

Meal delivery apps before and during the COVID-19: coverage in a Brazilian metropolis

Aplicativos de entrega de refeições antes e durante a COVID-19: cobertura em uma metrópole brasileira

Aplicaciones de entrega de comidas antes y durante el COVID-19: cobertura en una metrópoli brasileña

Juliana de Paula Matos¹ <https://orcid.org/0000-0002-1424-8344>, Larissa Loures Mendes¹ <https://orcid.org/0000-0002-0031-3862>, Paloma Aparecida Anastacio Barros¹ <https://orcid.org/0009-0008-1934-3106>, Nayhane Gomes Cordeiro¹ <https://orcid.org/0000-0002-1110-8944>, Luana Lara Rocha¹ <https://orcid.org/0000-0002-5963-6033>, Paula Martins Horta¹ <https://orcid.org/0000-0002-1848-6470>

Abstract The establishments present in meal delivery apps (MDA) and the coverage of these services are little known, especially after the COVID-19 pandemic. Objective: To analyze the establishments registered in two MDA in Belo Horizonte, Brazil, in 2019 and 2021. Methods: The sample consisted of the best rated establishments within the MDA in 18 neighborhoods in 2019 (n=357) and 2021 (n=308). Establishments were classified according to the predominance of meals present on their menus. The coverage of the establishments was calculated by dividing the number of neighborhoods served by each establishment and the number of neighborhoods. The Health Vulnerability Index (HVI) was used as a proxy of the social vulnerability of neighborhoods. Results: Fast-food restaurants were the most frequent establishment in the MDA in both periods and the percentage of neighborhoods served by these services was higher in 2021 (17.50%) than in 2019 (13.54%), although their participation in the sample was lower in 2019 (44.26% vs. 30.84%). The coverage of MDA establishments in the neighborhoods differed according to HVI. Conclusion: Coverage and participation of the establishments present in MDA in Belo Horizonte were different in both study periods, particularly in high socially vulnerable neighborhoods.

Keywords Food, Mobile Applications, COVID-19, Socioeconomic Factors

Resumo Os estabelecimentos em aplicativos de entrega de refeições (em inglês: Meal delivery apps - MDA) e a cobertura desses serviços são pouco conhecidos, principalmente após a pandemia de COVID-19. Objetivo: Analisar os estabelecimentos cadastrados em dois MDA de Belo Horizonte, Brasil, em 2019 e 2021. Métodos: A amostra foi composta pelos estabelecimentos mais bem avaliados dentro do MDA em 18 bairros em 2019 (n=357) e 2021 (n=308). Os estabelecimentos foram classificados de acordo com a predominância de refeições presentes em seus cardápios. A cobertura dos estabelecimentos foi calculada dividindo-se o número de bairros atendidos por cada estabelecimento pelo número de bairros. O Índice de Vulnerabilidade da Saúde (IVS) foi utilizado como uma proxy da vulnerabilidade social dos bairros. Resultados: Os restaurantes fast-food foram os estabelecimentos mais frequentes no MDA em ambos os períodos e o percentual de bairros atendidos por esses serviços foi maior em 2021 (17,50%) do que em 2019 (13,54%), embora sua participação na amostra tenha sido menor em 2019 (44,26% vs. 30,84%). A cobertura dos estabelecimentos nos bairros diferiu conforme o IVS. Conclusão: A cobertura e a participação dos estabelecimentos presentes no MDA em Belo Horizonte foram diferentes nos dois períodos de estudo, principalmente em bairros de alta vulnerabilidade social.

Palavras-chave Alimentos, Aplicativos Móveis, COVID 19, Fatores Socioeconômicos

Resumen Los establecimientos que ofrecen aplicaciones de entrega de comidas (MDA) y la cobertura de estos servicios son poco conocidos, especialmente después de la pandemia de COVID-19. Objetivo: Analizar los establecimientos registrados en dos MDA de Belo Horizonte, Brasil, en 2019 y 2021. Métodos: La muestra estuvo compuesta por los establecimientos mayor valorados dentro de la MDA en 18 barrios en 2019 (n=357) y 2021 (n=308). Los establecimientos fueron clasificados según el predominio de comidas presentes en sus menús. La cobertura de establecimientos se calculó dividiendo el número de barrios atendidos por cada establecimiento por el número de barrios. Se utilizó el Índice de Vulnerabilidad en Salud (IVS) como proxy de la vulnerabilidad social de los barrios. Resultados: Los restaurantes de comida rápida fueron los establecimientos más frecuentes en la MDA en ambos periodos y el porcentaje de barrios atendidos por estos servicios fue mayor en 2021 (17,50%) que en 2019 (13,54%), aunque su participación en la muestra fue menor en 2019 (44,26% vs. 30,84%). La cobertura de establecimientos en los barrios difirió según el IVS. Conclusión: La cobertura y participación de los establecimientos presentes en la MDA de Belo Horizonte fueron diferentes en los dos períodos de estudio, especialmente en los barrios con alta vulnerabilidad social.

Palabras clave Comida, Aplicaciones móviles, COVID-19, Factores socioeconómicos

¹Departamento de Nutrição. Universidade Federal de Minas Gerais (UFMG). Av. Alfredo Balena 190, 30130-100. Belo Horizonte MG Brasil. ju.liana2011@yahoo.com.br

Introduction

Food environments are increasingly experienced through technology and shaped by it in many ways ¹. Meal delivery apps (MDA), which are business platforms that provide order management, delivery, and payment services to establishments selling meals ², are a part of this environment. Notably, MDA allows users to purchase various food and beverage items, including meals, snacks, and beverages, through a connected device without needing to physically travel to a restaurant or store. This convenience can save time and money ^{3,4}.

The use of MDA has increased significantly in recent years, especially during the COVID-19 pandemic when commercial food establishments were closed for on-site consumption to reduce the spread of the SARS-CoV-2 virus ^{2, 4-6}. In Brazil, the number of food orders for home delivery increased by 9% and 10% during weekdays and weekends, respectively, between March and May 2020 ⁷. This trend continued over time, and by March 2021 the largest MDA company in Brazil received more than 60 million orders ⁸.

While the use of MDA can reduce physical contact and, therefore, the risk of SARS-CoV-2 contamination ^{2,4-6}, these services often have a large selection of unhealthy foods and beverages ⁹⁻¹⁵ and use advertising techniques to convince consumers to purchase these items ⁹⁻¹⁵. As a result, the food environment of MDA may encourage unhealthy eating habits and have a potential negative impact on public health ⁹⁻¹⁶.

Although research in Brazil has previously described the characteristics and nutritional quality of meals offered by MDA in a capital city before the COVID-19 pandemic ⁹ and has reported the presence of food advertising on these platforms ^{17,18} and on social media profiles ¹⁹ during the first phase of the pandemic, little is known about the profile of the establishments registered on these platforms before and during the COVID-19 pandemic, as well as the characteristics of the coverage of this service according to the profile of locations served.

Given these gaps in the existing literature, the aim of this study is to characterize the types of establishments registered on two MDA in Belo Horizonte, Brazil, in 2019 and 2021, and analyze the coverage of this service according to the socioeconomic data of the neighborhoods. The findings of this study can help to understand the changes generated by the COVID-19

pandemic in MDA's digital food environment and Brazilian consumers' exposure to these platforms.

Methods

Design

This is a comparative study of two cross-sectional data. The local of the study is Belo Horizonte, the capital of Minas Gerais, Brazil, which has a population density of 7,167 inhabitants per km² and a gross domestic product per capita of R\$ 36,759.66 ²⁰. Belo Horizonte has nine regional districts (Venda Nova, Norte, Nordeste, Pampulha, Noroeste, Leste, Oeste, Centro-Sul, and Barreiro), 487 neighborhoods, and 218 favelas ²¹. Centro-Sul district has the highest average income, with Belvedere and São Bento representing the city's wealthiest neighborhoods. In addition, the neighborhoods with the highest Human Development Index (HDI) are in this region (Savassi, Anchieta, and Cruzeiro) ²². Furthermore, as a conurbed metropolis, Belo Horizonte comprises 34 municipalities in its metropolitan region ²³.

The MDA analyzed in this study are the most popular in Brazil: Ifood and UberEats. According to an online survey of conducted in August 2022, Ifood was downloaded 24.4 million times in 2021 and UberEats 5.3 million times ²⁴. Furthermore, Ifood operated in more than 1,700 Brazilian cities in 2021 ²⁵ and UberEats closed its activities in Brazil in 2022 ²⁶.

Context of the COVID-19 pandemic

The cross-sectional data used in this study were obtained in February 2019, before the onset of the COVID-19 pandemic, and in May 2021, when Brazil had recorded a total of 16,907,425 confirmed cases and 472,531 deaths from the SARS-CoV-2 virus ²⁷. In Belo Horizonte specifically, there were 199,584 confirmed cases and 5,079 deaths ²⁸. In May 2021, the commercial establishments were operating in the municipality, but there were restrictions for on-site consumption in terms of opening hours, the number of people allowed inside, and rules for physical distancing ²⁹.

Selection of neighborhoods and food commercial establishments

Two neighborhoods of the nine regional districts of Belo Horizonte (n=18 neighborhoods) were randomly selected. To be included in the study the two MDA delivery services must be available in all neighborhoods, which was checked by searching for the name of each neighborhood in the search browser of the app and confirming it was possible to make an order for that address.

In both cross-sectional data, the best rated commercial food establishments in each neighborhood were searched on both MDA platforms and the 10 establishments best positioned in this ranking were selected. This criterium has been used in another study⁹ and was adopted in this investigation given the impossibility of evaluating all the establishments present on the MDA. Data were collected at three different times daily (11:00 am to 1:00 pm, 4:00 pm to 6:00 pm, and 8:00 pm to 10:00 pm) and on both a weekday and a weekend day. An anonymous tab of the Internet browser was used to avoid potential programmatic media targeting by the researcher's profile.

The selection of the 10 best rated commercial food establishments in the MDA in each neighborhood address resulted in a total of 2,160 establishments in each cross-sectional data. However, this number included repeated establishments that appeared in both MDA, at different times daily, and on different days. After excluding these repetitions but keeping establishments that appeared in more than one neighborhood, we had 357 establishments in 2019 database and 308 in 2021 database, with 18 establishments appearing in both years.

Socioeconomic profile of neighborhoods

The socioeconomic profile of the neighborhoods was classified based on the Health Vulnerability Index (HVI). The HVI is a synthetic indicator based on information from the 2010 Demographic Census and is used to assess the degree of social vulnerability of neighborhoods³⁰. It is a composite indicator that combines socioeconomic (residents per household, percentage of illiterate people, percentage of private households with a per capita income of up to half the minimum wage, average nominal income of the head of the household, percentage of mixed and black people, and indigenous)

and environmental variables (sewage, water supply, and solid waste destination. According to HVI, neighborhoods are classified in terms of their social vulnerability: low, medium, high, and very high. In our study, high and very high categories of the HVI were grouped and represented the most vulnerable neighborhoods of the sample³⁰.

Types of commercial food establishments

The commercial establishments were classified based on the predominance of preparations and items of the menus in: i) ice cream shops (predominance of ice cream and açaí, or preparations based on these foods); ii) bakeries/confectioneries (predominance of homemade sweets or baked goods); iii) regular restaurants (predominance of dishes based on national or international cuisines or meals predominantly plant-based); and iv) fast-food restaurants (predominance of hamburgers, pizzas, and fried snacks). This categorization was carried out by two experienced researchers with all the divergences being solved.

Data analysis

The participation of the types of commercial establishments in each cross-sectional database and according to neighborhood HVI categories was described in absolute and relative frequencies. Differences were verified by Pearson's Chi-Square test p-value for independent samples, with a significance level of 5%.

We also calculated the coverage of each commercial food establishments in the neighborhoods following the expression: *Total Coverage = (sum of neighborhoods served per establishment / total number of neighborhoods in the sample)*100*. According to this definition, an establishment that was among the 10 best rated in the MDA in one neighborhood of the 18 assessed has a coverage of 5.55%. This coverage was also checked in each HVI category following the expression: *HVI coverage: (sum of neighborhoods served per establishment in each HVI group / number of neighborhoods in each HVI group)*100*. The mean and the standard deviation of the establishments' coverage (total and in each HVI category) were estimated in the two cross-sectional database and differences were tested applying the Student's T test for independent samples at a significance level of 5%.

Analyses were performed using Stata software version 14.0, and the results were tabulated using EpiInfo software version 7.0.

Results

In 2019, fast-food restaurants were the most common type of establishment among the 10 best rated establishments in the MDA (44.26%). In 2021, fast-food restaurants (30.84%) and regular restaurants (31.49%) split this position. Comparing the two cross-sectional data, fast-food restaurants frequency was lower in 2021 (30.84%) than in 2019 (44.26%) ($p < 0.001$) while the frequency of bakeries/confectioneries were higher in 2021 (16.56%) in comparison to 2019 (10.64%) ($p = 0.026$). Ice cream shops were the least common types of establishments in the two cross-sectional data (Table 1).

The total coverage of establishments was lower in the neighborhoods in 2019 (13.54%) than in 2021 (17.50%) ($p = 0.0001$). After stratifying this analysis by the type of establishments, we found a greater coverage of fast-food restaurants in 2021 (20.88%) than in 2019 (12.94%)

($p < 0.001$). No significant difference was found in the coverage of other types of establishments between the cross-sectional data (Table 2).

The coverage of MDA establishments differed in the two cross-sectional data in neighborhoods with medium and high/very high HVI. In both cases, the establishments coverage was higher in 2021 than in 2019 (medium: 18.12% vs. 13.28%; high/very high: 18.32% vs. 13.45%) (Figure 1A). The stratified analysis by the type of establishment showed that, except for ice cream shops, all the other types of establishments had a different neighborhood coverage between the two years, according to the HVI classification of the neighborhoods. Fast-food restaurants had greater coverage in 2021 for neighborhoods classified as low HVI (2021: 22.46% and 2019: 11.81%), medium HVI (2021: 20.63% and 2019: 12.91%) and high/very high HVI (2021: 19.7% and 2019: 13.92%) (Figure 1B). Regular restaurants had greater coverage in 2021 than in 2019 only in high-HVI neighborhoods (16.05% vs. 10.64%, respectively) (Figure 1C).

Tabela 1. Characterization of the commercial food establishments in two meal delivery apps, in Belo Horizonte, Brazil, 2019 and 2021.

Type of establishment	2019 (n=357)		2021 (n=308)		p
	n	%	n	%	
Fast-food restaurants	158	44.26	95	30.84	<0.001
Regular restaurants	98	27.45	97	31.49	0.254
Ice cream shop	63	17.65	65	21.10	0.260
Bakery/confectionery	38	10.64	51	16.56	0.026
Total	357	100	308	100	-

Note: Pearson's Chi-Square test p-value for independent samples.

Tabela 2. Coverage of commercial food establishments in two meal delivery apps, Belo Horizonte, Brazil, 2019 and 2021.

Type of establishment	2019 (n=357)		Coverage (%)		p
	Mean	Standard deviation	2021 (n=308)	Standard deviation	
Fast-food restaurants	12.94	9.58	20.88	16.38	<0.001
Regular restaurants	12.64	10.49	14.95	12.76	0.1693
Ice cream shop	15.17	10.19	18.72	19.06	0.1931
Bakery/confectionery	15.64	11.02	14.49	11.23	0.6297
Total	13.54	10.12	17.50	15.39	0.0001

Note: Pearson's Chi-Square test p-value for independent samples.

Contrary to the trend shown by previous mentioned establishments, bakery/confectionery had lower coverage in 2021 than in 2019 in low HVI neighborhoods (2021: 9.8% and 2019: 21.93%) (Figure 1E).

Discussion

This study is the first to investigate the profile and coverage of establishments registered in MDA in a Brazilian metropolis before and during the COVID-19 pandemic. Fast-food restaurants were the most frequent establishments in the ranking of the best rated establishments in the MDA in both years of the study, confirming previous research findings that the food environment of these apps primarily promoted the

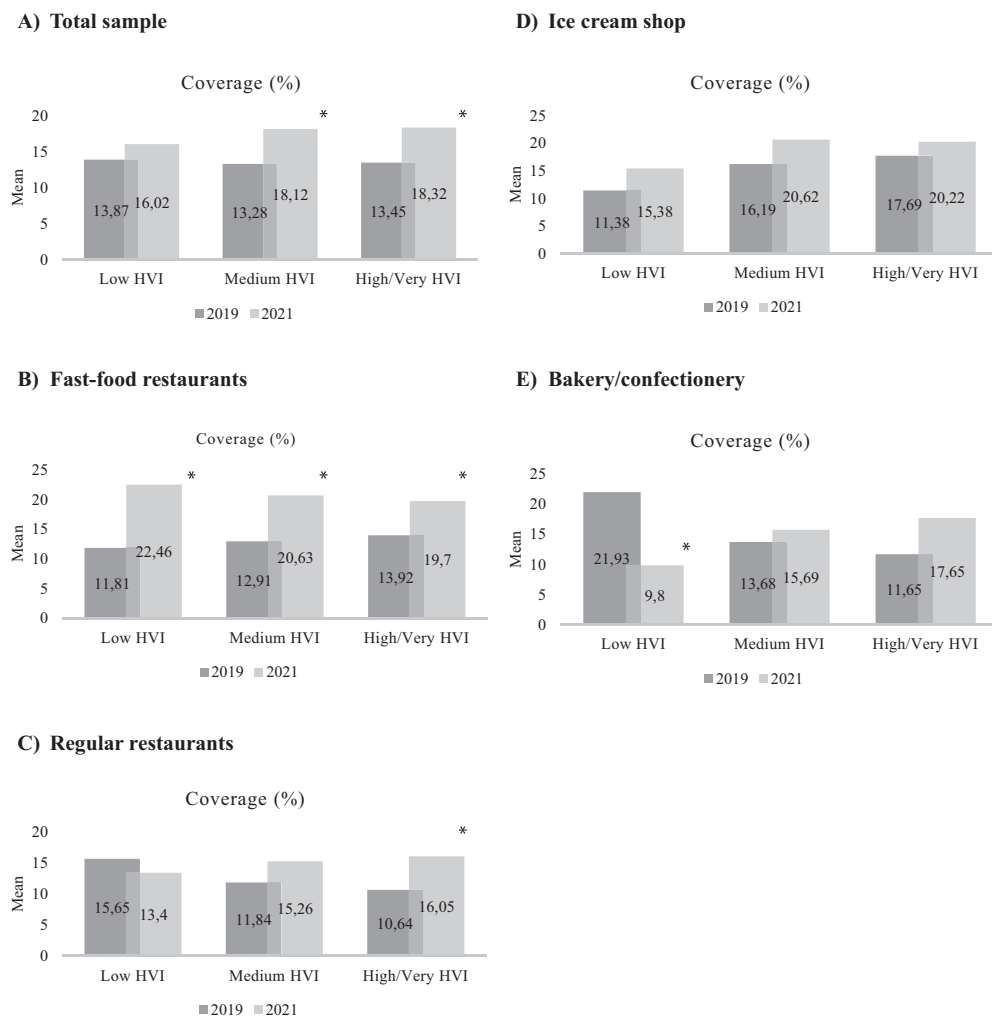


Figure 1. Coverage of commercial food establishments in two meal delivery apps according to the Health Vulnerability Index category of the neighborhood. Belo Horizonte, Brazil. 2019/2021.

Note: * p-value <0.05 by Student's T test for independent samples.

purchase of unhealthy meals⁹⁻¹⁵. However, fast-food restaurants frequency was lower in 2021 in comparison to 2019, while the contrary was noted for bakeries/confectioneries.

The higher presence of fast-food restaurants in MDA is a characteristic of the digital food environment that is similar to the physical food environment of the studied metropolis prior to the COVID-19 pandemic. In 2017, a study evaluating the community food environment around public and private schools in Belo Horizonte also found that fast-food restaurants were among the most readily available types of establishments for purchasing ready-to-eat meals³¹. Additionally, the physical food environment of the entire territorial area of this metropolis in 2015 was characterized by a high presence of establishments that predominantly sold ultra-processed meals, as well as fast-food restaurants³².

There is currently no evidence available on the characterization and coverage of food establishments in the physical food environment in Belo Horizonte after the onset of the COVID-19 pandemic. However, Mendes et al. suggest that the emergence of the health crisis has led to the migration of many establishments from the physical food environment to MDA, particularly those that sell food for immediate consumption³³. Our study provides evidence that the coverage of the establishments registered in MDA has changed after the onset of the pandemic. We noted a higher number of neighborhoods served by the establishments in 2021 comparing to 2019. In the case of fast-food restaurants, although they had lower participation among the 10 best rated establishments in 2021, their coverage was higher meaning that these types of establishments could have expanded its delivery route between years.

The migration of food services to the digital environment may have been driven by the control measures imposed by the City Hall of Belo Horizonte on the face-to-face service to the public. In this context, MDA offered many establishments a way to sustain their businesses³⁴. To attract establishments, maintain profitability, and expand the coverage of their services, MDA companies employed various strategies, such as increasing the profit margin per order, anticipating receipts from restaurants at no additional cost, offering professional training courses in crisis management, and preparing and sharing guides for safe reopening in accordance with the

current recommendations in the cities where the establishments operated³⁵.

In the context of the pandemic, another prominent strategy adopted by establishments and MDA was extensive investment in marketing resources. Establishments were advised by the Brazilian Association of Bars and Restaurants to invest in social media and paid media, offer discount coupons, and distribute ads by geolocation (advertisements targeted at consumers in a specific area)³⁶. Additionally, the organizational factors of the MDA, such as an increase in the number of deliverers, may have contributed to the expansion of their services. Data from the Institute for Applied Economic Research showed that the number of deliverers of goods, including food, via motorcycle increased from 25,000 in early 2016 to 322,000 in the fourth quarter of 2021³⁷.

In addition to the migration of establishments to MDA, the COVID-19 pandemic significantly changed the consumer profile in Brazil because of changes in work and leisure routines³³. These changes included the following: i) the implementation of the telecommute model in many work segments, leading to changes in the way people worked³⁸; ii) the closure of schools, which resulted in families dealing with distance learning and children being at home full-time; iii) changes in forms of leisure that led to increased screen use as a form of entertainment, potentially exposing individuals to more advertising content from MDA³⁹; and iv) consumers' fear of contamination by SARS-CoV-2 in commercial establishments⁴⁰. Consequently, many consumers who had previously used the apps mainly to purchase snacks for leisure may have started to use the technology to purchase meals for breakfast, lunch and dinner. Data from the largest MDA in Brazil indicated that the most ordered foods in 2021 in Brazil were traditional meals and snacks, such as hamburgers and pizzas⁴¹.

The coverage of establishments registered in the studied MDA showed particularities according to neighborhood's socioeconomic characteristics. According to the study's findings, the establishment coverage was higher in 2021 than in 2019 among neighborhoods with medium and high/very high HVI neighborhoods (i.e., the most socioeconomically vulnerable). The greater coverage of MDA in these types of neighborhoods has also been observed in studies conducted in other countries. In Canada, a

positive correlation was found between population density and the number of establishments available for food delivery¹⁴. In England, access to online food outlets was higher in socioeconomically vulnerable postal code districts⁴². This suggests that the digital food environment coverage differs from the physical food environment coverage.

In the physical environment of the metropolis evaluated in the present study, studies have shown that lower-income areas of the municipality including favelas areas⁴³ had a lower availability of all types of food establishments. Furthermore, Lopes et al. demonstrated that neighborhoods characterized by high residential economic segregation in Belo Horizonte had a lower availability of food establishments than with neighborhoods characterized by low economic segregation⁴⁴. The contrast between the coverage of commercial establishments in the physical and digital food environments of the MDA confirms that these platforms usually increase accessibility to different food establishments, particularly in more economically disadvantaged and geographically remote areas⁴⁵.

Although the literature suggests that the main users of MDA are individuals with better socioeconomic conditions⁴⁶, there seems to be a discrepancy between the coverage of neighborhoods by establishments on these platforms and the profile of platform users. However, it is worth considering that there are factors that may favor the establishment of commercial establishments in socioeconomically disadvantaged areas, such as reduced costs for renting or maintaining services, high population density, and low competition⁴². These establishments can use promotional strategies, such as offering discounts and free delivery, to attract the local population. As a result, there is potential for the shift of the MDA market, which may lead to more socioeconomically vulnerable consumers placing orders on these platforms compared with less vulnerable consumers.

Overall, the study's findings suggest a shift of MDA during the COVID-19 pandemic: the coverage of this service is higher during the crisis, particularly in neighborhoods with higher levels of socioeconomic vulnerability. In spite of this, different establishments had different coverage in the two years of the study in the analysis stratified by HVI. While fast-food restaurants presented greater coverage in 2021 for all neighborhoods, regular restaurants showed this result only among high/very high HVI neigh-

borhoods. Regarding bakery/confectionery, they had lower coverage in 2021 than in 2019 in low HVI neighborhoods.

Therefore, strategies that promote healthy food choices must be considered, regardless of the territory's socioeconomic vulnerability level. Thus, to expand the offer of traditional meals, establishments should improve the information provided about meal characteristics, such as listing ingredients, providing nutritional information, and indicating portion sizes. Further, the hygienic and sanitary conditions in which meals are produced and transported should be transparently disclosed⁴⁵. Specifically, for the most socioeconomically vulnerable population, to better understand the use of MDA, it is necessary to investigate when and how often this group uses these services and what factors most influence their use must be investigated.

Intersectoral action involving government, academia, MDA, and establishments must also be taken to protect consumer rights⁴⁷. These actions should focus on i) adapting and applying existing laws for the physical environment to the digital food environment; ii) using advanced technologies by public health authorities to collect and analyze data from MDA and monitor the platforms and iii) encouraging platforms to communicate clear and coherent health messages about the negative impacts of unhealthy food choices on health (Halloran et al., 2021).

While this study makes an important contribution to the field of public health, there are some limitations to consider. The study was conducted in a Brazilian metropolis using two MDA; thus, the characteristics found may differ in smaller cities with local MDA. Additionally, the sample studied does not represent all neighborhoods in the metropolis but includes neighborhoods from all regions. Data collection from a representative sample of the city's neighborhoods would be challenging because of the large volume of data. Finally, we highlight that the use of the HVI based on the 2010 Demographic Census carried out by the Brazilian Institute of Geography and Statistics may be also a limitation, considering the important economic recession experienced in Brazil in the last years, together with the economic impacts of the pandemic COVID-19. However, only 2010 Demographic Census data were available at the of this moment.

Conclusions

This study showed fast-food restaurants were the most frequent among the best rated establishments in 2019 and 2021 in the MDA. However, in 2021, the participation of these establishments was lower. The coverage of establishments was greater in 2021 than in 2019 and varied according to the type of the establishment and the socioeconomic characteristics of the locations served. In general, we found a greater coverage in locations with a lower socioeconomic profile, especially during the COVID-19 pandemic in 2021. Based on the results of the present study, there is an urgent need to understand the MDA's digital food environment characteristics and how they can configure socioeconomic inequalities related to access healthy and adequate food.

Collaborators

JP Matos, PM Horta, and LL Mendes participated in the conception of the study. JP Matos and PM Horta were involved in data analysis. JP Matos, PAA Barros, NG Cordeiro, and LL Rocha participated in data collection and manuscript writing. All authors reviewed the final manuscript.

Referências

1. Granheim SI, Løvhaug AL, Terragni L, Torheim LE, Thurston M. Mapping the digital food environment: A systematic scoping review. *Obes Rev* 2022; 23(1):e13356.
2. Maimaiti M, Zhao X, Jia M, Y Ru, S Zhu. How we eat determines what we become: opportunities and challenges brought by the food delivery industry in a changing world in China. *Eur J Clin Nutr* 2018; 72(9):1282–1286.
3. Yeo V, Goh S, Rezaei S. Consumer experiences, attitude and behavioral intention toward online food delivery (OFD) services. *J Retail Consum Serv* 2017; 35:150–162.
4. Pigatto G, Machado JGCF, Negreti AS, Machado LM. Have you chosen your request? Analysis of online food delivery companies in Brazil. *BFI* 2017; 119: 639-657.
5. Botelho LV, Cardoso LO, Canella DS. COVID-19 and the digital food environment in Brazil: reflections on the pandemic's influence on the use of food delivery apps. *Cad Saude Publica* 2020; 36(11):e00148020.
6. Sharma R, Dhir A, Talwar S, Kaur P. Over-ordering and food waste: The use of food delivery apps during a pandemic. *Int J Hosp Manag* 2021; 96:102977.
7. Kantar Ibope Media. *Kantar points out the main transformations and trends in post-quarantine consumer behavior*. [Internet]. 2020. [cited 2020 dec. 01]. Available from: <https://kantariopemedia.com/conteudo/kantar-aponta-as-principais-transformacoes-e-as-tendencias-de-comportamento-do-consumidor-pos-quarentena/>. Accessed December 2022.
8. Institucional Ifood. [Internet] 2022. [cited 2020 dec. 01] Available from: <https://institucional.ifood.com.br/ifood>.
9. Horta PM, Souza JPM, Rocha LL, Mendes LL. Digital food environment of a Brazilian metropolis: food availability and marketing strategies used by delivery apps. *Public Health Nutr* 2021; 24(3):544–548.
10. Goffe L, Uwamahoro NS, Dixon CJ, Blain AP, Danielson J, Kirk D, Adamson AJ. Supporting a Healthier Takeaway Meal Choice: Creating a Universal Health Rating for Online Takeaway Fast-Food Outlets. *IJERPH* 2020; 17(24):9260.
11. Wang C, Korai A, Jia SS, Allman-Farinelli M, Chan V, Roy R, Raeside R, Phongsavan P, Redfern J, Gibson AA, Partridge SR. Hunger for Home Delivery: Cross-Sectional Analysis of the Nutritional Quality of Complete Menus on an Online Food Delivery Platform in Australia. *Nutrients* 2021; 13(3):905.
12. Poelmann MP, Thornton L, Zenk SN. A cross-sectional comparison of meal delivery options in three international cities. *Eur J Clin Nutr* 2020; 74(10): 1465–1473.
13. Partridge SR, Gibson AA, Roy R, Malloy JA, Raeside R, Jia SS, Singleton AC, Mandoh M, Todd AR, Wang T, Halim NK, Hyun K, Redfern J. Junk Food on Demand: A Cross-Sectional Analysis of the Nutritional Quality of Popular Online Food Delivery Outlets in Australia and New Zealand. *Nutrients* 2020; 12(10):3107.

14. Brar K, Minaker LM. Geographic reach and nutritional quality of foods available from mobile online food delivery service applications: novel opportunities for retail food environment surveillance. *BMC Public Health* 2021; 21(1):458.
15. Mahawar N, Jia SS, Korai A, Wang C, Allman-Farinelli M, Chan V, Raeside R, Phongsavan P, Redfern J, Gibson AA, Partridge SR, Roy R. Unhealthy Food at Your Fingertips: Cross-Sectional Analysis of the Nutritional Quality of Restaurants and Takeaway Outlets on an Online Food Delivery Platform in New Zealand. *Nutrients* 2022; 14(21):4567.
16. Dana LM, Hart E, McAleese A, Bastable A, Pettigrew S. Factors associated with ordering food via online meal ordering services. *Public Health Nutr* 2021; 24(17):5704–5709.
17. Horta PM, Matos JP, Mendes LL. Digital food environment during the coronavirus disease 2019 (COVID-19) pandemic in Brazil: an analysis of food advertising in an online food delivery platform. *The Br J Nutr* 2021; 126(5):767–772.
18. Horta PM, Souza JPM, Mendes LL. Food promoted on an online food delivery platform in a Brazilian metropolis during the COVID-19 pandemic: a longitudinal analysis. *Public Health Nutr* 2022; 1–23.
19. Botelho LV, Freitas JV, Camara AOD, de Almeida IF, Gonçalves TS, Horta PM, Canella DS, Cardoso LO. Digital marketing of online food delivery services in a social media platform before and during COVID-19 pandemic in Brazil. *Public Health Nutr* 2023; 26(1): 1–11.
20. Instituto Brasileiro de Geografia e Estatística (IBGE). Belo Horizonte. [Internet] 2021. [acessado 202 Dez 01]. Disponível em: <https://cidades.ibge.gov.br/brasil/mg/belo-horizonte/panorama>.
21. Prefeitura de Belo Horizonte (PBH). Belo Horizonte. [Internet], 2024. [acessado 2024 Mar 01]. Disponível em: <https://prefeitura.pbh.gov.br/bhgeo/bh-em-numeros#bh>.
22. Instituto Nossa BH. *Mapa das Desigualdades*: Belo Horizonte e Região Metropolitana de Belo Horizonte - 14 municípios. [Internet] 2021. [acessado 2024 Mar 01] Disponível em: <https://nossabh.org.br/uploads/2021/06/Mapa-das-desigualdades-da-RM-BH-2021.pdf>.
23. Instituto de Pesquisa Econômica Aplicada (IPEA). 2015. *Governança Metropolitana no Brasil*. [cited 2024 Mar 01] Available from: https://www.ipea.gov.br/redeipea/images/pdfs/governanca_metropolitana/rell1_1_rmbh.pdf.
24. Statista. *Leading food delivery apps in Brazil in 2021, by number of downloads*. [Internet]. 2021. [cited 2020 Dec. 01]. Available from: <https://www.statista.com/statistics/1328025/most-downloaded-food-delivery-apps-in-brazil/>.
25. Ifood. [Internet]. 2021. [cited 2024 Mar 01] Relato de Impacto. Available from: <https://institucional.ifood.com.br/wp-content/uploads/2024/01/Relato-de-Impacto-iFood-2021-4.pdf>.
26. Uber. [Internet]. 2022. [cited 2024 Mar 01]. Available from: <https://messages.uber.com/public/messages/fd-5f5d68-e349-4bef-9317-933d7e2b13fe>.
27. Brazil. *Special epidemiological bulletin 66*. Ministry of Health. Secretary of Health Surveillance. [Internet]. 2021. [cited 2020 Dec. 01]. Available from: https://www.gov.br/saude/pt-br/media/pdf/2021/junho/11/boletim_epidemiologico_covid_66-final_-11-junho.pdf.
28. SESMG. State Secretary of Health of Minas Gerais. *Epidemiological Bulletin*. [Internet]. 2021 [cited 2020 Dec. 01]. Available from: https://coronavirus.saude.mg.gov.br/images/1_2021/05-maio/31.05.21COVID-19_-_BOLETIM.pdf.
29. Decree 17604 of 2021. *Amends the Annexes of Decree No. 17,361, of May 22, 2020, which provides for the gradual and safe reopening of sectors that had their activities suspended as a result of measures to confront and prevent the epidemic caused by the new coronavirus*. [Internet]. 2021. [cited 2020 Dec. 01]. Available from: <https://www.cmbh.mg.gov.br/atividade-legislativa/pesquisar-legislacao/decreto/17604/2021>.
30. PBH. Prefeitura de Belo Horizonte. 2013. *Índice de Vulnerabilidade da Saúde*. [Internet] 2013. [cited 2020 Mar 01] Available from: https://prefeitura.pbh.gov.br/sites/default/files/estrutura-de-governo/saude/2018/publicacoes-da-vigilancia-em-saude/indice_vulnerabilidade2012.pdf.
31. Peres CMDC, Costa BVL, Pessoa MC, Honório OS, Carmo ASD, Silva TPRD, Gardone DS, Meireles AL, Mendes LL. Community food environment and presence of food swamps around schools in a Brazilian metropolis. *Cad Saude Publica* 2021; 37(5):e00205120.
32. Honório OS, Pessoa MC, Gratão LHA, Rocha LL, de Castro IRR, Canella DS, Horta PM, Mendes LL. Social inequalities in the surrounding areas of food deserts and food swamps in a Brazilian metropolis. *Int J Equity Health* 2021; 20(1):168.
33. Mendes LL, Canella DS, Araújo ML, Jardim MZ, Cardoso LO, Pessoa MC. Food environments and the COVID-19 pandemic in Brazil: analysis of observed changes in 2020. *Public Health Nutr* 2022; 25(1): 32–35.
34. Gavilan D, Balderas-Cejudo A, Fernandez-Lores S, Navarro-Martinez G. Innovation in online food delivery: Learnings from COVID-19. *Int J Gastron Food Sci* 2021; 24:100330.
35. Ifood. *What is iFood doing for partner restaurants at this time of a pandemic?* [Internet] 2021. [cited 2020 Dec 01] Available from: <https://news.ifood.com.br/pandemia-restaurantes/>.
36. Abrasel. *How to increase your restaurant sales via delivery*. [Internet]. 2021. [cited 2020 Dec 01]. Available from: <https://abrasei.com.br/revista/mercado-e-tendencias/como-aumentar-as-vendas-do-seu-restaurante-via-delivery/>.
37. Institute of Applied Economic Research (IPEA). *Gig Economy panel in the transport sector in Brazil: who, where, how many and how much they earn*. [Internet]. 2022. [cited 2020 Dec 01]. Available from: https://www.ipea.gov.br/portal/images/stories/PDFs/conjuntura/220510_cc_55_nota_14_gig_economy.pdf.
38. Institute of Applied Economic Research (IPEA). *Remote work and the pandemic: what the PNAD covid-19 showed us*. [Internet]. 2021. [cited 2022 Dec 01]. Available from: https://www.ipea.gov.br/portal/images/stories/PDFs/conjuntura/210201_nota_teletrabalho_ii.pdf.

39. Rodrigues MB, Matos JP, Horta PM. The COVID-19 pandemic and its implications for the food information environment in Brazil. *Public Health Nutr* 2021; 24(2):321–326.
40. Hakim MP, Zanetta LD, Cunha DT. Should I stay, or should I go? Consumers' perceived risk and intention to visit restaurants during the COVID-19 pandemic in Brazil. *Food Res Int* 2021; 141:110152.
41. Ifood. *Retrospective 2021: the 10 most requested foods on iFood*. [Internet]. 2021. [cited 2022 Dec.]. Available from: <https://news.ifood.com.br/retrospectiva-2021-as-10-comidas-mais-pedidas-no-ifood/>.
42. Keeble M, Adams J, Bishop TRP, Burgoine T. Socioeconomic inequalities in food outlet access through an online food delivery service in England: A cross-sectional descriptive analysis. *Appl Geogr* 2021; 133.
43. Rocha LL, Lima Friche AA, Melo GBV, Cordeiro NGC, Honório OS, Cardoso LO, Mendes LL. Food retail in favelas of a Brazilian metropolis. *Food Sec* 2024; 16:277–292.
44. Lopes MS, Caiaffa WT, Andrade ACS, do Carmo AS, Barber S, Mendes LL, Friche AAL. Spatial inequalities of retail food stores may determine availability of healthful food choices in a Brazilian metropolis. *Public Health Nutr* 2021; 1–12.
45. WHO EUROPE. *Slide to order: a food systems approach to meals delivery apps*. WHO European Office for the Prevention and Control of Noncommunicable diseases. [Internet]. 2021. [cited 2020 Dec. 01] Available from: <https://apps.who.int/iris/handle/10665/350121>.
46. Keeble M, Adams J, Sacks G, Vanderlee L, White CM, Hammond D, Burgoine T. Use of Online Food Delivery Services to Order Prepared Food Away-From-Home and Associated Sociodemographic Characteristics: A Cross-Sectional, Multi-Country Analysis. *IJERPH* 2020; 17(14):5190.
47. Halloran A, Faiz M, Chatterjee S, Clough I, Rippin H, Farrand C, Weerasinghe N, Flore R, Springhorn H, Breda J, Tedstone A, Wickramasinghe K. The cost of convenience: potential linkages between noncommunicable diseases and meal delivery apps. *Lancet Reg Health Eur* 2021; 12:100293.

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