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Impacts of COVID-19 on changing patterns of household food consumption: An intercultural study of three countries

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In light of COVID-19’s effects on individuals’ social, economic, political, and psychological values, this paper aims to investigate the pandemic’s role in possible changes to people’s food consumption and meal habits in three countries, namely China, Portugal, and Turkey. The sample includes individuals from the three countries, exploratory factor analysis and non-parametric tests were used to test the differences. Results suggest that the COVID-19 coronavirus has played a strong part in altering households’ food consumption and meal habits within these countries. The pandemic has particularly led to greater consumption of fresh fruits and vegetables and spending more time eating meals at home. Portugal appears to be consuming more seafood, bread, and butter whereas China features higher consumption of rice and meat products; Turkey is consuming more meat and eggs. The study closes with a set of recommendations for the society and future research.

1. Introduction

First reported in Wuhan, China in late December 2019, the World Health Organization (WHO) declared the novel coronavirus (COVID-19) a global pandemic on March 11, 2020 (World Health Organization, 2020a). To limit the spread of the virus, many governments imposed nationwide lockdowns. More than half of the world’s population was forced to quarantine (Meo et al., 2020). Lockdown restrictions greatly limited the time people spent outside the home. In some countries, people were allowed to leave home only for essential shopping or for sports. Many people also shifted to working from home and found themselves facing varying degrees of social isolation (Lima et al., 2020).

The vaccine rollout is ongoing, and no antiviral treatment currently exists for COVID-19 following a healthy diet during the pandemic could help individuals strengthen their immune system and overall wellbeing (Muscogliuri et al., 2020). In the early days of the pandemic, the WHO published nutritional guidance that recommended consuming fresh vegetables, fruits, pulses, and whole-grain foods to obtain adequate dietary fiber (WHO, 2020b). High consumption of fruits and vegetables is one fundamental of a healthy diet (WHO, 2005). However, market data have shown that the initial shock of the pandemic caused people to buy food with a long shelf life, such as canned and frozen items, ultra-high-temperature milk, pasta flour, and eggs; sales of fresh and perishable foods (e.g., fruits and vegetables) declined (Bracale and Vaccaro, 2020).

The Food and Agriculture Organization (FAO) (2020) also reported that household purchases of long-shelf-life foods and less perishable foods increased at the start of the pandemic (FAO, 2020). Moreover, panic shopping arose due to concerns about food security during the initial outbreak (FAO, 2020). While some studies have indicated that people are eating fewer fruits and vegetables (Giacalone et al., 2020; Jia et al., 2021), others have reported that people’s fruit and vegetable consumption remains unchanged (Di Renzo et al., 2020; Poelman et al., 2021; Rodríguez-Pérez et al., 2020). Still others have found that people have increased their fruit and vegetable consumption to cope with the pandemic (Cancello et al., 2020; Coulthard et al., 2021; Lamarche et al., 2021; Marty et al., 2021).

Amid world market globalization, understanding inter-cultural similarities and differences has become vital to managing supply and demand. However, a solid methodology and effective tools are needed to reach concrete empirical conclusions. Therefore, by assuming an inter-cultural perspective (Hofstede, 1980), this paper aims to investigate...
the role of COVID-19 on possible changes to individuals’ eating/food habits in three countries: China, Portugal, and Turkey. The study sample includes individuals as well as households with at least two people living together. Specifically, this study examined possible increases or decreases in the consumption patterns of six food categories: (1) fruits and vegetables; (2) snacks, sugar-sweetened beverages, and alcoholic beverages; (3) meat and eggs; (4) rice and meat products; (5) bread, legumes, and butter; and (6) fish and seafood. The study also sought to investigate possible changes in meal habits between and within the focal countries as a consequence of a “new normal.” This paper closes with a set of recommendations to adapt the supply food chain to the new normal and diet habits of populations as well as for future studies to extend this line of research.

2. Literature review

Food is a basic necessity in sustaining human existence. As a result of the industrial revolution and civilization, the function of food has transcended from satisfying physiological needs to offering health benefits beyond mere nutritional value (Firth et al., 2020). As a result, this work draws upon the theory of Edward T. Hall, a well-known scholar in inter-cultural communication, who states that “the activities of living matter are functions neither of chance nor of design, but of direct and dynamic interaction of the organism with its environment. This interaction is specialized or limited by the presence of other organisms of the same kind, in association” (Hall and Trager, 1953, p.8). Taking this as a departure point, Hall (1959, 1992) created his own theory, called the “subsistence” includes food procurement and consumption. Specifically, food consumption is expected to satisfy the hunger need, but fulfillment of this need can manifest in various ways. Methods include consuming fresh, fast, or frozen food; cooking at home or dining out; or ordering food.

In fact, several scholars have pointed out that culture has the most compelling influence on one’s food choices and eating habits (Tse and Crotts, 2005). Culture defines how food should be prepared and cooked (Long, 2004). However, humans’ eating behavior varies due to differences in race, sex, and physical activity (Ma, 2015). Taking this as a departure point, this study’s authors considered Hofstede’s (1980) theory of cultural dimensions when selecting the sample countries of China, Turkey, and Portugal. As indicated in Fig. 1, with the highest scores, China holds distinct positions in power distance, masculinity, and long-term orientation; Portugal takes the leading position in uncertainty avoidance, followed by Turkey. These countries represent different cultural orientations to reveal potential culture-based influences on people’s dining behavior (see Fig. 2).

For instance, with its long-standing history, the Chinese cuisine in particular can be traced back about 5000 years. Food holds symbolic meaning to the Chinese (Ma, 2015) and has long been considered an art imbued with diversity, flexibility, and creativity (Chang, 1977; Li and Hsieh, 2004). A typical Chinese meal includes rice or noodles as staples, vegetables and meat as side dishes, and soup (Chang, 2010). What further distinguishes Chinese cuisine is its cooking techniques and flavor principles (Chang, 2010). Different from the salads or baked vegetables commonly found in Western countries (Lv and Brown, 2010), frying, stewing, boiling, and steaming with soy sauce, garlic, and ginger undergird Chinese food culture (Rozin, 1983). Also, rice and noodles are essential to the Chinese diet, whereas potatoes and pasta are valued more in the West (Lv and Brown, 2010).

For the Chinese, food is closely tied to the social context (Chang, 2010), as observed in greeting styles: rather than saying “How are you?”, Chinese people are accustomed to asking “Have you eaten yet?” (Zhang, 2014). The value of food consumption thus lies in its social functions, which include but are not limited to networking, sharing, and business purposes (Zhu and Liu, 2020). As such, the Chinese normally eat communally at round tables, symbolizing the unity of family and society (Zhu and Liu, 2020).

The symbolic meaning of food is further evident in the roots of Chinese culture. Inspired by the Han custom, Chinese people eat noodles, which denote longevity, on their birthday (Zhang and Ma, 2016). Likewise, the homophonic nature of Mandarin Chinese implies that some foods signal bad luck (Ma, 2015). For example, eating a pear could connote separation. In addition, different types of food are served during specific Chinese events and festivals (Ma, 2015): moon cakes are served at the Mid-Autumn Festival while rice dumplings are served at the Dragon Boat Festival. Although essential nutrients can be obtained from a wide range of foods and ingredients (Kaur and Das, 2011), individuals’ nutrient intake depends on cultural and social factors that subsequently shape one’s eating habits, food choices, and preferences (Ma, 2015).

In Turkey, a country marked by a blend of Eastern and Western

![Fig. 1. Comparison of sample countries by Hofstede’s cultural dimensions.](image-url)
cultures and that feels uncomfortable with risk taking, wheat is a staple of national cuisine. The grain is often consumed through bread, bulgur, and pasta. The country’s climate allows for ready access to fruits and vegetables in all seasons. These ingredients also constitute key components of Turkish cuisine (Pekcan and Karaagaoglu, 2000); fruits and vegetables represent one leaf of the “four-leaf clover” Turkish food guide, which stresses the importance of fruit and vegetable consumption (MOH, 2016). Legumes such as chickpeas, lentils, and fava beans are main dietary protein sources and are often cooked in soups and stews. In terms of dairy products, the Turkish people primarily consume yogurt and cheese. Lamb and goat are popular meats in the eastern part of the country, whereas fish and seafood are more representative of Turkey’s coastal region.

Another regional difference is seen in the consumption of fats and oils. While olive oil is common in olive-growing areas of Turkey, sunflower oil, margarine, or butter are more often consumed in the east (Chambers et al., 2016). The Turkish diet revolves around three meals per day (FAO, 2010). Turkish cooking includes various techniques such as stewing, frying, grilling, roasting, and baking. A typical Turkish lunch and dinner starts with soup (hot soups in winter and cold soups in summer), followed by a main dish of vegetables, meat, or legumes. Rice, bulgur, or pasta is served with the main entree. Salads, cacık (diluted yogurt with cucumber and garlic), or compote are also consumed during meals. The country

3. How has food consumption changed?

In addition to its sweeping effects on several life domains, research has confirmed the pandemic’s impacts on households’ food consumption patterns. For instance, changes in eating behavior during lockdowns have been found to vary with people’s age (Cancello et al., 2020; Di Renzo et al., 2020; Poelman et al., 2021), body mass index (Coulthard et al., 2021; Huber et al., 2020; Poelman et al., 2021), gender (Carroll et al., 2020), and educational level (Jia et al., 2021; Rodriguez-Pérez et al., 2020). Older adults’ eating behavior during COVID-19 appears less likely to be influenced by lockdowns compared with younger adults (Di Renzo et al., 2020; Poelman et al., 2021). Having a higher body mass index has been associated with greater consumption of unhealthy snacks.

Table 1

Dietary characteristics of China, Portugal and Turkey.

| Countries          | Staples          | Cooking techniques                | Spices                                         | Protein source         | Oil source            | Carbohydrate source | Major food crops       |
|--------------------|------------------|-----------------------------------|------------------------------------------------|------------------------|----------------------|----------------------|-----------------------|
| Chinese cuisine    | Rice and noodles | Stir-frying, stewing, boiling, and steaming | Soy sauce, garlic, ginger, pepper, fermented soybean, chili peppers | Pork, poultry, soybean | Soybeans, peanuts, corn oil | Rice and noodles | Rice, maize, wheat, soybeans |
| Portuguese cuisine | Wheat bread      | Boiled, frying, stewing, and pan-braising | Pepper, saffron, cumin, curry powder, paprika, cinnamon, cloves, nutmeg, garlic, coriander, mint, bay leaves, parsley, sage, oregano, and red chili peppers | Beef, poultry, lamb, legumes | Sea food, poultry, pork and beef | Olive oil | Wheat (bread), tuber (potato) |
| Turkish cuisine    | Wheat bread, bulgur, pasta and rice | Grilling, sautéing, boiling, frying and braising | Cumin, pepper, mint, oregano, parsley, paprika, cinnamon, cloves, and garlic | Olive oil, sunflower oil, corn oil | Wheat (bread), bulgur, pasta and rice | Wheat, tomato, maize, olives, hazelnut, apricots, figs |

Source: Information was obtained from the FAOSTAT.
During the COVID-19 lockdown in Spain, adults consumed more fruits, vegetables, and legumes whereas consumption of red meat, alcohol, fried foods, and pastries declined compared with usual habits (Rodríguez-Pérez et al., 2020). A study conducted in Italy during the first lockdown between May and April 24, 2020 indicated that consumption of homemade bread, desserts, and pizza increased while consumption of processed meat, snacks, and sugar-sweetened beverages fell (Di Renzo et al., 2020). The same research showed that, regardless of barriers to accessing fresh fruits and vegetables, the intake of these foods did not decline among the Italian population (Di Renzo et al., 2020).

The UK is one country where fruit and vegetable consumption increased during lockdown (Buckland et al., 2021). Lower fruit and vegetable intake was conversely observed among Danes (Giacalone et al., 2020). In Poland, one-third of the study population reported low intake of fruits and vegetables (Sidor and Rzymski, 2020). Among Chinese youth, the consumption of rice, meat, poultry, fresh vegetables and fruit, soybean products, and dairy products decreased whereas the intake of wheat products, other staple foods, and preserved vegetables increased (Jia et al., 2021). Another study conducted in China during March 2020 revealed low consumption of fish and seafood and high consumption of cereals, fruits, and vegetables. This study also indicated low consumption of processed foods (Zhao et al., 2020).

Food availability has varied internationally during the pandemic as well. One study indicated challenges in obtaining meat, vegetables, and fish from markets during the COVID-19 lockdown in Spain (Rodríguez-Pérez et al., 2020). Other research has pointed to difficulties in accessing fish and seafood in China (Zhao et al., 2020). Moreover, people seem to have shifted to less healthy diets due to the limited availability of fresh foods like fruits, vegetables, and seafood in China (Jia et al., 2021).

4. Eating habits

Eating habits tend to be stable in adults, although changes in one’s environment or daily routine can alter eating behavior (Jastran et al., 2009). Because routines such as going to work/school or engaging in outdoor activities were impossible during lockdowns, many scholars reported changes in individuals’ meal habits. Błaszczyk-Bebenek et al. (2020) observed that more people were eating five meals per day in Poland, whereas Di Renzo et al. (2020) noted that more than half of Italians did not change their meal habits and consumed the same number of meals per day during lockdown. The amount of food consumed (as snacks) during lockdown increased in Canada (Carroll et al., 2020), Denmark (Giacalone et al., 2020), Poland (Sidor and Rzymski, 2020), and the UK (Buckland et al., 2021). Food intake did not change considerably in the Netherlands (Poelman et al., 2021) or Germany (Huber et al., 2020).

The most noticeable change in eating behavior during the pandemic has involved home cooking. Lockdowns forced people to stay at home, leading to lifestyle changes. Many people suddenly had more time to cook and plan meals. Studies indicated that the amount of time individuals are devoting to food preparation and cooking has increased (Ben Hassen et al., 2020; Cancelli et al., 2020; Carroll et al., 2020; Coulthard et al., 2021; Di Renzo et al., 2020; Giacalone et al., 2020; Lamarche et al., 2021; Marty et al., 2021; Sidor and Rzymski, 2020; Zhang et al., 2020). Home cooking is also generally associated with a lower intake of total calories, carbohydrates, fat, and sugar (Wolfson and Bleich, 2015).

Lockdowns have affected food consumption outside the home as well. Many restaurants are only open for food delivery and takeaway. Many people apparently prefer home cooking, as eating out and takeaway orders have decreased during the pandemic (Ben Hassen et al., 2020; Błaszczyk-Bebenek et al., 2020; Carroll et al., 2020; Chenarides et al., 2020; Lamarche et al., 2021; Zhang et al., 2020). Dining outside the home is positively associated with high fat and calorie intake and negatively associated with micronutrient consumption (Jachat et al., 2012).

At the same time, lockdown has negatively affected some individuals’ eating habits: relatively unlimited access to food and boredom can increase the frequency of snacking. Many studies have revealed higher snack consumption during lockdowns (Błaszczyk-Bebenek et al., 2020; Buckland et al., 2021; Carroll et al., 2020; Giacalone et al., 2020; Sidor and Rzymski, 2020). Snacks often contain fewer micronutrients than meals, and frequent snacking is associated with a higher caloric intake and risk of obesity (Ovaskainen et al., 2006). Furthermore, due to the economic situation of families and the uncertainty related with their professional situation, eating out was avoided in Portugal (DGS, 2020) – the behavior that we anticipated in the three focal countries under this study.

5. Methodology

Based on the findings of earlier studies regarding the pandemic’s effects on consumer behavior (e.g. Gössling, Scott and Hall, 2020; Sigala, 2025; Wen et al., 2021), the survey distributed as part of the present research was intended to investigate how COVID-19 may have inspired possible changes in individuals’ food consumption and eating habits. The questionnaire adopted in this study was developed through seven steps. First, relevant references, as indicated in the literature review (Di Renzo et al., 2020; Poelman et al., 2021; Zhang et al., 2020), were scanned to produce an initial pool of questions. Second, the authors reflected upon their personal experiences to refine the list of items in quality and quantity. Third, the authors developed the initial questionnaire form by sharing their opinions via e-mail and virtual meetings. Fourth, the final survey version was drafted in English and distributed to 30 respondents for a pilot study. As the study was planned to include three countries, the authors obtained a list of new items for inclusion in the survey to address cultural heterogeneity of the chosen countries. Fifth, all authors reviewed the amended version of the survey to ensure items flowed well. Next, the questionnaire was translated into Chinese, Portuguese, and Turkish for distribution among citizens of the focal countries. Finally, each translated form was sent to five academics per country to verify that the items read well in their own language and that the survey measured what it was intended to regarding meaning and cultural values. Some items were reworded to enhance clarity and comprehensibility, but no additional items were included at this stage.

The final survey consisted of four parts. The first section focused on how respondents’ food consumption patterns have changed amid their “new normal” compared with before the pandemic. The second section aimed to investigate the likelihood that respondents’ cooking, meal time, and food waste habits have changed. The next section was intended to provide a snapshot of respondents’ general psychological and physical mindsets compared with before the pandemic. The last section solicited respondents’ demographics.

This questionnaire was uploaded onto an online platform with unique links for automatic distribution to respondents in each country. Data for the main survey were collected between 3 January and February 1, 2021. Each author was responsible for approaching potential respondents in their respective country by sending separate emails to each respondent. Using snowball sampling, the authors leveraged their social networks by asking friends and colleagues to distribute the survey to potentially interested individuals. Only one person per household was asked to participate in the survey. Once data collection was discontinued, all questionnaires were checked for missing variables. Surveys containing more than five unanswered items and 11 respondents who responded incorrectly to an attention-check question were discarded from analysis. The remaining items were merged into a single table to run statistical analysis and explore possible differences within or between countries. The authors ultimately gathered 319 useable surveys from China, 351 from Portugal, and 449 from Turkey.
Empirical data were analyzed using factor analysis and non-parametric tests to examine differences among the countries. Analysis consisted of five steps. Exploratory factor analysis (EFA) was conducted to identify dimensions and constructs in the data, as no prior studies had tested all these items together. Factor extraction involved maximum likelihood estimation with VARIMAX rotation. The analysis applied a latent root criterion of 1.0 for factor insertion; 0.5 was the cut-off criterion for factor extraction. The second step involved rescaling the constructs extracted using a 5-point scale. The means of all components within each construct were used. The third step entailed independent-samples Kruskal-Wallis tests of the extracted components to determine whether distribution of all samples was the same. The fourth step consisted of sign tests for dependent samples to ensure that within-country behavior before and after COVID-19 was similar.

6. Results

Data were gathered in China, Portugal, and Turkey from largely similar samples. The authors aimed to approach 314 respondents in each country, following the assumption of a binomial distribution with a maximum dispersion; that is, at least half of the population would presumably change their food habits during lockdown with a confidence interval of 95% and a sample error of 2.5%. The 319 questionnaires from each country sample was nearly identical: 66.0% in China, 67.0% in Portugal, and 65.0% in Turkey. Many respondents held full-time employment: 57.0% in China, 82.0% in Portugal, and 61.0% in Turkey. Proportionally, a fair number of Chinese respondents were students (25.0%), some Turkish respondents were retired (17.0%). Nearly half of the respondents were living with two or three other people. In China, about one-third of respondents (33.8%) lived with four to six other people. Roughly one-quarter lived with another person in Portugal and Turkey. Regarding the risk of spreading COVID-19, Turkey was ranked first in the number of family members who had tested positive for the virus (12.5%), followed by Portugal (7%) and China (0.5%).

As indicated in Table 3, this unprecedented crisis and resultant lockdowns led to high stress across all country samples (M = 3.5). This homogeneity was tested with a Kruskal-Wallis test for independent subsamples (t = 1.182, p = 0.554). In terms of respondents’ extent of happiness with their life conditions, the authors observed differences in quality of life due to the “new normal.” Pairwise comparison tests were performed to better understand this heterogeneity. Respondents from Portugal and Turkey exhibited similar levels of unhappiness (t = 19.133, p = 0.384); both countries had an average mean score of 2.20. Chinese respondents seemed more comfortable with their conditions (M = 2.78) and reported feelings distinct from respondents in Portugal (t = 165.875, p = 0.000) and Turkey (t = 185.007, p = 0.000). Quality-of-life perceptions also differed across the three countries (t = 70.388, p = 0.000): the Chinese were the most pleased with their quality of life (M = 3.01), followed by the Portuguese (M = 2.71) and Turkish (M = 2.35).

As indicated in Table 4, pairwise comparison tests were run for Turkey–Portugal (t = 102.336, p = 0.000), Turkey–China (t = 187.969, p = 0.000), and Portugal–China (t = 85.633, p = 0.000). These differences may be related to respondents’ sense of being healthy (t = 50.028, p = 0.000), eating healthy food (t = 27.672, p = 0.000), and being physically active (t = 131.877, p = 0.000). These perceptions all varied across the three countries. Portugal and Turkey were similar in respondents’ perceptions of leading a healthy life (t = 43.980, p = 0.043) but differed in perceptions of eating healthy food (t = 57.110, p = 0.024) and of being physically active (t = 158.133, p = 0.000). China was distinct from Portugal and Turkey, ranking as the country with a more optimistic outlook regarding leading a healthy life (M = 3.45), eating healthy food (M = 3.72), and engaging in physical activity (M = 3.02). China was followed by Portugal in life perceptions (M = 3.12) and physical activity (M = 2.71), whereas Turkey ranked highest in respondents’ perceptions of eating healthy food (M = 3.54). Accordingly with DGS (2020), the consumption of fruits and legumes increased but still there are a number of persons with unhealthy food habits in Portugal.

7. Possible changes in food consumption patterns

Respondents’ perceptions of their food consumption patterns varied compared with before the pandemic. The 24 food items that constituted the food wheel were submitted to EFA to depict food patterns. Results showed that six factors were extracted from the 24 items, collectively accounting for 59.2% of the total variance (KMO = 0.842; Bartlett’s test of sphericity; p = 0.00). Based on the items grouped with higher loadings (i.e., between 0.60 and 0.80), identified food consumption patterns were as follows: (1) fruits and vegetables; (2) snacks, sugar-sweetened beverages, and alcohol; (3) meat and eggs; (4) rice and meat products; (5) bread, legumes, and butter; and (6) fish and seafood (see Fig. 3). These factors’ internal consistency was measured using Cronbach’s alpha coefficients, which were adequate (i.e., equal or superior to 0.57 in all cases). These food consumption patterns were classified under several well-known diets. Table 5 presents a summary of the EFA results.

Table 6 lists the results of Kruskal-Wallis analysis to test the asymptotic significance of observations; Table 7 presents the results of paired comparisons. Each country’s fruit and vegetable intake increased (M = 3.5 for all three countries) compared with before the pandemic.
The distribution mean was identical for all countries (t = 0.937, p = 0.626). In Portugal and Turkey, people generally appeared to follow the Mediterranean diet, which emphasizes consumption of fruits and vegetables. Fish and seafood consumption patterns differed across the three countries (t = 2.97, p = 0.005) and Turkey and China (t = 98.408, p = 0.000) varied whereas Turkish and Portuguese patterns were more similar (t = 29.325, p = 0.194), the Mediterranean diet that is used in both countries may explain this homogeneity. Only egg consumption rose in all countries. Meat consumption increased slightly in Turkey (M = 3.11), did not change in China (M = 2.97), and fell in Portugal (M = 2.78).

The consumption of rice and meat products was higher in China (M = 3.5). Portugal’s (M = 3.0) consumption remained the same, and Turkey’s rice and meat products intake declined (M = 2.4). These differences were significant in all countries (t = 2.71, p = 0.000) and in pairwise country comparisons. Portuguese meals typically include meat, rice, and potatoes, which may explain why citizens’ consumption patterns remained the same as before the pandemic. This tradition was implemented to provide high levels of carbohydrates to agricultural workers and to segments of the population requiring warmth from food due to poverty. Thus, rice, potatoes, and meat served in one meal has become a cultural value.

The category of bread, legumes, and butter also showed significant differences within all countries (t = 173.326, p = 0.000) and in pairwise comparisons. On average, the consumption of these items increased most in Portugal (M = 3.3). Turkey appeared to maintain a similar level of consumption (M = 2.96) while China’s intake lessened (M = 2.6) during the lockdown. In Portugal, more frequent bread baking at home may have led to this jump.

8. Possible changes in meal habits

Meal habits were also submitted to an EFA to reduce the data dimensionality. As indicated in Table 8, the nine items under consideration were grouped across three components: (1) having meals with
family and friends; (2) more meal times; and (3) home-cooked meals. Together, these components explained 74.154% of variance in the data ($KMO = 0.730$, $p = 0.000$; all reliability coefficients were greater than 0.8).

The likelihood of eating meals with family and friends increased in Portugal ($M = 3.5$), remained the same in Turkey ($M = 3.0$), and declined in China ($M = 2.5$). These differences held across countries, with pairwise comparisons revealing that all country pairs differed ($t = 103.022$, $p = 0.000$). Such discrepancies were due to the countries’ lockdowns and culture. For example, in Portugal, family meals are essentially mandatory, at least on weekends. The amount of time spent on meals also varied ($t = 97.677$, $p = 0.000$), although Portugal and China demonstrated similar patterns ($t = 4.787$, $p = 0.844$). The Turkish spent more time on meals ($M = 3.96$), followed by Portugal ($M = 3.4$) and China ($M = 3.4$). Intentions to eat at home differed among countries as well ($t = 65.879$, $p = 0.000$): Portugal ($M = 3.9$) and China ($M = 3.9$) were again similar ($t = 1.899$, $p = 0.938$) while Turkish respondents expressed lower intentions to have at-home meals ($M = 3.4$). This difference may have arisen because the restaurants were closed, people feared the virus, individuals were under lockdown or even because they felt the need to save money due to the instability of the business life (Table 7).

The last step of analysis involved a dependent sample test of the distribution of median attitudes before and during the pandemic. A sign test was conducted to understand how attitudes changed situationally within countries. Results revealed slight within-country differences before and during the pandemic. For instance, the Portuguese ate more meals daily ($t = 68$, $p = 0.000$): 68 of 351 respondents reported having more meals (positive difference), 14 of 351 had fewer (negative difference), and 269 had the same number of meals. In China, the habit of sharing family meals diminished ($t = 72$, $p = 0.000$): 96 out of 319 respondents ate fewer meals with family whereas 51 ate more. The opposite pattern was observed in Turkey ($t = 109$, $p = 0.012$), where 109

![Fig. 3. Food consumption patterns.](image-url)

Table 5
EFA for Food consumption patterns.

| Factor labels                | Factor loadings | Mean  | Variance explained | Alpha |
|------------------------------|-----------------|-------|--------------------|-------|
| Vegetables and fruits        |                 |       |                    |       |
| Fresh vegetables             | 0.757           | 3.65  | 0.755              |       |
| Fresh fruits                 | 0.704           | 3.61  |                    |       |
| Water                        | 0.632           | 3.86  |                    |       |
| Fresh fruit/vegetable juice  | 0.619           | 3.02  |                    |       |
| Nuts and seeds               | 0.438           | 3.19  |                    |       |
| Snacks, SSB and alcohol      |                 |       | 0.757              |       |
| Salty/fried snacks (chips,   | 0.815           | 2.46  |                    |       |
| crackers etc.)              |                 |       |                    |       |
| Sugar sweetened beverages    | 0.792           | 2.23  |                    |       |
| (SSB) (soda, sport drinks,   |                 |       |                    |       |
| energy drinks etc.)          |                 |       |                    |       |
| Sweet snacks (cakes, pastries,| 0.692           | 2.81  |                    |       |
| sweets, chocolates etc.)     |                 |       |                    |       |
| Alcoholic beverages          | 0.530           | 2.37  |                    |       |
| Meat and eggs                |                 |       | 0.606              |       |
| Red meat                     | 0.754           | 2.97  |                    |       |
| Poultry                      | 0.715           | 3.05  |                    |       |
| Eggs                         | 0.508           | 3.63  |                    |       |
| Rice and meat products       |                 |       | 0.57               |       |
| Rice                         | 0.737           | 3.14  |                    |       |
| Meat products                | 0.591           | 2.64  |                    |       |
| Cereal and cereal products   | 0.484           | 2.98  |                    |       |
| Bread, legumes and butter    |                 |       | 0.622              |       |
| Bread                        | 0.709           | 2.93  |                    |       |
| Legumes                      | 0.611           | 3.20  |                    |       |
| Butter                       | 0.525           | 2.75  |                    |       |
| Fish and seafood             |                 |       | 0.684              |       |
| Seafood                      | 0.725           | 2.54  |                    |       |
| Fish                         | 0.563           | 3.10  |                    |       |

KMO=0.842 Sig.<0.0001
data reflected a slight increase in that 67 of 319 respondents ate more meals alone. These results could be related to national lockdowns of 433 respondents ate more meals with family and 74 ate fewer. This finding suggests that individuals in this study reported consuming less processed food and/or frozen food. Because pandemic precautionary measures vary nationally, it is critical to understand how inter-cultural similarities and differences influence possible changes in individuals’ eating/food habits from supply and demand perspectives.

of 433 respondents ate more meals with family and 74 ate fewer. Regarding the intention to eat meals alone, differences emerged in Turkey (t = 56, p = 0.033) where 82 respondents ate fewer meals individually than before the pandemic. In China (t = 67, p = 0.003), the data reflected a slight increase in that 67 of 319 respondents ate more meals alone. These results could be related to national lockdowns (Table 9).

9. Conclusion and implications
The COVID-19 pandemic has radically altered individuals’ routines and quality of life. Homes have become a hub for socialization and family gatherings due to mobility restrictions. Even rampant modernization (e.g., food delivery) has not dethroned some traditional ways of life, especially around food preparation and consumption. For example, individuals in this study reported consuming less processed food and/or frozen food. Because pandemic precautionary measures vary nationally, it is critical to understand how inter-cultural similarities and differences influence possible changes in individuals’ eating/food habits from supply and demand perspectives.

First, study findings are elaborated to showcase the theoretical contributions by using Hofstede theory to understand food consumption patterns and differences influence possible changes in individuals nationally, it is critical to understand how inter-cultural similarities and differences influence possible changes in individuals’ eating/food habits from supply and demand perspectives.
During the pandemic, a rise in home prepared bread was observed (Bracale, 2021; Güney and Sangün, 2021; Di Renzo et al., 2020). Moreover, a higher frequency of home cooking was associated with healthy lifestyles. Many studies reported more frequent home cooking because most restaurants were closed in China during the pandemic. In addition to fear of the virus, this phenomenon may have appeared because most restaurants were closed in China during the pandemic. Subsequent analysis confirmed this assumption, demonstrating that Chinese individuals’ intentions to share meals with family diminished substantially amid the outbreak.

The empirical evidence of this study reinforces the cultural food habits and their diet habits with a special focus on the healthy lifestyle. With the patterns of healthy food consumption and spending more time to cook, this paper suggests that life has changed in all countries and even though the population feels depressed and anxious they accept the new normal and use the time they have now to adopt sustainable and healthy lifestyles. Many studies reported more frequent home cooking during pandemic (Skotnicka et al., 2021; Pfeifer et al., 2021; Rodríguez-Pérez et al., 2020; Sidor and Ryzmski, 2020; Zhang et al., 2020). Moreover, a higher frequency of home cooking was associated with greater adherence to the Mediterranean Diet in Croatia (Pfeifer et al., 2021). Having provided the evidence of positive sights of this unprecedented crisis, the study also presents important cues that need to be taken into account in what concerns the supply and distribution of food as well as helping to reinforce the endeavor of being more sustainable and healthier.

Second, as to the implications for the society, this study focuses on cultural aspects to explain possible changes in food consumption before and during the pandemic. Theoretically, this research highlights the need to understand inter-cultural similarities and differences to satisfy people’s needs amid a “new normal.” The findings provide further implications for sociologists as well as for practitioners engaged in commercial/business activities. For instance, our results can help food delivery operators optimize in-app restaurant recommendations. This study also

### Table 8
Results of EFA analysis for meal habits.

| Factor labels                          | Factor loadings | Variance explained |
|---------------------------------------|----------------|--------------------|
| Family and friends                    |                |                    |
| Happier with dinner out with          | 0.866          | 32.945             |
| my close family                       | 3.02           | 0.913              |
| Happier with dinner out with          | 0.890          |                    |
| my friends/relatives                  | 3.07           |                    |
| Happier to invite my friends/relatives | 0.870          |                    |
| for dining at home                    | 2.97           |                    |
| Happier that my friends/relatives     | 0.881          |                    |
| do invite me/us for dining at home    | 2.93           |                    |
| Meal time                             | 23.503         | 0.844              |
| Breakfast time at home               | 0.897          |                    |
| Lunch time at home                   | 0.840          |                    |
| Dinner time at home                  | 0.862          |                    |
| Home meals                            | 17.706         | 0.854              |
| Stay at home                          | 0.937          |                    |
| Eating at home                        | 0.922          |                    |
| KMO=0.730 Sig.=< 0.001               |                |                    |

Turkish. This phenomenon can be partially explained by China’s position as a high-power distance culture and long-term-oriented society (Hofstede, 1980; Yoon, 2009). Because the Chinese tend to obey governmental regulations, complying with the rules of their “new normal” can lead to a more positive post-COVID situation compared with Portugal and Turkey. Regarding changes in food consumption patterns, this study identified an increase across cultures in fruit and vegetable intake. These findings suggest that COVID-19 may promote healthy eating, as dietary guidelines of the countries where the study was conducted (CNS, 2016; MOH, 2016; FCNAUP, 2003) promote a higher degree of fruit and vegetable consumption in all three countries. Meat and seafood consumption also shifted due to the pandemic. Our results showed that intake of red meat among Portuguese people decreased. This is in line with the results of Görski et al. (2021) who reported that the respondents from Portugal declared the lower consumption of red meat during pandemic whereas red meat consumption practices remained similar among the Chinese and Turkish during the pandemic. This finding was consistent with another study among adults in Turkey, which showed that the majority of the participants did not change their meat consumption habits (Haskaraca et al., 2021). However, our findings were inconsistent with another study conducted in China reporting a decrease in meat consumption among Chinese adults (Luo et al., 2021). Concerning staple food, it was unsurprising to find that rice intake was higher in China while bread consumption was higher in Portugal and Turkey. Since cereals can be stored long, many studies reported higher consumption of cereals during pandemic (Görski et al., 2021; Güney and Sangün, 2021; Di Renzo et al., 2020). Moreover, during pandemic a rise in home prepared bread was observed

### Table 9
Sign tests for median distribution within the same country (pre- and post-corona era).

| Items                              | Country | N  | Test  | Standard Error | df   | Asymptotic Sig. (2-sided test) | Observations | Positive differences | Negative differences | Ties |
|------------------------------------|---------|----|-------|----------------|------|------------------------------|--------------|----------------------|----------------------|------|
| The median of differences between  | China   | 319| 41.000| 4.213          | 1.187| 0.235                        | Retain       | 14.00                | 269.00                |      |
| number of daily meals before and   | Portugal| 351| 68.000| 4.528          | 5.853| -0.000                       | Reject       | 82.00                | 285.00                |      |
| now                                |         | 97.000| 6.964 | 0.000          | 1.000| Reduce                       | Retain       | 12.00                | 215.00                |      |
| and now                            |         | 72.000| 6.225 | -0.803         | 0.422| Reduce                       | Retain       | 70.00                | 206.00                |      |
| in the same table before and now   |         | 109.000| 6.764 | 2.513          | 0.012| Reject                       | Retain       | 20.00                | 275.00                |      |
| Median of differences between      |         | 51.000| 6.062 | -3.629         | -0.000| Reject                       | Retain       | 46.00                | 172.00                |      |
| meals taken with all the family     |         | 12.000| 6.006 | -0.803         | 0.422| Reduce                       | Retain       | 56.00                | 285.00                |      |
| and now                            |         | 7.000 | 4.472 | -1.901         | 0.057| Reject                       | Retain       | 46.00                | 172.00                |      |
| and now                            |         | 5.000 | 4.372 | -2.128         | 0.033| Reject                       | Retain       | 56.00                | 285.00                |      |
| and now                            |         | 18.000| 4.359 | -0.344         | 0.731| Retain                       | Retain       | 36.00                | 216.00                |      |

Although COVID-19 has altered people’s eating habits (Laguna et al., 2020), this study indicates that habits and cultural preferences are difficult to change. People have spent longer at home during the pandemic, yet they appear to be relying on what they are accustomed to eating rather than trying new types of food. This propensity may be explained by the concept of uncertainty avoidance: for instance, because Portugal has a high uncertainty avoidance culture (Ferreira et al., 2013), the Portuguese may generally prefer to continue eating what they ate before the pandemic. Regarding sweets and alcohol, our results show that COVID-19 had compelling impacts, especially on the Chinese. A higher level of alcohol consumption was reported also in many other countries like Poland, Denmark and Italy during pandemic (Skotnicka et al., 2021; Di Renzo et al., 2020; Giacalone et al., 2020; Sidor and Rymski, 2020). However, this is not consistent with the earlier findings. While alcohol intake unchanged in Canada (Lamarche et al., 2021), more than half of the respondents declare lower alcohol consumption during confinement (Rodríguez-Pérez et al., 2020).

Furthermore, dining with friends and family only increased in Portugal during the study period—even though family reunions and gatherings are highly valued in countries such as China (Chang, 2010). In addition to fear of the virus, this phenomenon may have arisen because most restaurants were closed in China during the pandemic. Subsequent analysis confirmed this assumption, demonstrating that Chinese individuals’ intentions to share meals with family diminished substantially amid the outbreak.

The empirical evidence of this study reinforces the cultural food habits and their diet habits with a special focus on the healthy lifestyle. With the patterns of healthy food consumption and spending more time to cook, this paper suggests that life has changed in all countries and even though the population feels depressed and anxious they accept the new normal and use the time they have now to adopt sustainable and healthy lifestyles. Many studies reported more frequent home cooking during pandemic (Skotnicka et al., 2021; Pfeifer et al., 2021; Rodríguez-Pérez et al., 2020; Sidor and Rymski, 2020; Zhang et al., 2020). Moreover, a higher frequency of home cooking was associated with greater adherence to the Mediterranean Diet in Croatia (Pfeifer et al., 2021). Having provided the evidence of positive sights of this unprecedented crisis, the study also presents important cues that need to be taken into account in what concerns the supply and distribution of food as well as helping to reinforce the endeavor of being more sustainable and healthier.

Second, as to the implications for the society, this study focuses on cultural aspects to explain possible changes in food consumption before and during the pandemic. Theoretically, this research highlights the need to understand inter-cultural similarities and differences to satisfy people’s needs amid a “new normal.” The findings provide further implications for sociologists as well as for practitioners engaged in commercial/business activities. For instance, our results can help food delivery operators optimize in-app restaurant recommendations. This study also

and Vaccaro, 2020; Di Renzo et al., 2020; Effimov et al., 2020).
provides valuable insight for restaurateurs in terms of designing menus to suit target customers’ characteristics.

However, this study is not without limitations. First, our work only assessed habit changes in people from three countries. Although the sample contained a heterogeneous group based on respondents’ geographical distribution across each country, one limitation of this study is that the survey was only distributed to people with access to a computer or smartphone. Respondents were also limited to those living in urban cities who were educated; residents of rural areas and those under 18 years old were excluded. Moreover, the three chosen countries have different population sizes, which warrants caution: China is home to almost 1.5 billion people while Portugal has about 10 million. In terms of China’s population, attention should be paid to regional differences in national cuisine and food choices. As a result, the findings cannot be generalized to other populations. Future studies are suggested to extend this research on a more global level. Moreover, because changes in food consumption preferences occur through a long-term process, we recommend that longitudinal studies be conducted to more thoroughly understand how the pandemic’s impacts apply to individuals’ broader life contexts.

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Authors’ contributions

AK and MK designed research; all authors collected the data; AC analyzed data; AK, MK, AEÖ, JL and AC wrote and reviewed the paper. All authors read and approved the final manuscript.

Implications for gastronomy

• This paper aims to investigate the pandemic’s role in possible changes to people’s food consumption and meal habits.
• The sample includes those citizens in three countries, namely China, Portugal, and Turkey.
• The sample includes individuals as well as households with at least two people living together.
• Coronavirus has played a strong part in altering households’ food consumption and meal habits.
• The pandemic has particularly led to greater consumption of fresh fruits and vegetables and spending more time eating meals at home.
• Portugal appears to be consuming more seafood, bread, and butter.
• China features higher consumption of rice and meat products.
• Turkey is consuming more meat and eggs.

Ethical Statement

Hereby, we, Asker Kartari, Asli Ozen, Antonia Correia, Jun Wen, & Metin Kozak, consciously assure that for the manuscript “Impacts of COVID-19 on changing patterns of household food consumption: An intercultural study of three countries” the following is fulfilled:

1) This material is the authors’ own original work, which has not been previously published elsewhere.
2) The paper is not currently being considered for publication elsewhere.
3) This study followed human ethics and consent has been obtained before collecting data.
4) The paper reflects the authors’ own research and analysis in a truthful and complete manner.
5) The paper properly credits the meaningful contributions of co-authors and co-researchers.
6) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.
7) All authors have been personally and actively involved in substantial work leading to the paper, and will take public responsibility for its content.

I agree with the above statements and declare that this submission follows the policies of Solid State Ionics as outlined in the Guide for Authors and in the Ethical Statement.

Declaration of competing interest

All authors declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jifgsf.2021.100420.

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