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Food services in times of uncertainty: Remodeling operations, changing trends, and looking into perspectives after the COVID-19 pandemic

Thaiza Serrano Pinheiro de Souza [a], Roberta Fontanive Miyahira [b,c], Julia Rabelo Vaz Matheus [a], Talita Braga de Brito Nogueira [a], Carollyne Maragoni-Santos [a], Francisco Fabio Cavalcante Barros [d], Adriane Elisabete Costa Antunes [c], Ana Elizabeth Cavalcante Fai [a,b,*]

[a] Food and Nutrition Graduate Program, Federal University of the State of Rio de Janeiro (UNIRIO), Rio de Janeiro, Brazil
[b] Department of Basic and Experimental Nutrition, Institute of Nutrition, State University of Rio de Janeiro (UERJ), Rio de Janeiro, Brazil
[c] School of Applied Sciences, State University of Campinas (FCA/UNICAMP), Limeira, SP, Brazil
[d] National Institute of Industrial Property (INPI), Fortaleza, CE, Brazil

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ABSTRACT

Background: Social distancing and the economic downturn imposed by COVID-19 have significantly affected the food service segment. Therefore, operation recovery and adapting to a new reality must be achieved as quickly and efficiently as possible. Studies on this topic, which have been conceptualized in various parts of the world, have brought new ideas to light to mitigate the negative effects of COVID-19 on food service.
Scope and approach: This study aimed to discuss the impact of COVID-19 on food service operations, changes in pre-existing trends, and post-pandemic perspectives.
Key findings and conclusions: COVID-19 has changed all business segments. When dining rooms were forced to close, many food services had to resort to innovation to survive, and many added deliveries and/or adopted the dark kitchen models in one of their many forms. It is expected that the demand for delivery, dark kitchens, and the adoption of technological solutions, for example, contactless payment, will remain in the post-pandemic scenario. Food quality control measures have become more strictly enforced, not only to prevent SARS-CoV-2 contamination but also to increase credibility with the customer. These long-established food safety practices have returned to the spotlight, been revised, and should be maintained for well into the post-pandemic period. Restaurants are operating again and restrictions on opening hours and capacity have been relaxed or eliminated. Continued studies on this topic are important for supporting creative and scientifically based solutions for socio-economic recovery.

1. Introduction

The COVID-19 pandemic has changed the world. People were ordered to "#stay home" which has transformed social life. Food is vital for human existence, but where and how we fed ourselves during the pandemic have undergone profound readjustments. Eating out is an everyday practice in many countries. This market is an important part of the food industry and the population's eating habits and lifestyle.

In the case of food service, evidence shows that SARS-CoV-2 is not a foodborne pathogen, and COVID-19 is mostly spread on a person-to-person basis (Rizou et al., 2020; Shahidi, 2020; Jayaweera et al., 2020). Thus, to avoid crowded dining rooms and kitchens, food services faced an unprecedented challenge. Furthermore, the added impact of the economic downturn and weakened social bonds meant that many food services have closed down and others have had to adapt to the new reality.

Food service is a dynamic field, which includes different sectors, such as commercial (e.g., restaurants, coffee shops, hotels) and institutional (e.g., hospitals, schools, universities) segments (Edwards, 2013). The commercial food service sector has been significantly affected by the social distancing measures imposed because of COVID-19, as this type of business is mostly used for socializing. Because of the increased risk of

* Corresponding author. State University of Rio de Janeiro (UERJ), Maracanã Campus, São Francisco Xavier street, 524, 12th floor, room 12006 D, Maracanã, Rio de Janeiro, RJ, 20550-900, Brazil.
E-mail address: bethfai@yahoo.com.br (A.E.C. Fai).

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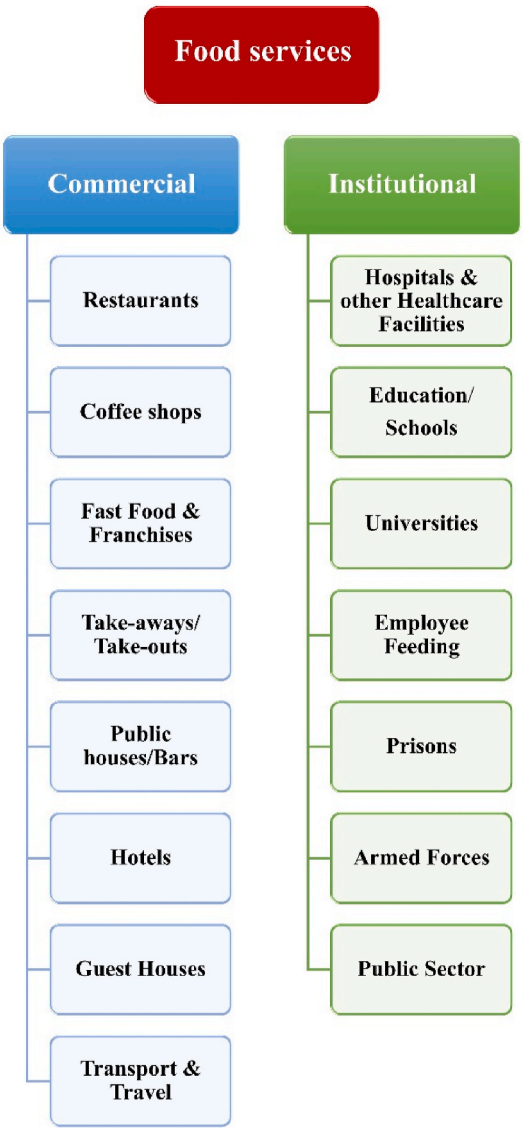

Fig. 1. Food service and their sub-sectors. Source: Edwards (2013).

contracting COVID-19 when eating out, governments worldwide required the closure of food business establishments, which led to changes in food consumption habits and client behaviors. The consumer's perception of food has changed in terms of the way the food is purchased, more people started cooking at home, concerns about preventive measures during food purchase increased, food delivery services increased, and eating out became a matter for concern (Soon et al., 2021).

The institutional recommendations for fighting the pandemic are based on the dynamics of the scientific knowledge that has been built around it. As in other fields of study, the consolidation of protocols in the area of food safety permeates the understanding and discussion of what is known to date, considering current needs and future perspectives. Civilization has been threatened by the virus, and the recovery of the food service industry must be accompanied by a broad study on this topic. In the post-pandemic scenario, the structure of society may need to be redesigned, and our lives and habits will also change. Therefore, it is expected that food service will also undergo changes to keep up with new behaviors. Thus, this study aims to provide an overview from an international perspective regarding the impact of COVID-19 on food service operations by discussing the changes in pre-existing trends and post-pandemic perspectives.

2. Food service – context of changes imposed by COVID-19

Before the COVID-19 pandemic, eating out increasingly replaced having meals at home. Food service establishments serve meals and snacks for immediate consumption on-site, that is, eating away from home. Food service can be divided into two categories, namely the commercial and institutional sectors (Fig. 1). The commercial sector was possibly the most financially affected food service business, as COVID-19 affected access to the places where people ate away from home, which led to a shift in how people acquire food (Leone et al., 2020). For example, customer expenditure at restaurants and hotels has decreased by over 60% because of the pandemic (Roe et al., 2020). At the institutional level, schools and universities have decreased or discontinued such services, which has disrupted regular access to food assistance and, thus, contributed to food insecurity in many countries. Moreover, in hospitals, food companies have been challenged to produce on a larger scale because of COVID-19 (Oliveira et al., 2020).

According to the USDA (2020), in 2019, 54.8% of meals were eaten outside the home, and commercial food service outlets accounted for the largest share of food expenses away from home. This is mainly because these meals were easily accessed and saved time. Moreover, in Europe, eating out has become an everyday practice for many consumers; one in four meals is eaten outside the home, and one in two meals is eaten at work. This market has become an important part of the food industry, increasing by 230.5 million euros a year. As in the United States and Europe, eating out is an important option in Brazil, where approximately one-third of Brazilian household expenses consist of food outside the home (32.8%) (IBGE, 2019).

Importantly, eating includes numerous aspects, from nutritional to cultural factors; it is a fundamental activity that positions individuals as social and complex beings. Sharing meals is a ritualistic socialization habit that brings people together. Therefore, the food service sector is not only an important economic factor but it is also a major socio-cultural contributor to social relationships (Gheribi & Bonadonna, 2019).

The COVID-19 pandemic may bring about medium and long-term changes in the dietary patterns of populations. As a result of the socio-economic disruption caused by the pandemic, companies have been closed and many workers have lost their jobs. Border closures, trade restrictions, and containment measures prevented farmers from buying and selling inputs and products, and agricultural workers were unable to harvest, which led to decreased purchasing power and interference in national and international food supply chains, which affects access to healthy, safe, and diverse food (ILO et al., 2020).

3. Food service operations: adaptation and innovations imposed by COVID-19

Since the beginning of the COVID-19 pandemic, the demand for restaurant food has reduced. The impact of the pandemic shutdown in the food service industry in the United States in 2020 led to a reduction of $ 240 billion of the predicted sales before the pandemic, 110,000 food service establishments have closed either temporarily or permanently, and it is estimated that more than 8 million employees have been laid off (NRA, 2021b). In Brazil, it is estimated that in the bar and restaurant sectors, from March 2020 to July 2021, 300,000 companies closed permanently, and 1.2 million workers were dismissed (ABRASEL, 2021). The pandemic has had diverse effects in different countries. The demand for restaurants in the U.S. fell by 60%, while it grew by 5% in Germany in June 2020 compared to the same month in 2019. In Brazil, 30% of restaurants and bars may not re-open, and in Spain, more than 40,000 restaurants and bars closed permanently last year (ANR, 2020).

Because of restaurant shutdowns and social distancing, consumer behavior regarding food consumed at home has shifted considerably, with takeaways and home deliveries becoming the alternative to closed restaurants (Li et al., 2020). Thus, online food deliveries increased and

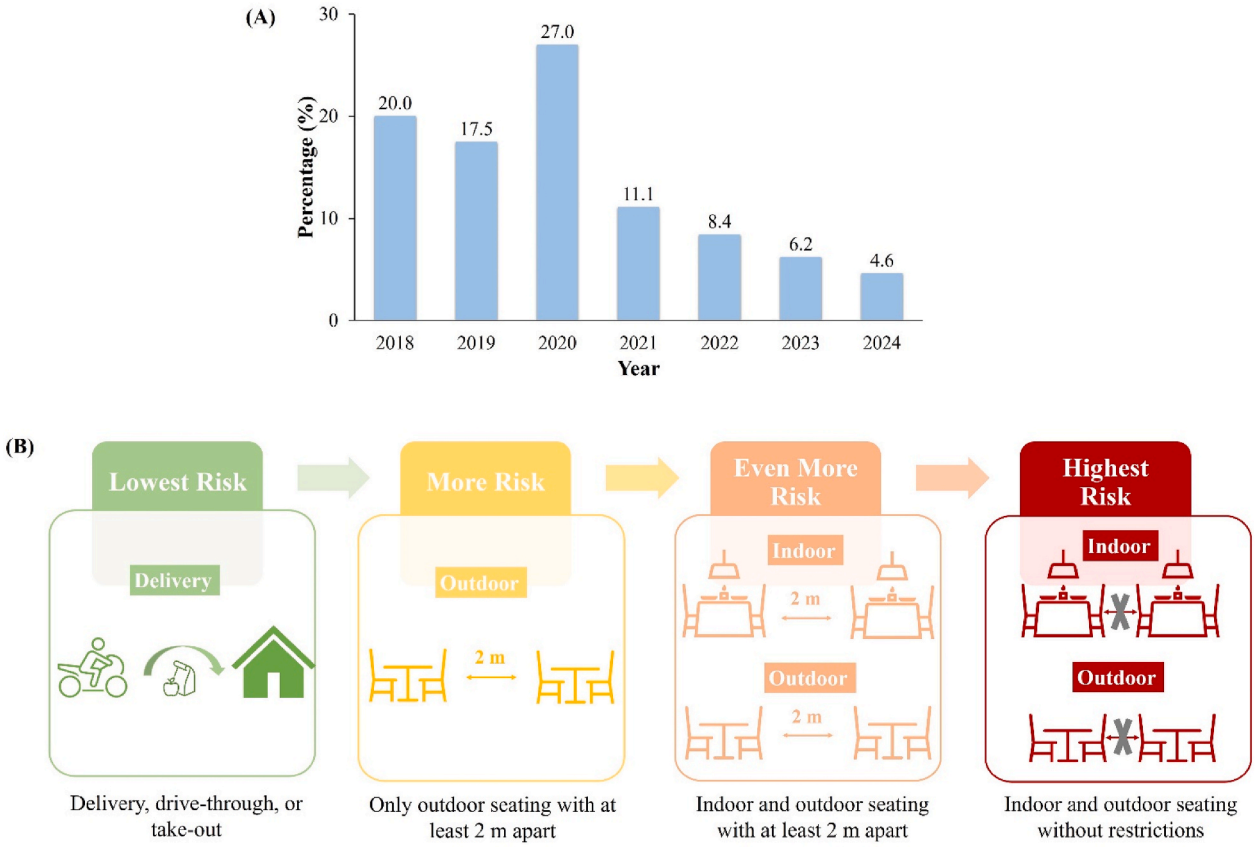

Fig. 2. (A) Revenue growth of the food delivery segment in the world; (B) Risk level when eating out. Sources: CDC, 2020; Statista, 2021.

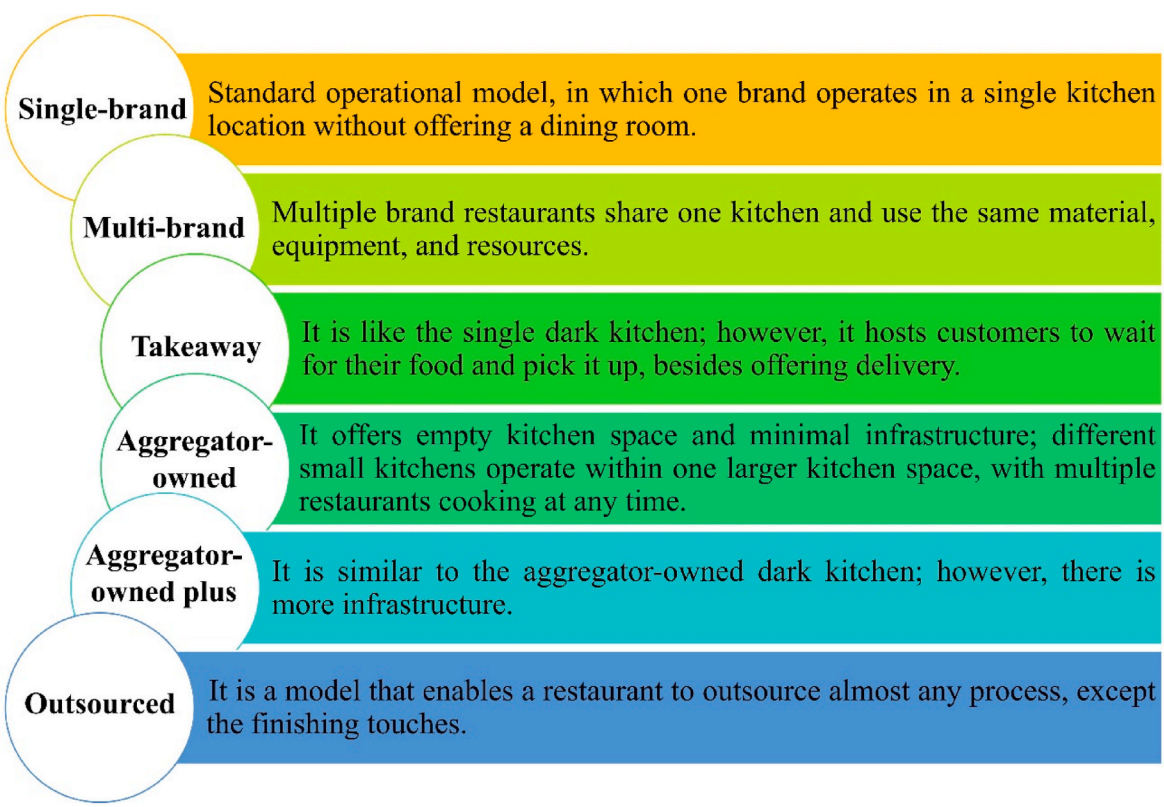

Fig. 3. Different set-up models of dark kitchen. Source: Deliverect, 2020.

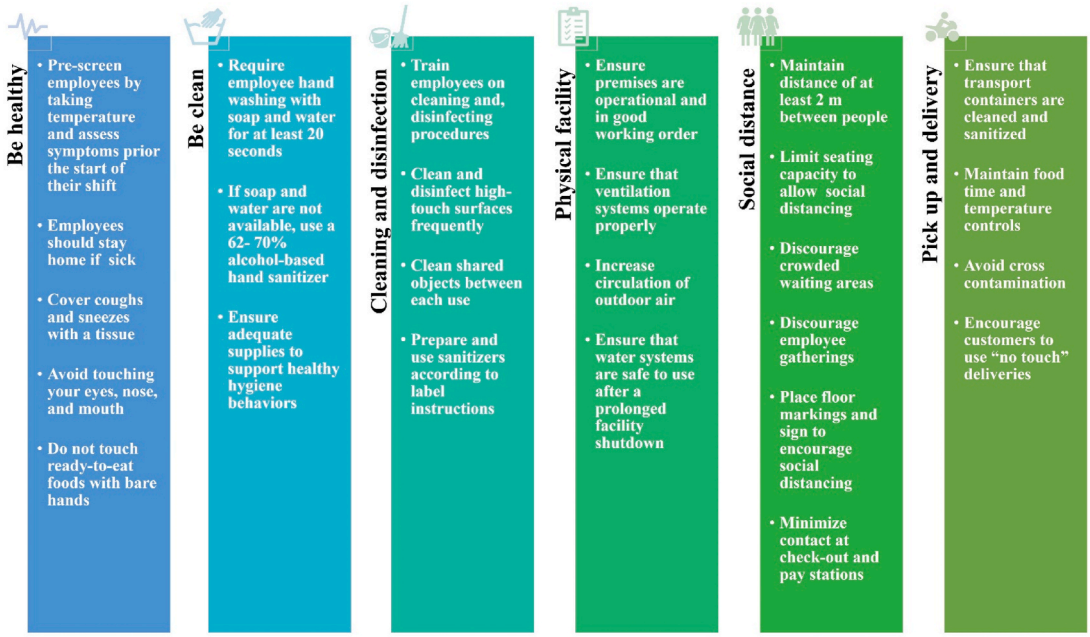

Fig. 4. Summary of main operating instructions for food stores, restaurants, and food delivery services. Sources: CDC (2020); FDA (2020b).

remains high during the COVID-19 outbreak. According to the National Restaurant Association (NRA, 2021a), 68% of consumers in the U.S. are more likely to use food delivery services than before the pandemic, and 53% of consumers consider delivery essential to their lifestyle. This segment is projected to reach more than US$ 152 million in 2021 (Statista, 2021). Fig. 2A shows the revenue growth of the world food delivery segment from 2018 until the forecast for 2024. There was an increase of 9.5% in 2020 compared with 2019, which is a result of the pandemic outbreak.

COVID-19 has the least chance of spreading through food service when it is limited to drive-through, delivery, take-out, and curb-side pick-up, while the highest risk occurs when eating on-site in an indoor setting without following the distancing requirement of at least 2 m between tables (Fig. 2B) (CDC, 2020). Although the above-mentioned practices are considered to be less risky, those who make deliveries are at greater risk of coronavirus infection and may become spreaders. Therefore, some practices should be followed to reduce this risk, for example, contact-free delivery; strict use of new face masks, gloves, and hand sanitizers; use of e-wallet or credit card payment methods; and disposal of the packaging as soon as possible and handwashing immediately after receiving the meal (Nguyen & Vu, 2020).

Owing to the expected growth of the online delivery market, a new concept of cuisine, termed "dark kitchen" (also known as ghost or cloudy kitchen) has been growing and has become a trend. This emergent business model consists of a food service establishment that offers only off-site meals (no on-site meals, no waiters) (NRA, 2020a). Virtual kitchens have the same operational process: receive the orders, prepare the food, and package to-go meals, but they can be set up and organized in different ways (Fig. 3). Costs are reduced because of the facilities used and the need for fewer employees. Additionally, there is a greater capacity to increase the diversity of menus, concepts, or brands, and one kitchen can serve diverse gastronomic experiences (Li et al., 2020).

Another trend, which has become pivotal, is the adoption of technological solutions. According to the NRA (2021b) survey, 40% of restaurant operators in the U.S. have added a contactless and mobile payment method since the beginning of the pandemic to minimize person-to-person contact and reduce points of contact. Digital trends include the following: online ordering systems and delivery applications; contactless payment; online table reservation systems; digital menu board for kitchen staff; tracking of food and beverage stocks using automated inventory management software; access to menus online via QR codes; and air purification technology to promote clean air (EHL, 2021).

Commercial restaurants that have survived the pandemic must remain resilient to ensure they can remain economically active while following the food safety practices suggested by sanitary regulations (Freitas & Stedefeldt, 2020). The key considerations when re-opening food establishments relate to how the food can be safely managed and delivered to the public, the best practices for employee health, cleaning and sanitizing, and the use of personal protective equipment (FDA, 2020a). Fig. 4 shows a summary of the main operating instructions for food stores, restaurants, and food delivery services as issued by food regulatory agencies during the COVID-19 pandemic.

The authorities eased restrictions, which led to a careful, slow, and gradual reopening process. However, reopening the sit-down restaurants did not mean that consumers would be ready and comfortable eating in restaurants (Gursoy & Chi, 2020). In addition to clients' insecurity, high operational costs have presented a challenge. Brizek, Frash, McLeod, and Patience (2021) found that 25% of restaurants did not survive the closure after two months, and about 65% of respondents felt they could not keep their restaurants open if the pandemic restrictions remained until 2021.

Consumers have become accustomed to ordering takeaway food, and restaurants have been transforming their business models to meet this new demand, mainly by innovating in the experiential value of ordering food online (Gavilan et al., 2021). Currently, the world is in the process of vaccination, which will allow more consumers to return to restaurants, especially when there are options for tables in an open area and the delivery of orders. These transformations will facilitate greater resilience and growth in food services, which were heavily affected by the economic crisis resulting from the pandemic. Furthermore, currently, many countries are considering the requirement of proof of vaccination for consumers to frequent bars and restaurants, the so-called "vaccine passport" (Abrasel, 2021; COVID Passport, 2021a; 2021b; Forbes, 2021; Gouvernement du Québec, 2021).

4. Safety measures in food service before and after COVID-19 – has anything changed?

COVID-19 has substantially altered human activities (Finger et al.,

2021), such as closing non-essential places that could promote large gatherings (Qureshi et al., 2021), social distancing and isolation (Schimit, 2020), and intensifying personal hygiene practices (Daverey and Dutta, 2020). These changes have directly affected the out-of-home food business. To date, there is no evidence that the SARS-CoV-2 virus can be transmitted through food or food packaging. Nevertheless, concerns about food hygiene have increased substantially since the start of the pandemic. Thus, safe food hygiene practices are crucial and must be adopted by food producers, manufacturers, and handlers to reduce any chance of infection. Good hygiene practices and food safety management systems ought to be reviewed, improved, and complemented in food service, for example, physical separation, installing physical barriers, adequate ventilation, improving cleaning protocols, and offering personal hygiene training to food workers (ICMSF, 2020).

In the 1990s, within the scope of the World Trade Organization (WTO, 1995), the Sanitary and Phytosanitary (SPS) Agreement was signed. This agreement proposed actions to harmonize sanitary measures. Thus, the sanitary measures of members must be based on international standards, guidelines, or recommendations. Moreover, members must be part of international organizations and their subsidiary bodies, in particular the Codex Alimentarius Commission (CAC), to promote – within these organizations – the development and periodic review of standards, guidelines, and recommendations concerning all aspects of sanitary measures (WTO, 1995). Thus, under the SPS Agreement and the codes of practices issued by the CAC, a standard was set for international harmonization of the government's regulatory mechanisms (Aruoma, 2006).

Despite international standards, countries have different food safety issues and risk levels in their domestic food chain. These risks differ because of differences in available technologies, plant and livestock host factors, food production traditions, cultural differences, and topographical or climatic conditions (McAllister, 2018). While developed countries monitor their food systems and reach the expected outcome, many developing countries are faced with the challenges posed by unsafe and inadequate food supply (Aruoma, 2006).

Table 1
Impact of the measures imposed during the COVID-19 pandemic in post-pandemic food service.

Measure during COVID-19 pandemic	Trends after COVID-19 pandemic
Use signs and posters to build awareness of good handwashing technique (BEIS, 2020)	Clients and employees are more conscious and attentive to handwashing/hygiene
Hand-washing sink and hand sanitizer in multiple locations besides the toilets (Shahbaz et al., 2020)	More sanitizer dispensers and sinks available in the establishment (not just in the toilets).
Clean surfaces and objects (tables, laminated menus, etc.) between each customer use (NRA, 2020b)	Habit to clean surfaces and objects with 70% alcohol after customer use.
Adequate distance between tables (2 m) and chairs (1 m) and, if possible, installation of physical barriers between tables and/or clients (ABRASEL, 2020)	Less contact between customers
Avoiding raw and poorly cooked food of animal origin (meat, eggs, dairy products) to reduce exposure to other viruses (COVID-19 is not a foodborne disease) and foodborne pathogens (FAO, 2020)	Consumers are more concerned with food security and apprehensive of consuming raw food (vegetable salad, Japanese food, etc.) and food of animal origin outside the home.
Creation of Guidelines to assist the food sector during the COVID-19 pandemic (ANVISA, 2020a, 2020b; FDA, 2020b; WHO, 2020a)	The incentive to rethink pre-pandemic guidelines and create new guidelines (clearer and updated) regarding best practice procedures
Adoption of safe practices that were previously considered impossible to implement. Such measures were adopted in a clear, direct, and science-based manner (Freitas & Stedefeldt, 2020)	Restaurants will work more safely than in the pre-pandemic period. Moreover, clients, employees, and employers will be more attentive and conscious of cleaning the establishment and of food hygiene.

Developing countries suffer the largest portion of foodborne illnesses and death. This places a substantial burden on over-stretched public health services (Oloo et al., 2018). Some of these problems could result from lack of requirements and evaluation methods when receiving raw materials (Mesquita et al., 2016), absent or inadequate sanitary surveillance (Oloo et al., 2018), or inadequate sanitary facilities (Neme et al., 2017). Moreover, cultural and traditional practices may contradict new food processing and handling regulations (Oloo et al., 2018; Yang, 2013), and some people may criticize the negative impact of introducing harsher regulations in developing countries (Das, 2008).

Recently, several documents have been published and practices have been tested in several countries. One of these cases is the "Framework for Action on Food Safety in the WHO South-East Asia Region," a document that aimed to encourage member states to initiate, develop, and sustain multisectoral approaches and measures to promote food safety. The implementation of the framework takes place over a six-year period (2020–2025) in three steps: assess the status of the national food control system, develop a national strategic plan and policy setting for implementation, and monitor the performance of the national food control system (WHO, 2020b).

The impact of the COVID-19 pandemic may accelerate the regulatory processes related to these food production chains and food handling sectors worldwide. The following recommendations were made: reinforce personal hygiene measures and provide training to food workers to eliminate or reduce the risk of contamination of food surfaces and food packaging materials by the virus (WHO, 2020b). This includes emphasizing the application of CAC practical guidelines to ensure food hygiene (CAC, 2003), correct meat handling (CAC, 2005), and controlling viruses in foods (CAC, 2012). Furthermore, applying these food safety practices will reduce the probability of pathogens contaminating foods and prevent foodborne infections, reducing the stress on the public health system (FAO, 2020).

As each country implemented different measures concerning distance restrictions, rules about the area per table, and hygiene measures (Madeira et al., 2020), they accomplished different results. Food regulatory agencies in different countries have published guidelines and documents regarding precautions and best practices for food security regarding the COVID-19 pandemic, which are generally based on WHO guidelines (Maragoni-Santos et al., 2021; WHO, 2020a), for example, the United States (FDA, 2020b), the European Union (European Union, 2020), the United Kingdom (FSA, 2020), China (CFS, 2020a; 2020b; 2020c), Canada (CFIA, 2020), Brazil (ANVISA, 2020a, 2020b), Argentina (MAGyP, 2020), Australia, New Zealand (FSANZ, 2020a; 2020b; SWA, 2020), India (FSSAI, 2020), and Nigeria (NAFDAC, 2020).

Epidemiological evidence indicates that SARS-CoV-2 is not considered a foodborne disease as it is mostly transmitted by human-to-human contact through respiratory droplets and aerosols (Rizou et al., 2020; Shahidi, 2020; Jayaweera et al., 2020). Therefore, frequenting restaurants and food courts may increase the spread of the new coronavirus. A decisive factor is the act of eating, since the mouth can be a route of infection by the SARS-CoV-2. In many countries, the population's use of masks is a significant factor, especially in environments with a large flow of people. Although this device is an important protective factor for users, when it is taken off and placed on tables, for example, it poses a risk of cross-contamination that must be considered.

5. Remodeling food services – post-pandemic perspectives

While pre-pandemic municipal legislation across the globe already includes the necessary hygiene precautions to minimize risks of biological contamination (including viruses), some specific strategies should be addressed.

The strategies include advising clients about the correct handling of their masks, ensuring the availability of a hand-washing sink for customers at the entrance to the establishment and in the food courts of malls (not just in the toilets), laminated menus to allow cleaning with

70% alcohol, using a "leaner" menu during the peak of the pandemic, careful maintenance of air conditioning filters, adequate distance between tables and, if possible, installation of physical barriers between tables and/or clients. The physical barriers, made of acrylic or other equivalent materials, should be easy to clean and be installed in the buffet area. Importantly, during the COVID-19 pandemic, it is preferable to replace the buffet with the *à la carte* or "set meal" systems. While the strategy of measuring customers' temperatures before they enter restaurants can be useful, it will not prevent asymptomatic infected people from accessing the establishment.

According to FAO (2020b), food of animal origin should be cooked at an appropriate internal temperature (70 °C). While the transmission of COVID-19 through food has not been reported, avoiding raw and poorly cooked food of animal origin (meat, eggs, and dairy products) will reduce exposure to other viruses and foodborne pathogens. Therefore, as some dishes with raw food of animal origin pose an increased risk of contamination, they may become less accepted by customers or be less available on menus, for example, "steak tartare," "ceviche," and "carpaccio." Moreover, recipes that use raw eggs, such as mousses and non-processed mayonnaise, may have to be prepared differently.

Additionally, the consumption of Japanese food served with raw fish may have to be re-evaluated. Because these foods do not undergo any process of microbial load reduction, such as cooking or sanitization, it is difficult to guarantee a low microorganism load, including viruses.

Conversely, raw foods of plant origin should be consumed freely since they can be sanitized. However, some people may not feel safe consuming them outside the home. The quality of ingredients and safe food handling procedures must be even more rigorous after the pandemic to regain customer trust.

Table 1 shows safety measures imposed on food service during the COVID-19 pandemic and the trends in the post-pandemic period. In general, it can be shown that hygiene measures previously established by best practices will be more appreciated and further reinforced. It is expected that consumers will become more aware of hand hygiene.

6. Conclusion

COVID-19 has prompted unprecedented challenges for food services. Restaurants are often an area of socialization and celebration, but because of social distancing, the economic downturn, weaker social bonds, restaurant visits have decreased sharply. Many employees were dismissed, several establishments have closed down, and food consumption has greatly changed. Currently, the vaccine rollout has led to a reduction in the restrictions for restaurants and bars, and activities have been resuming. However, recovery may not yet have reached pre-pandemic levels. Home delivery and take-out became a lifeline for restaurants during the pandemic and the concept of dark kitchens has become a trend. The adoption of technological solutions for online and in-person services has also emerged, such as the following: online ordering systems and delivery applications, contactless payment, online table reservation systems, digital menu boards for kitchen staff, tracking food and beverage stocks with automated inventory management software, access to menus online via QR codes, and air purification technology. Furthermore, food quality control measures have become more strictly enforced during the pandemic, not only to prevent contamination of food products by SARS-CoV-2 but also to increase customer trust. These long-established best practice measures have returned to the spotlight, have been revised, and should be maintained for a long time into the post-pandemic period.

Declaration of competing interest

No conflict of interest.

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