



# How has the strict lockdown during the SARS-COV-2 outbreak changed the diet of Spaniards?

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## ABSTRACT

**Purpose:** We investigate the impact of a specific macroeconomic shock that occurred as a response to the SARS-COV-2 outbreak, namely the strict lockdown imposed in Spain on the March 14, 2020.

**Methods:** We use fortnightly purchase data relating to over 50,000 households from a supermarket chain in Catalonia from March to June in 2019 and 2020. Using a panel data approach, we analyse the impact of the lockdown on the caloric content, sugar composition, and alcohol content in beverages and food purchases bought before and after lockdown. We corrected our results to take into account the likelihood of stockpiling.

**Results:** The lockdown is related to an increase in unhealthy beverage and food purchases. We find heterogeneous effects across groups of the sample based on cardholder characteristics. Families with children or babies and those in the upper two income quintiles had the unhealthiest changes. As the lockdown went through phases of relaxation, households made better food decisions but maintained unhealthy beverage choices.

**Conclusions:** The very restrictive lockdown negatively impacted the characteristics of food and beverage purchases made by Spaniards. However, we are unsure whether there was substitution to restaurant and bar visits. Additional work to find out whether there were permanent changes in purchasing behaviour after lockdown ended is needed in the future.

## 1. Introduction

Spain was one of the European countries most affected by the first wave of the severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) outbreak. The measures and restrictions adopted by the Spanish central government were arguably Europe's most drastic. A lockdown was imposed on March 14th, 2020, and the country would not open fully until June 20th, although from May, some of the restrictions were relaxed. During this time it was only possible to leave home for specific reasons (i.e., if you were an essential worker, to buy food at supermarkets or food stores, or go to the pharmacy). The strict lockdown was the government's attempt to reduce the health burden of the disease. According to the National Statistics Institute (INE "National Institute of Statistics, 2020), between March and May 2020, more than 45,000 deaths in Spain were caused by the pandemic. On the 2nd of April, the death toll reached 950 in a single day, the highest of any country at that time.

The lockdown in Spain was a sudden shock that affected food

consumption at home by restricting access to food outside the home (i.e., in bars and restaurants) and changing the opportunity cost of time (e.g., modifying working and childcare arrangements). The lockdown meant that people were only allowed to buy at their nearest supermarket, and many shops were closed (bakers, greengrocers, wine shops, etc.). Restaurants and bars could not open or provide takeaway or delivery services. In Spain in 2019, 34.1% of spending on food and beverages was for food and drink consumed in bars and restaurants, corresponding to 13.9% of total household consumption (MAPAMAde AgriculturaAlimentación, 2020). On average, each person consumed 137 kg of products annually out of the house. Of these, fruits and vegetables accounted for 27.3%, meat 14.9%, bread 11.6%, fish and seafood 9.5% and pastries 5.7%. Most of this consumption is related to social lunches and dinners in restaurants or bars (only 25% was take-away food). A study by de Lourdes Samaniego-Vaesken et al. (2018) using a self-reported dietary record in 2013 shows some gender differences in food consumption: alcoholic beverages, oils and fats, meats and ready to eat meals are higher amongst males, particularly in rural and semi-urban

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areas, while non-alcoholic beverages are higher for females. In addition to changes in access to food, the lockdown also provoked changes in income and time constraints. One economic impact of the pandemic was an increase in the Gini index of disposable income, especially in the first two months of the lockdown (Aspachs et al., 2021). In April 2020, the first month of the lockdown, unemployment benefits were paid to 5.2 million people, including ERTE (temporary benefits to workers in companies forced to cease their activity). In the same month in 2019, 2.2 million people received unemployment benefits. The percentage of employees who worked online in Spain in 2019 was 4.8% but during the lockdown, it is estimated that more than a third of Spanish employees were working online (Peiró & Soler, 2020). The sudden pandemic and the shutdown of the economy was an immediate economic shock to many households despite countermeasures such as the ERTE and similar levels of public aid that was given to the self-employed.

There is extensive economics literature on the determinants of dietary choices, particularly about the effects of income, education, the macroeconomy, social networks, money, and time prices of food (Cawley, 2015). Whilst there is evidence in resource-rich countries that higher income impacts positively healthier diets (Pampel, Krueger & Denney, 2010; Parker et al., 2013), the impact of macroeconomic shocks, social networks, availability and type of food stores, and changes in the money and time price of food is less clear (Anderson & Matsa, 2011; Casas et al., 2022; Cotti & Tefft, 2013; Courtemanche & Carden, 2011; Dave & Kelly, 2012; Hut, 2020; Yakusheva, Kapinos & Eisenberg, 2014). This lack of clear evidence may be due to differences in estimation methods – as many of these studies use different instrumental variables or experimental settings – or it may be due to differences in the various subgroups of interest or type of macroeconomic shock. Furthermore, most of these studies are focused only on a few determinants of dietary choices.

There is an emerging literature on the changes in dietary patterns provoked by the COVID-19 crisis. There is some evidence of the worsening of nutrition during the pandemic, possibly due to emotional eating and uncontrolled eating behaviors (Elmacioğlu et al., 2021). Young people increased caloric consumption (Huber et al., 2021) and changed their nutrition behaviour during SARS-COV-2 pandemic lockdown. There have also been reported results on worsening nutrition habits, changes in diet quality and meal sources in the USA during the COVID-19 pandemic. This evidence comes from survey data of 2020 compared to 2018 from a subset of men and women in the cancer prevention study-3 (Um, Hodge & McCullou, 2023). Disparities and heterogeneous impacts of the pandemic have also been outlined in nutrition and obesity correlate closely with the alarming racial and ethnic disparities related to SARS-COV-2 (Belanger et al., 2020).

Specifically for Spain, a study based on an online survey of 945 Spanish adults in April 2020 suggests improvements in the quality of the diet and adherence to the Mediterranean diet, although increasing caloric intake (Casas et al., 2022). The study, done at the beginning of the lockdown, does not agree with most international literature.

Our paper contributes to this literature in three ways. Firstly, we investigate how the three-month lockdown induced changes in the diets of Spaniards, particularly concerning unhealthy food and beverage purchases and by considering unhealthy measures such as caloric and sugar content in foods and grams of alcohol in beverages (WHO, 2021). Secondly, we examine a unique type of macroeconomic shock, the lockdown, affecting income, opportunity cost of time and movement restrictions, restrictions on the types of food available, and limited out-of-home food and beverage consumption. As a macroeconomic shock, the pandemic affected employment resulting in substitution and income effects. The substitution effect implies that as incomes decline, so will the opportunity cost of time. Thus, we should expect a shift towards more time-intensive investments in health, such as food preparation. The income effect will be ambiguous, leading to an increase or decrease in healthy food purchases. However, in addition to these effects, the pandemic has also led to higher stress with potentially

deleterious consequences on diets and binding time constraints for those groups who had to school children at home or care for the vulnerable (Jansen et al., 2021). It also restricted the availability of food and its consumption in social settings, with food sources restricted to retailers. This means that more people may have had to cook from scratch and eat either alone or with their closest relatives. The total effect will therefore depend on the combination of these constraints with the relative size of income and substitution effects. But on the other hand, time constraints will be eased for some families due to reduced commuting time. Further, there may be redistribution of tasks within the household with food preparation being done by those who, before the pandemic, would not have been there due to work commitments. Ultimately, whether time stress went up or down is an empirical question, and the direction of change will likely differ enormously across different demographic groups. Finally, we add to a small but growing number of studies examining the impact of the pandemic on individuals and households. O'Connell et al. (2022) use Kantar scanner data on food and non-alcoholic beverage purchases from supermarkets and on-the-go food purchases from restaurants and take aways before and after the first lockdown in the UK between 2019 and 2020. They examine changes in diet and their implications on body weight (O'Connell et al., 2022). Our contribution is to examine alcohol purchases and to focus on a stricter lockdown in Spain compared to the UK (Hirsch, 2020). Other studies have documented the deterioration of mental health, health and social care in the UK during the pandemic (Banks & Xu, 2020; Propper et al., 2020).

To answer this empirical question, we use a rich individual-level food and beverage purchases database in a supermarket chain in Catalonia, a north-eastern region of Spain. For each household, using longitudinal data, we estimate the impact of the lockdown by comparing fortnightly purchases during the lockdown (March–June 2020) with purchases in the same fortnight of the previous year (2019).

## 2. Data and methods

We obtain data on all beverage and food purchases made by loyalty card holders in a supermarket chain between March and June in 2019 and 2020. This middle-range chain represents 6% of all of the chain-store market share in Catalonia and covers the whole territory and income levels. Catalonia represents 16% of the Spanish population and 19% of the Spanish Gross Domestic Product. The average age of the Catalan population in 2022 was 43.3 years, quite close to the Spanish one (44.1). As described more in detail by Fichera et al. (2021), although this chain is in Catalonia, it owns and manages supermarkets in other regions of Spain. This study shows that the Catalan clientele's socio-demographics are similar to the ones in the rest of Spain (Fichera et al., 2021). However, in the rest of Spain, most households are in the top two income quartiles, whilst in the Catalanian chain sample, they are in the middle two income quartiles.

An observation is denoted by each item purchased on a shopping trip. We excluded stores that opened or closed during our analysis period to ensure spell comparability, although these shops represented less than 1% of the total. These rich and longitudinal data contain detailed food and beverage product information. We have information on the item bought, the date of purchase, the quantity (in litres for liquids and kg for solids) purchased, prices and expenditures on each shopping trip. Our data also contains nutritional information for 22,261 different items. Information about the caloric content (kJ), the sugar content (in grams per 100 ml and 100 g) and the alcohol content for each alcoholic drink were collected from the web pages of multiple supermarket chains.

The data also provide some demographic characteristics of the cardholder and the store's location. Socio-demographic information is requested from families when they get the loyalty card. We have card holder's demographic characteristics such as age and gender; a dummy variable that equals one if s/he has children between the age of 0–3 and another one indicating whether s/he has children between the age of 3

and 15; an indicator of customer’s loyalty to the chain (referring to the past three purchases, which indicates whether the customer always shops at the chain, whether s/he shops at other chains or sporadically shops at the chain). As a measure of socio-economic position, we use an estimate of household income provided by the chain. For marketing purposes, the chain has asked a consultancy firm to estimate household income by combining customers’ responses to the chain’s loyalty card registration questionnaire and area-level information (e.g., education, population density, housing, employment, and type of occupation). Income groups were defined as follows: (i) low (household income below €13.3 k); (ii) low-middle (between €13.3 k and €18.4 k); (iii) middle (between €18.4 k and €27.1 k); (iv) middle-high (between €27.1 k and €39.8 k), and (v) high (above €39.8 k). We aggregate low and lower-middle-income groups into one group because of the sample size for each beverage and food product. Additionally, we match the database with microdata corresponding to a random sample of the 2013 income tax declarants provided by the Fiscal Studies Institute to confirm its validity. It contains 1112 postcodes for Catalonia, where there are 169 stores. We calculate the average tax base in each postcode and allocate that value as a proxy of income corresponding to the store located in the same postcode.

Our analyses are based on each household’s fortnightly purchases at any store. The latter allows us to consider overall purchases and explore consumers’ shopping behaviour. We empirically evaluate the purchase of beverages and food separately. After removing households with discontinuous or sporadic purchases, our final sample is a balanced panel of families purchasing in all fortnights between March and June 2019 and 2020. Sample sizes are 29,331 households for beverages and 52,668 for food.

The lockdown was a sudden exogenous event starting on the March 14, 2020 and finishing on the June 20, 2020. Restrictions were then relaxed in phases. These phases were implemented by municipalities based on the evolution of specific pandemic indicators (incidence and hospitalisations). Phase zero included opening premises and establishments for individual customer service by prior appointment and restaurants with a takeaway service without consumption on the premises. In phase one, open-air terraces were opened in restaurants with occupancy limitations of 30% and in hospitality, hotels, and tourist accommodations, excluding common areas. In phase two, indoor spaces were only available for table service, with table distancing at a third of the premises’ capacity. Finally, capacity and occupancy restrictions were somewhat relaxed in phase three, although social distancing was still required. Our models estimate purchase changes as households transitioned between these phases.

Fig. 1A and B report the average caloric content from beverages and food purchased during the above-mentioned fortnights before and after the lockdown for several types of cardholders. We find an increase in purchases across the board during the lockdown. The most significant purchase increases were observed for relatively younger and wealthier households.

We use a before and after panel data approach to estimate the impact of the lockdown on food and beverage purchases.

We estimate the lockdown effect for each household  $i$  ( $i = 1, 2, \dots, n$ ) using a period of  $t = 16$  fortnights from the 15th of March to the June 20, 2019 and 2020. For a given fortnight  $t$  ( $t = 1, 2, \dots, 16$ ) and household, 2019 is the “control” observation, and 2020 is the “intervention” observation. To account for seasonality effects, we compare the same calendar fortnights in the two years. The dummy variable  $L$  (lockdown) equals one for  $t \geq 5$ , as the lockdown occurred in  $t = 5$  during 2020. When we do account for relaxation of phases that vary by municipality we introduced dummy variables for each phase. In equation (1),  $y_{i,t}$  corresponds to different nutritional contents in different versions of the model: caloric content in kJ, sugar in kg and percentage of alcoholic content in beverages. Exogenous time-varying characteristics ( $X_{i,t}$ ), include the number of trips within each fortnight. Additionally, we include individual ( $\alpha_i$ ) fixed effects. ( $\varepsilon_{i,t}$ ) is the time-varying random error term. When using random effects models, vector  $X$  contains fixed sociodemographic variables (sex, age group, household size, income group, the presence of children and babies at home and loyalty to the supermarket chain). Robust standard errors were clustered at the municipality level because this is the geographical level at which income is calculated, and SARS-COV-2 restrictions are implemented. The model is estimated for the overall sample and subgroups defined by different household characteristics (female, shop loyalty, the number of babies and older children, wealth).

$$y_{i,t} = \beta \cdot X_{i,t} + \gamma \cdot L + \alpha_i + \varepsilon_{i,t} \tag{1}$$

### 3. Results

Fig. 2A and B report our panel data estimates of the statistically significant impact of the lockdown on caloric food and beverage purchases. Although the random effects and the fixed effects models produce similar results, we prefer to use the latter to account for individual time-invariant characteristics. There is a 131.3 kJ increase in beverage caloric content, representing 11.2% of the total caloric purchase per trip before the pandemic (1176.5 kJ). In contrast, the overall impact on food’s caloric content was 4.7% of the calories purchased at baseline

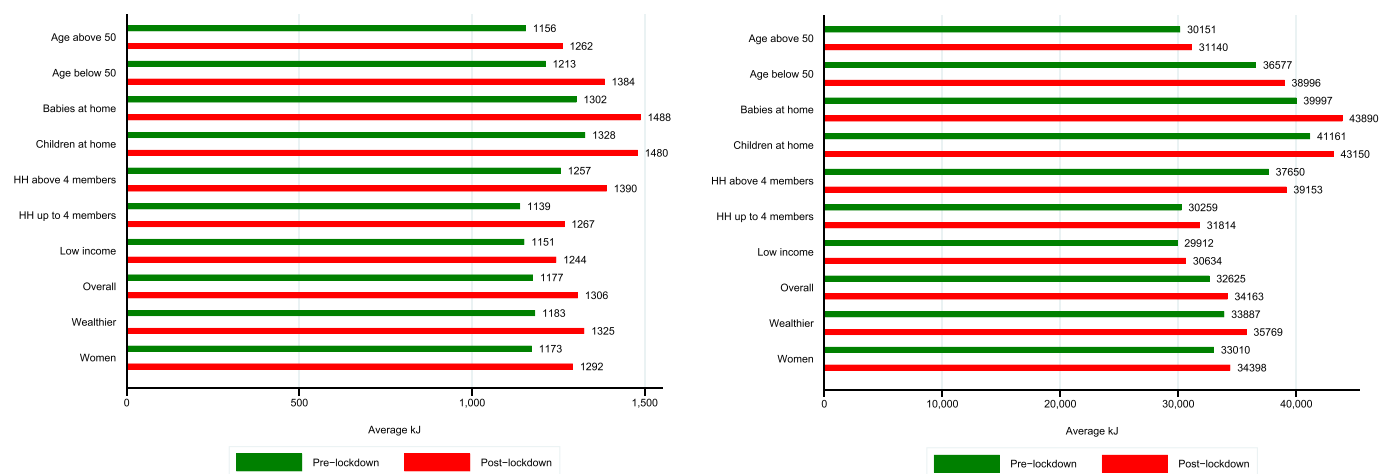
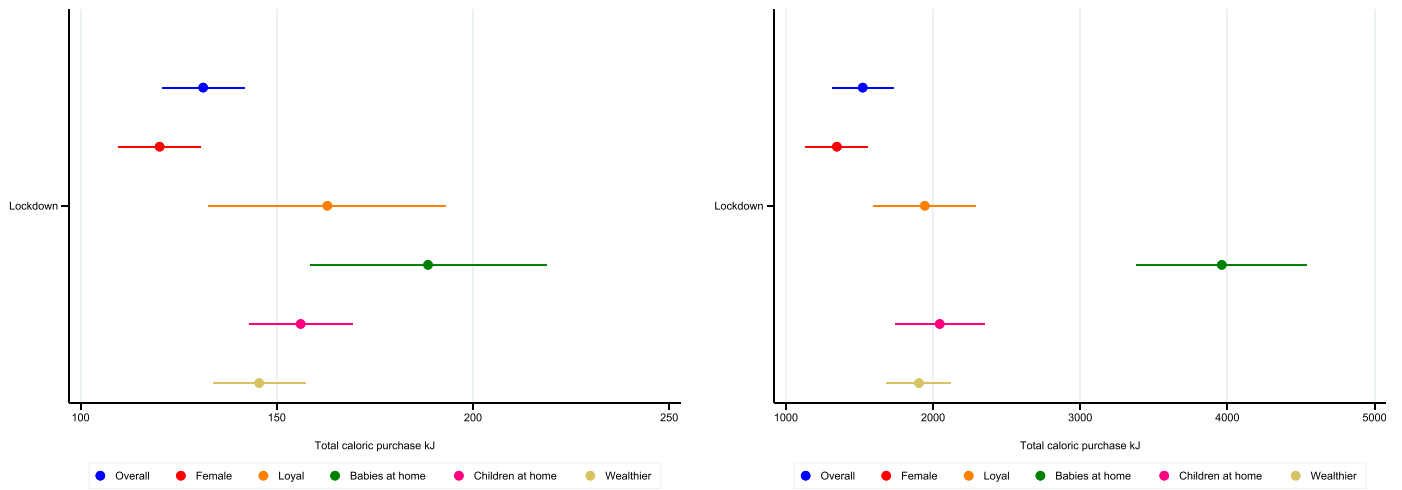


Fig. 1. A. Descriptive statistics for caloric content of drink purchases based on cardholder characteristics. B. Descriptive statistics for caloric content of food purchases based on cardholder characteristics. Note: HH (households), Wealthier (cardholders in the two upper quintiles of household income) and low income (cardholders in the two lower quintiles of household income). All differences were statistically significant at baseline.



**Fig. 2.** A. Impact of the lockdown on total caloric content per trip for drink purchases. **B.** Impact of the lockdown on total caloric content per trip for food purchases. Note: Overall (overall impact), Female (females cardholders), Loyal (cardholders always buying in this chain), Babies at home (having infants at home), Children at home (having children from 3 up to 15 years at home).

(32,625.2 kJ).

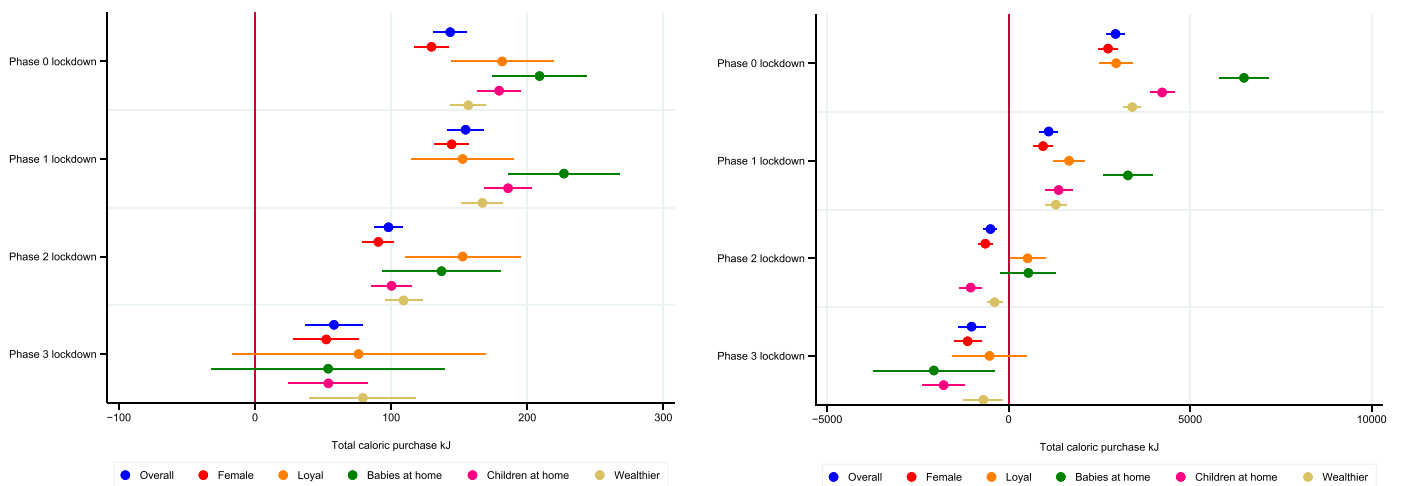
As shown in other studies, it is also important to consider heterogeneous effects (Casas et al., 2022; Pérez-Rodrigo et al., 2021). Splitting the sample according to gender, we find a smaller increase in total caloric purchases for females than males (4.1% and 10.2%, respectively). We find this increase to be larger for loyal cardholders (13.8% compared to 6.0% for less loyal shoppers), those having either infants (16.0%; 12.1% for those without infants) or children (13.3%; 6.3% for those without older children) at home as well as wealthier households (12.4% compared to 5.8% for the less wealthy). We find our previous findings for age and postal code income level (our continuous controls) are robust to using another approach, the conditional average treatment effects.

Next, we examine the lockdown impact on sugar content in drinks or food purchases. We find an overall positive and statistically significant impact equivalent to 5% for drinks and 7.7% for food, compared to baseline values (0.55gr per 100 ml and 0.98gr per 100 ml). Again, this increase was smaller for females than for men (4.4% and 7.1%, respectively). Stronger increases in sugar purchases are observed for the following groups: loyal cardholders (7.9% and 8.2%), those having either infants (12.8% and 17.0%) or children (6.4% and 9.3%) at home

as well as wealthier households (5.7% and 8.3%). Again, the group with infants saw the largest increase compared to all of our other subsamples.

We investigate the impact of the lockdown on the number of grams of alcohol purchased in drinks. The lockdown led to an overall increase of 24.8% compared to the baseline amount (26.95gr). In this case, females (23.4%) and loyal cardholders (23.8%) had a slightly lower increase than the average. In contrast, those with infants (30.4%), or children up to 15 years old at home (28.8%) and wealthier households (26.9%) increased the alcohol content of their purchases by more than the overall average.

We consider how purchases changed as the lockdown moved into its different phases. As movement between phases occurred at different times across municipalities depending on their SARS-COV-2 incidence, we assign variables that indicate the degree of lockdown for each location during each fortnight. Then, we estimate the impact of the different stages of the lockdown on food and beverage purchases, considering when these purchases were made. As shown in Fig. 3A and B, interesting findings are observed for the caloric content. We found a very different pattern between beverages and food. Concerning drinks, we observe a generally decreasing pattern for caloric purchases as lockdown was relaxed (12.2%, 13.2%, 8.3% and 4.9%). Whereas there



**Fig. 3.** A. Impact of the relaxation of the lockdown via phases on total caloric content per trip for drink purchases. **B.** Impact of the relaxation of the lockdown via phases on total caloric content per trip for food purchases. Note: Overall (overall impact), Female (female cardholders), Loyal (cardholders always buying in this chain), Babies at home (having infants at home), Children at home (having children from 3 up to 15 years at home).

was an increase in caloric content of food purchases in the first two stages, as lockdown was relaxed, calories purchased declined afterwards (9.0%, 3.4%, -1.5% and -3.1%). A similar pattern was observed with respect to sugar purchases: 7.0%, 6.1%, 1.1% and 0.0% versus 14.1%, 6.0%, -1.6% and -4.0%. The latter means that whereas unhealthy beverage purchases persisted (i.e. with respect to calorie and sugar content, or grams of alcohol), these unhealthy purchases were only observable for food in the two most severe phases of lockdown. These patterns persist when considering subsamples of our data. Loyal cardholders and those having infants at home purchase slightly more unhealthy food and beverages during phase 2 of lockdown, whereas we observe a small impact for wealthier individuals once phase 1 of lockdown started.

Finally, we explore the possibility that individuals might have stockpiled after hearing rumours about the upcoming outbreak and seeing the news from other countries. To address this, we remove the first fortnight of the lockdown from our sample. Our results show a slightly lower impact of the lockdown on shopping behaviour than our previous estimates. We find the caloric content of beverage purchases was 10.6% compared to 11.2% when considering the full sample, and 4.4% compared to the previous 4.7% for food purchases. These results indicate that individuals may have reacted by stockpiling during the initial lockdown stages.

#### 4. Discussion

The Spanish lockdown generated a sudden shock restricting social food consumption in bars and restaurants, as well as changing income and time constraints of consumers. Using supermarket data, we examine the impact of the lockdown on sugar and alcohol purchases for food and beverages before and after its introduction in March 14th, 2020.

With a panel data fixed-effects model, comparing treated and control households (before and after the lockdown), a significant unhealthy impact of the lockdown was found for the caloric content and the amount of sugar per 100 ml of beverage and food purchases, as well as the alcoholic percentage content of beverages. We find heterogeneous effects across households. Specifically, a more significant impact was observed for households with infants or children and for wealthier households. This behaviour was still evident for females but less than for males.

How do our results compare to the literature? It is difficult to make comparisons because most of the literature on the impact of macroeconomic conditions on health focuses on outcome measures such as obesity and body weight (Charles & DeCicca, 2008; Deb et al., 2011; Ruhm, 2005). This literature finds considerable heterogeneity of impacts by age, gender, and socioeconomic status, with the more vulnerable being most affected by macroeconomic shocks linked to job loss (Charles & DeCicca, 2008). It is hard to establish why we observe different patterns between males and females with this data. However, it is possible that is due to different consumption behaviour at baseline. A previous study using self-reported dietary consumption in the same population in 2013 suggests gender differences in food consumption with alcohol and ready meals consumption being higher for males, and non-alcoholic beverage consumption being higher for females (Samaniego-Vaesken et al., 2018). Although our study focuses on food and beverage purchases, it is reasonable to assume that our results also reflect consumption patterns as evidenced by our analyses on stockpiling and as found by another study (O'Connell et al., 2022).

Like in other studies focused on small locality estimates (Charles & DeCicca, 2008; Deb et al., 2011; O'Connell et al., 2022), we find evidence of pro-cyclicality, that is, health outcomes and behaviours worsen in times of adverse economic shocks. This is contrast to Ruhm (2005) finding that a one-percentage point increase of the unemployment rate in US states was associated with a two-percentage point decline in daily fat intake.

Our results showing an 11.2% rise in total caloric purchases are

similar to O'Connell et al. (2022) who find a 15% increase in calories and spending, rising to 20% during the second half of the first lockdown in the UK.

Whereas food purchases became healthier in phase 2 of the lockdown, our results show that the unhealthy trend of beverage purchases continued during all stages of the lockdown, although this behaviour improved over time. Similar patterns across different lockdown stages in the UK have also been shown by O'Connell et al. (2022).

We find evidence that, based on individual characteristics, not everyone reacted to the same extent during the later lockdown phases. Like in O'Connell et al. (2022), the increase in total calories was stronger for relatively wealthier households. Results were relatively robust to potential stockpiling by individuals during the first stage of the lockdown. The latter might have consequences on oriented policy interventions towards healthier nutritional decisions at the regional administration level targeting specific individuals.

#### 5. Conclusion

The very restrictive lockdown impacted food and beverage purchases made by Spaniards, with more unhealthy food and drinks being purchased in supermarkets. We also find heterogeneous effects across different groups of cardholders. Unhealthier purchases of food, but not drinks declined once lockdown eased.

This work provides relevant conclusions in relation to public health and public policy. It draws attention to young parent families with young children, who have worsened their shopping patterns during the pandemic more than others. It suggests the need for special public health attention to this demographic group and, above all, suggests more research. If the increase in caloric and sugar purchases corresponds to the substitution of school canteens for the home and the bar for the home in alcohol consumption, there would be no problem from a nutritional perspective, but further research would be needed. The fact that women have reacted better, from the point of view of health-related purchasing behaviour, than men would suggest health and nutrition marketing campaign initiatives specifically targeting men.

Our analysis has some limitations. First, our data cover only one chain of supermarkets in a region of Spain. Although another study (Fichera et al., 2021) has shown that this sample is representative of the socio-demographic characteristics of Spain, there are some differences in the income distribution. Nevertheless, our results are generalisable to populations in the middle quartiles of the income distribution.

Second, changes in purchases may only reflect changes in the diet if purchases fully correspond to consumption. This might not be true for everyone. For instance, people may shop for others (an example is children shopping for their elderly parents, reluctant to leave home during the pandemic). Some foods may expire and be thrown away. Regular food and beverage consumption away from home is very common in Spain, particularly among young people. We are still determining whether we have found a worsening of consumption or a substitution of unhealthy products outside home (at the bar or restaurant), particularly when restrictions eased. However, alcohol purchases never declined (unlike those of unhealthy foods) when restrictions were eased and consumption in bars and restaurants was allowed again. This indicates that the higher alcohol purchase habits initiated during lockdown may have persisted even afterwards.

This study has some advantages too. The rich database allows us to examine changes in the behaviour of different types of households, thus making it possible to investigate heterogeneities and make suggestions as to whom to target with social marketing campaigns, and family/community health visits. Moreover, the fact that lockdown was eased at different stages across municipalities has allowed us to approximate the dynamics of behavioural changes as normality was restored.

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## Précis

Spaniards made unhealthier decisions on food and beverage because of the lockdown. These reversed for food but not drinks once the lockdown progressively disappeared.

## Compliance with ethical standards

The Ethical Review Board approved the study at the Universitat Internacional de Catalunya, Barcelona (Spain).

## Declaration of competing interest

An unrestricted grant from the Ministry of Science supported this research. All authors have no financial or other conflicts of interest that are directly relevant to the content of this article.

## Data availability

The data that has been used is confidential.

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Authors would like to acknowledge the marketing department of the anonymous supermarket chain.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmph.2023.101512>.

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