xiao, Y., Becerik-Gerber, B., Lucas, G., and Roll, S. C. (2021). Impacts of working from home during COVID-19 pandemic on physical and mental well-being of office workstation users. *J. Occup. Environ. Med.* 63, 181–190. doi: 10.1097/JOM.0000000000002097