The potential influence of the digital food retail environment on health: A systematic scoping review of the literature

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Summary

Introduction: The digital food retail environment (defined in this study as a digital platform, app or website where food can be purchased by individuals for personal consumption) is an emerging component of the wider food system. We aimed to systematically search and review the literature to understand the potential influence of the digital food retail environment on population diets and health.

Methods: Four databases (across health, business, and marketing) and grey literature were searched using terms relating to “food and beverages,” “digital,” and “purchasing.” Identified studies were included if they examined any aspect of the digital food retail environment where outcomes were examined with a health-related focus and were published before September 2023. All study designs were included (quantitative, qualitative, observational, and experimental). Reviews and conference abstracts were excluded.

Results: We identified 21,382 studies, of which 57 articles were eligible for inclusion. Of the 57 included studies, 30 studies examined online grocery retail, 22 examined online food delivery platforms, and five examined meal kit subscription services. Of the 30 studies examining online grocery retail, six studies reported that customers believed they purchased fewer unhealthy food and beverages when shopping online, compared with shopping in-store. Nevertheless, customers also reported that their ability to choose healthy foods and beverages was reduced when shopping online due to difficulty in product comparison. Studies that examined online food delivery platforms primarily found that they promoted unhealthy foods and beverages more often than healthy options, through extensive use of marketing practices such as price discounts and images, and that unhealthy food offerings on these platforms dominate. Meal kit subscription services offered mostly healthy meals, with studies suggesting that these types of services may help individuals alleviate some of their “mental load” and stress related to cooking meals for their families.

Conclusions: The literature describing the digital food retail environment was found to be diverse, with different aspects having potential to impact health in different ways. Some evidence suggests that online grocery retail and meal kit subscription services...
may have positive population dietary impacts, whereas online food delivery platforms appear likely to promote unhealthy food purchasing. However, the current evidence base is fragmented, with many knowledge gaps. Further research is required to understand the influence of the digital food retail environment on population diets and how these environments can be designed to support healthy food choices.

**KEYWORDS**
food environment, nutrition policy, online food delivery, public health

1 | BACKGROUND

“Food environments” are defined as “the collective physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence people’s food and beverage choices and nutritional status.”

There is strong evidence that food environments have a substantial influence on population diets. Food environments that are “obesogenic” are those that promote consumption of energy dense, highly processed foods. Unhealthy diets are a leading risk factor in developing non-communicable disease, including type two diabetes and metabolic syndromes such as obesity and high blood pressure.

The global prevalence of obesity has tripled since 1975, with 39% of the world’s adult population currently experiencing overweight or obesity.

“Digital food environments,” including digital food marketing, online food ordering platforms, and food and recipe blogging, are an increasingly prominent component of wider food systems. Digital food retail environments include digital platforms, such as mobile phone apps or websites, which can be used to purchase food and beverages. These digital platforms include, among others, online food delivery platforms (such as Uber Eats and DoorDash), online grocery stores, and “meal kit” subscription services (such as Hello Fresh and Marley Spoon). The use of these platforms is substantial and is increasing over time. For example, globally, DoorDash (an online food delivery platform) has more than 20 million monthly users and generated US$9.9 billion gross for the first quarter of 2021. A recent market research report of the Australian Uber Eats online platform found that fast food delivery services doubled their customer base in the 18 months from mid-2018, with 19% of Australians now reporting that they have previously used the service. Internationally, the online grocery sector has been experiencing an increase in sales. In the United States, between 2017 and 2022, online grocery sales increased by an average of 17% per year, with the 2022 revenue predicted to be in excess of US$32 billion. The Australian online grocery sector has also experienced market growth, with a reported 39% year-on-year growth compared with 2% yearly growth in traditional grocery sales. Globally, meal kit subscription service Hello Fresh saw a 42% year-on-year growth in the number of orders between 2018 and 2019, with 10.5 million meals delivered.

The growth of meal kit subscription services highlights their position as a small, but expanding, component of the digital food retail environment. Although their global revenue (US$17.8 in 2022) is much smaller than that of online grocery retail (US$285 billion in 2021) and online food delivery platforms (US$323 billion in 2022), they have a unique position in the digital food retail environment as an important place of food procurement, though their impact on diet is unclear. Meal kits are mostly purchased entirely through digital means, with limited physical shopfronts or locations for in-store purchasing. Meal kits subscriptions are also designed to fill a niche: to make preparing a home cooked meal as easy and convenient as possible so users do not need to resort to unhealthy takeaways.

The use of these digital food retail platforms accelerated further during the COVID-19 pandemic, with Australian online grocery sales experiencing a further 5% increase in sales in 2021. Australian online food delivery platform Menu Log also reported a 54% increase in orders
Similar to European online food delivery platforms, the COVID-19 pandemic has disrupted the delivery of food, with a recent scoping review by Granheim et al. and reported according to the PRISMA guidelines. 

However, there is the potential for online grocery retail to be used as a way to increase fruit and vegetable intake among those who find physical grocery shopping difficult, such as older adults, people with mobility or health conditions, or those without transport. 

Despite the widespread and increasing use of digital food delivery platforms, to date, there has been no synthesis of the literature to understand the potential influence on population diets and health of the digital food retail environment. This scoping review aimed to systematically search the literature in order to understand the potential influence of the digital food retail environment on population diets and health. Our intention was to summarize the evidence in a way that could guide public health policy in this area.

2 | METHODS

This systematic scoping review followed protocols outlined by Arksey and O’Malley, and the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis, and reported according to the PRISMA guidelines for scoping reviews. A systematic scoping review methodology was selected to allow for a broad research question, while maintaining the rigor of a systematic review.

2.1 | Inclusion criteria and exclusion criteria

Included studies were those that examined any aspect of the digital food retail environment (including, but not limited to, online food delivery platforms, online grocery stores, and meal kit subscription services) where an aim or rationale of the study was related to health. Because this review was intended to inform public health policy recommendations, all included studies were required to have a public health focus. This focus on health could be included as part of the study design (e.g., classifying foods or purchases by an indicator of healthiness and measuring participant health indicators such as body mass index [BMI]) or referred to by the authors in the rationale for the study or aims.

We considered all aspects and types of digital food retail environments. Populations for included studies could include human (adults, children) users/customers or digital food retailers, companies, or products. No restrictions were placed on country studied or year of publication. All study designs were considered, including quantitative, qualitative, observational, and experimental. Editorials were screened against the inclusion criteria.

We excluded intervention studies that targeted a specified population with pre-existing health conditions that require therapeutic diet, for example, low carbohydrate diets for those with diabetes. Studies that primarily examined alcohol delivery services were excluded, as this was beyond the scope of this review. Studies examining online marketing external to a digital food retail environment were excluded. Systematic reviews and conference abstracts were excluded.

2.2 | Search strategy

The search strategy aimed to locate both published studies and grey literature to identify non-empirical research. An initial limited search of Medline was undertaken to identify key articles based on the research aim, which was used to guide the search strategy.

The search was conducted in September 2023. Three overarching search terms were used (“food and beverages,” “digital,” and “purchasing”), combined with the operator “AND.” Within these broader search terms, more specific terms were combined with the operator “OR.” Databases that were searched included MEDLINE Complete, EBSCO Business Source Complete, EBSCO Communication and Mass Media Complete, and Medline ProQuest. A full list of search strings is available in Table S1.
The Medline specific search terms were food and drink (food* OR drink* OR beverage* OR grocer* OR diet*) and digital (online OR digital OR app OR apps) and purchasing (prevalence OR purchas* OR use*). Boolean search operators were modified for each database searched, and search results were limited to English. Reference lists of all included articles were screened for additional literature. Forward and backward citation screening of included studies was also undertaken to identify further articles.

Grey literature was sourced using systematic keyword searches of Google, Google Scholar, Proquest Dissertations & Theses Global, and the Preprints database. The first 100 search results from each of these databases were screened against the inclusion criteria.

Following the search, all identified citations were collated and uploaded into Covidence,22 which is a web-based software platform designed to streamline the research review process. Duplicate search results were removed. Titles and abstracts were screened by the first author (RB), with a sample of articles (n = 1583, approximately 7% of total papers) screened independently by two authors (RB and CD) to determine the degree of consistency in exclusion of irrelevant articles. This produced an agreement rate of 90%, similar to other scoping reviews.23 Subsequent full text screening against inclusion and exclusion criteria was carried out by two authors independently (RB, MK and CD). Reasons for exclusion at full text were recorded using Covidence. Disagreements between these two reviewers regarding inclusion were resolved through discussion and, if needed, inclusion of a third reviewer to reach consensus.

2.3 | Reporting of findings

Data were extracted from included studies. Using a standardized data extraction template, the following data were included: country, population, study aims, methods, study type, digital food retail environment category, and key findings.

Pilot searching of the literature identified three key digital food retail environments: (i) online food delivery platforms, (ii) online grocery retail, and (iii) meal kit subscription services. Findings were therefore narratively synthesized, according to these three identified domains of the digital food retail environment (we were also open to other domains emerging as we synthesized the data, but no further domains were identified). Reporting was further divided into studies that reported on (i) characteristics of the digital food retail environment, (ii) potential influence on healthiness of purchasing behavior, or (iii) other contextual factors relevant for health.

2.4 | Quality of included studies

The quality of included studies was assessed using the Joanna Briggs Institute critical appraisal tools.33 The appropriate tool was selected based on study design. These appraisal checklists evaluate methodology by assessing the inclusion criteria of the sample, the descriptions given of study population, the appropriateness of the analysis methods, and other aspects of the study design as a binary “yes/no” question.33 Following methods described by Shi et al., studies were reported as “good” quality when they had only “yes” or “not applicable” ratings, “fair” if they had one or two “no” or “unclear” ratings, and “poor” quality if they had three or more “no” or “unclear” ratings.34

3 | RESULTS

3.1 | Search results

The results of the search are reported in a PRISMA flow diagram (Figure 2).

The literature search identified 21,382 studies, of which 762 were duplicates. All studies were identified through database and grey literature searching. We did not identify any further relevant articles through forward or backwards citation screening; 19,812 articles were excluded due to irrelevant titles, and a further 681 studies were excluded for irrelevant abstracts.

A total of 126 articles were reviewed in full, with 57 articles meeting the inclusion criteria.

3.2 | Overview of included studies

A summary of all included studies is shown in Table S2. The date of publication for included studies ranged from 2007 to 2023. The majority of studies were quantitative and used a cross sectional (n = 33), longitudinal (n = 5), or randomized control trial (n = 6) study design. Seven studies used a mixed methods approach, and six were qualitative studies.

Thirty studies examined online grocery retail, 22 examined online food delivery platforms, and five examined meal kit subscription services. Forty-eight studies were conducted in high income countries, including the United States (n = 20), the United Kingdom (n = 11), Australia (n = 7), Canada (n = 3), Denmark (n = 2), the Netherlands (n = 1), New Zealand (n = 1), Saudi Arabia (n = 1), Singapore (n = 1), and multiple high income countries (n = 3). Seven studies were conducted in upper middle income countries, including Brazil (n = 3), China (n = 2), Malaysia (n = 1), and multiple Latin American counties (n = 1). The year of data collection ranged from 2007 to 2022. Thirty-three studies examined how adults engage with the digital food retail environment, and 24 studies examined the contents or an aspect of the digital food retail platform themselves. Eleven studies had a focus on a particular socioeconomic group, with six studies examining Supplemental Nutrition Assistance Program (SNAP) recipients, two studies examining low income population groups, one study examining seniors with low incomes, one study examining a food insecure population, and one study examining participants of the SNAP for Women, Infants, and Children (WIC). Three studies examined the way that the COVID-19 pandemic has affected the digital food retail environment. Health-related outcomes measured by each study are reported in Table 1:
Of the 57 included studies, 11 were classified as “good quality,” 32 as “fair,” and 14 as “poor.” Common methodological weaknesses included participant inclusion criteria not being adequately described, study subjects and settings not being described in detail, confounding variables not being clearly identified, and not addressing the influence of the researcher on the research for qualitative studies.

3.3 | Online grocery retail

Thirty of the included studies examined online grocery retail, from the United States (n = 18), the United Kingdom (n = 7), China (n = 1), Canada (n = 1), Australia (n = 1), and the Netherlands (n = 1). One study included multiple high-income European countries. Twenty-two studies examined the items purchased by online grocery retail users, and the remaining eight studies examined the websites or some aspect of the online grocery retail platform itself, including the availability of nutritional information. Ten studies examined users of online grocery by an indicator of socioeconomic position. Generally, it was reported that shopping online for groceries enabled healthier purchasing compared with in-store shopping, despite studies also reporting that nutritional information for products was inconsistently available.

3.3.1 | Characteristics of the online grocery retail environment

The online grocery retail environment was generally characterized as having variably available nutritional information. A study by Lee et al. analyzed the availability of nutritional information on eight Canadian supermarket websites. The researchers found that although all of the 555 items examined had some product images available, most (81%) of these images were illegible even after zooming in to increase image size. Of the products that were required to provide nutritional information per regulations (i.e., all pre-packaged foods), this information was only available for 61% of those products. A similar study by Stone et al. examining nutritional labeling across five UK grocery retailers’ websites found that nutrition information was available for every product analyzed in the product’s “description page,” but this...
TABLE 1 Summary of the examined health related outcomes or measures for included studies.

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<tr>
<th>Study</th>
<th>Health-related outcome or measure</th>
<th>Other food environment measures (e.g., in-app marketing and food environment scoring tools)</th>
<th>Health outcomes associated with use of online food retail environments</th>
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<td>Study examining online grocery retail</td>
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information was not available on the “results” page after searching for a product. Similarly, Wallis and Moore reported that of price promoted products available on three major UK supermarket websites, front of pack nutritional information was often unavailable on webpages (70% available) and images (52% available).

A 2021 cross sectional study by Bhatnagar et al. compared the price, promotions, and nutrition information availability of products from supermarkets in store and online. The study found that the median price for the same products in store and online was similar (£1.87 and £1.85, respectively) and that price promotions were more common in store (32%) compared with online (24%). No difference was found in the nutrient composition information displayed across the two different shopping mediums.

3.3.2 | Potential influence of the online grocery retail environment on the healthiness of purchasing behavior

It was generally reported that shopping for groceries online led to healthier food and drink purchases compared with shopping in store. Dillahunt et al. studied the effect of an intervention providing grocery delivery to 20 adults with limited transport access. The researchers found that participants who were in the intervention group purchased a higher percentage of “green” (healthier; 55%) than “red” (less healthy; 22%) classified foods, when compared with the non-intervention group (46% “green” and 25% “red”). A 2017 study by Huyghe et al. also compared the purchasing of “vice” food products (including salty snacks, chocolate, chips, etc.) across online and in-store shopping events. This study was conducted using purchasing data from 4313 shoppers at large European grocery retailer. The mean relative expenditure per shopping trip on “vice” products was significantly lower when shopping online compared with in-store (0.056 vs. 0.111, respectively), and fewer “vice” items were purchased online compared to in-store. This was despite customers spending more overall when shopping online compared to in-store (£167 and £120, respectively). On the other hand, Lacko et al. analyzed Neilson Homescan data and found that those who shopped for groceries online purchased 73 calories per person per day, whereas in-store shoppers purchased 686 calories per person per day. However, the authors highlighted that the number of online grocery shoppers in the study sample was low (i.e., only 0.8% of total volume sales reported were from online grocery retail stores).

An 8-week randomized control trial by Gorin et al. found that participants who were overweight and were assigned to the intervention group, which instructed participants to order their groceries online instead of shopping in store, perceived that the grocery delivery helped them to “decrease impulse purchases” and “make healthier choices” compared with shopping in-store. Although, there was no significant difference in weight loss between the intervention and control groups (7.5 ± 8.5 vs. 9.0 ± 6.7 lbs, respectively), a non-significant trend was reported for the number of grocery deliveries.
participants completed and weight loss after 8 weeks ($r = 0.71$, $p = 0.8$). In contrast, a thesis by Thomas found that when using a mobile phone app for grocery purchases, 68 university student reported lower “health fluency” scores due to reduced access to external reference points such as nutrition labeling, and other products at hand for easier comparisons, compared with if they shopped in store (mean health fluency score = 5.97 vs. 5.28, respectively). However, the study did not find that this reduction in health fluency was associated with the healthiness of products purchased.

A 2011 Australian study by Sacks et al. found that introducing greater detail of nutrition information on a supermarket website in the form of a “traffic light” warning system for amounts of fat, saturated fat, sugar, and sodium produced no significant changes in the real-world online sales of products that were labeled “red” when compared with sales from a website that did not provide traffic light labeling (control). A 2022 study by Stuber et al., analyzing sales data from 11,775 shoppers in an online Dutch supermarket, found that there was no overall significant effects from four different conditions (information nudge, positing nudge, both nudges, or control). The information nudge included labeling being applied to designated healthier options, including “convenient,” “tasty,” or “popular.” Shoppers from deprived areas that were allocated to the intervention nudge intervention purchased 2.4% (95% CI: 0.8, 4.0) more healthy products compared with the control group. A randomized controlled trial conducted in conjunction with a major UK supermarket found that shoppers randomly assigned to the intervention arm (where they saw healthier top of page banners, healthier recipe ingredient lists, and reordered search results for yogurts and ice creams by healthiness) found no significant differences in overall energy purchased between trial arms, despite intervention participants purchasing greater quantities of selected healthy recipes ingredients (spaghetti bolognese recipe ($B = 0.89, SE = 0.22, 95% CI (0.45, 1.33), p < 0.001$) and fajita recipe ($B = 1.72, SE = 0.17, 95% CI (1.28, 2.05) p < 0.001$).

### 3.3.3 Other contextual factors relevant for health

Eleven studies reported on use of online grocery retail across socioeconomic strata. Of these studies, six examined recipients involved in SNAP, two studies examined low income populations, one study examined seniors with low incomes, one study examined a food insecure population, and one study examined SNAP WIC participants.

Generally, participants in the SNAP or WIC programs were reluctant to shop online due to their concerns over the quality and freshness of groceries, particularly fruit, vegetables, and meat products. The mixed methods study by Martinez highlighted perceived barriers to using online grocery services, indicating that participants in the United States felt that online grocery services were more expensive, only for affluent people or for those who had limited mobility and could not shop independently. They were also concerned that by using online grocery retail stores, they were surrendering some “control” over the freshness and quality of what they were purchasing as they were not there in person to select items using their own sense of smell and sight. Similar concerns were raised by SNAP participants in a focus group study by Rogus et al., where participants were hesitant to shop for perishable foods online because of a perceived risk of receiving spoiled items as part of their grocery order, particularly for meat, dairy products, and fruits and vegetables. Trude et al. used mixed methods to examine online grocery purchasing behaviors among SNAP recipients in Maryland. Participants self-reported that they less frequently bought fresh produce (OR = 0.34, $p < 0.001$), meat and seafood (OR = 0.29, $p < 0.001$), and sweets (OR = 0.54, $p = 0.005$) when shopping online compared with in-store.

In contrast to findings from studies using general population groups, Jilcott Pitts et al. found that WIC participants generally perceived that they made more impulse food and beverage purchases when shopping online compared with in store. Despite concerns about freshness, being able to use their SNAP or WIC allowances for payment online was a motivator for these groups to use online grocery retail stores. crowell et al. examined online grocery orders placed by seniors with low incomes in New Jersey, USA, as part of a program aiming to improve their nutrition while living in a “food desert.” Analyzing receipts from 151 orders placed over 4 months by 28 participants, they found that 45% of items ordered by the seniors had “no nutritional value” according to the Food Finder classification, but 36% of items ordered had the highest rated nutritional value. No comparison was made with in-store grocery purchases.

### 3.4 Online food delivery platforms

Twenty two studies examined online food delivery platforms, from Australia ($n = 4$), the United Kingdom ($n = 4$), Brazil ($n = 2$), the United States ($n = 2$), Malaysia ($n = 1$), Saudi Arabia ($n = 1$), China ($n = 1$), New Zealand ($n = 1$), Singapore ($n = 1$), one from multiple high income countries, and one from multiple Latin American countries. Seventeen studies used a cross sectional study design, two used longitudinal methods, and two used mixed methods, and one was a qualitative study.

Nine of these studies examined the characteristics of online food delivery platform users, with the remaining 13 studies examining the characteristics of the platforms themselves, such as the in-app promotional marketing, the healthiness of products offered, and their food availability across different geographical areas.

The studies that examined the users of online food delivery platforms were based in the United Kingdom, Australia, Malaysia, Saudi Arabia, Singapore, the United States, and
multiple high income countries. Two studies examined the influence of online food delivery platforms on dietary habits during COVID-19 lockdown restrictions, one study examined the in-app advertising of online food delivery platforms during the COVID-19 pandemic, and one study examined what food items were promoted on online food delivery platforms during the COVID-19 pandemic. Studies generally reported that the offerings available through online delivery platforms were mostly unhealthy and that frequent users of these platforms were highly educated or had high BMI.

3.4.1 | Characteristics of the online food delivery platform retail environment

Studies that examined online food delivery platform characteristics examined the access of food outlets to a specified delivery location and also the healthiness of menu items, the healthiness of menu items only, or access to food outlets from different locations, and the availability of calorie labeling or nutritional information, and others examined the health aspects of in-app promotional marketing strategies.

Studies that examined the healthiness of menu items found that they were mostly unhealthy. A 2021 study by Brar and Minaker examined the distance from food outlets to delivery location, as well as the healthiness of foods available through Canadian online food delivery platforms. They found a high correlation between city population size and the total number of food retailers available through the online food delivery platform ($r = 0.71$) and a positive correlation between population density and the total number of retailers ($r = 0.51$). This study also examined the menus of the most popular three food outlets across four online food delivery platforms. Most ($n = 9$ of 12) of these menus scored fewer than 36 points out of 100 when scored against the Healthy Eating Index-2015. A score of 36 corresponds to an “F” score, the lowest possible.

Wang et al. and Partridge et al. examined the menus of outlets available through the Uber Eats online delivery platform in Australia and Australia and New Zealand. Partridge et al. extracted menu items classified as “popular near you” by the Uber Eats app ($n = 5769$), and Wang et al. extracted the menus in their entirety ($n = 12,734$). Partridge et al. found most food outlets were rated “unhealthy,” using the food environment scoring (FES) tool (73.4% in Sydney and 73.6% in Auckland), with significantly higher healthier food environment scores in the least disadvantaged suburbs compared with the most disadvantaged. However, the FES tool is yet to be validated for use in an online context. Additionally, Partridge et al. reported that 84.3% of the “most popular” menu items in Sydney and 88.2% in Auckland were classified as “discretionary.” Similarly, Wang et al. found that 80.5% of items analyzed from all menus on Uber Eats were “discretionary,” with the “cereal based mixed meal” category (pizzas, pastas, burgers, etc.) comprising 42.3% of total discretionary menu items. Wang et al. also found that discretionary menu items available from online delivery platforms were more likely than healthy menu items to be offered as part of an value bundle (9.6% and 1.6%) and include a product photo (30.7% and 25.1%).

Similar findings were found in Brazil where Horta et al. also found that the foods most promoted and available through Brazilian online food delivery platforms were “ultra-processed” foods such as sugar sweetened beverages, ice creams, and salty packaged snack foods. Additionally, these ultra-processed foods compromised 70% of menu offerings, with the remaining 30% made up of healthier traditional, vegetable-based meals. However, a study by Cong et al. examining the healthiness of meals available through online food delivery platforms in China found that more than 60% of menu items analyzed were classified as “healthy,” with these most commonly being classified as “noodle and dumpling meals.”

Areas with greatest deprivation were found to have the greatest access to unhealthy food outlets through online delivery platforms. A 2021 study by Keeble et al. aimed to examine associations between neighborhood postcode district deprivation level and access to take-away food outlets through online food delivery platforms. Across 2118 postcodes, they found that the most deprived areas had significantly greater access to takeaway food outlets through online food delivery platforms, compared with the least deprived areas (106.1 outlets vs. 70.4 outlets, respectively).

A study by Goffe et al. engaged with 20 expert stakeholders to create a scoring system (“Health Rating score”) to objectively assess the healthiness of outlets offered through the UK online food delivery platform “Just Eat.” Following creation of this scoring framework, 149 menus from different outlets were assessed for healthiness by the expert stakeholders. Metrics including the availability of water or sugar sweetened beverages as a drink choice and the presence of deep fried potato products like chips were also used to assist with rat- ing the healthiness of a food outlet. The rating score ranged from 0 (least healthy) to 5 (most healthy). The most frequently awarded Health Rating score was 1 with no outlets achieving a score of 5.

Studies that examined the prevalence of nutritional information available on online food delivery platforms found that it varied across platforms and across locations. A study by Vanderlee et al. found that the availability of menu calorie labeling varied between different Canadian regions, with platforms delivering to Ontario more likely to display calorie information than those in Alberta (OR = 2.75, 95% CI 2.63–2.88) or Quebec (OR = 3.42, 95% CI 3.27–3.58). Additionally, the Uber Eats platform was more likely to provide menu calorie labeling than the Skipthedishes platform (OR = 2.26, 95% CI 2.16–2.36) or DoorDash platform (OR = 1.14, 95% CI 1.09–1.19). Similarly, an American study found calorie labeling was available for 27% of menus on DoorDash, 19% of menus on Uber Eats, and 6% of menus on Grubhub.

3.4.2 | Other contextual factors relevant to health

The frequency of online food delivery platform use ranged from 28% in the prior month among Australian adults (ordering at least once in the prior month) to 40.3% among Malaysian university students (who reported using the platforms 1–3 times per month). Moreover,
15% of 19,378 respondents from Australia, Canada, Mexico, the United Kingdom, and the United States reported using an online food delivery platform at least once in the previous week.\textsuperscript{79}

Characteristics of online food delivery platform users were mostly reported as being highly educated or having higher BMI than non-users. The multi-country analysis (including Australia, Canada, Mexico, the United Kingdom, and the United States) found that respondents who used online food delivery platforms were most likely to be male, White, highly educated, or living with children aged under 18 years.\textsuperscript{78} Approximately 40% were living with overweight or obesity, and the median age was 33 years.\textsuperscript{78} In another study of 2010 Australian adults (aged 18+ years), multivariate logistic regression modeling found that a younger age, higher BMI, higher education, and higher income were positively associated with likelihood of using online delivery platforms at least once per month.\textsuperscript{79} The likelihood of using these platforms was also higher for groups that also reported consuming other fast food and sugar sweetened beverages regularly.\textsuperscript{70} Eu and Sameeha reported that of 290 Malaysian university students surveyed, 85.9% intended to purchase healthy food through online delivery platforms.\textsuperscript{72} Despite this, most had negative perceptions of the healthy food available for purchase (76.9%), so ordered unhealthy foods most often (77.6%).\textsuperscript{72} In interviews with 22 UK online food delivery platforms users, Keeble et al. found that participants reported that they did not use online food delivery platforms for the purpose of ordering healthy food.\textsuperscript{81} A longitudinal Australian study found that online food delivery platform use at baseline, relative to non-use, was associated with greater assessed urges to overeat, though these were small in magnitude.\textsuperscript{84} A study of young adults aged 18–25 by Buettner et al. found that experiencing food insecurity was significantly associated with greater use of online food delivery platforms ($\beta = 0.32, p < 0.001$).\textsuperscript{40}

There was some suggestion that the COVID-19 pandemic influenced the type and amount of advertising by food delivery platforms. Horta et al. examined the Brazilian digital food retail environment in the context of the pandemic, but their cross-sectional methodology did not allow for comparisons with before the pandemic.\textsuperscript{75} They described the digital food retail environment in Brazil during the pandemic to be “obesogenic” due to the high prevalence of unhealthy foods and beverages being promoted by in-app promotional marketing in online food delivery platforms.\textsuperscript{75} Promotions for free delivery were most often used for ice creams, candies, salted snacks, and pizza rather than traditional meals or vegetables ($p < 0.01$), and photos were most often used for unhealthy menu items such as ice creams, candies, or salted snacks rather than traditional meals or water ($p = 0.03$).\textsuperscript{75} In another study by Horta et al. conducted during the COVID-19 pandemic, it was found that a Brazilian online food delivery platform most promoted messaging relating to the tastiness and “value for money” of food offerings, rather than their healthiness.\textsuperscript{77} Additionally, “traditional meals” (unprocessed or minimally processed Brazilian foods), pasta, ultra-processed beverages, and sandwiches were the most commonly promoted food items, with promotions for water, natural juices, fruits, and vegetables being least common (20–25% of promotions vs. <5%, respectively).\textsuperscript{77}

### 3.5 Meal kit subscription services

Five studies reported on meal kit subscription services, with three conducted in Australia\textsuperscript{88,89,92} and two in Denmark.\textsuperscript{90,91} The years of data collection ranged from 2017 to 2020. Two studies\textsuperscript{89,92} analyzed the nutrition quality of the meals provided through subscription meal kits, and three\textsuperscript{88} aimed to understand the motivations of shoppers for using these subscriptions. The nutritional composition of meal kits was generally reported to be healthy, with users reporting that they helped to alleviate stress surrounding family meal planning.

#### 3.5.1 Characteristics of the meal kit food retail environment

Overall, it was found that meal kit subscriptions provided mostly healthy meals. The studies by Gibson et al. and Moores et al. both had similar methodology, with dieticians analyzing the macronutrient composition of the prescribed meals supplied by different meal kit subscription services. Moores et al. analyzed 12 months of HelloFresh recipes, and Gibson et al. physically prepared 60 meals across five different meal kit subscription services (Dinnerly, HelloFresh, Marley-Spoon, Pepper Leaf, and Thomas Farms Kitchen), weighed the supplied ingredients, then analyzed the nutritional composition using FoodWorks software.\textsuperscript{89,92} Both studies reported that the time of preparation across the different meal kit brands was between 23 and 37 min, most recipes instructed to season with salt (86% and 100%, respectively), and nutrition information was provided to consumers.\textsuperscript{89,92} Moores et al. also identified that many aspects of using meal kit subscription services align with the Conceptual Model of Healthy Cooking for Chronic Disease Prevention, that is, cooking at home, cooking from basic ingredients, accurately measuring ingredients, adding unprocessed vegetables, using olive oil in cooking, and using herbs, spices, and citrus to add flavor.\textsuperscript{92}

Both studies highlighted the high sodium content of the meals, with Gibson et al. reporting that all meals analyzed were above 30% of the Suggested Dietary Target (SDT) for sodium\textsuperscript{89} and Moores et al. finding that median sodium content of HelloFresh meals was 42% of the SDT and 8% of recipes exceeded the total daily recommended intake of sodium.\textsuperscript{92} However, both studies also found that the meals provided a sizeable proportion of the recommended five serves of vegetables per day, with 3\textsuperscript{92} and 2.3–2.9\textsuperscript{89} vegetables per serve per meal on average. Moores et al. also reported that although meal kits were cheaper than eating at restaurants, the cost of purchasing meal kits was up to three times more per serve than traditional grocery purchasing.\textsuperscript{92}

#### 3.5.2 Other contextual factors relevant for health

Three further studies analyzed meal kit subscription services, the motivations for using them, and their role in families with children aged under 18 years.\textsuperscript{98,90,91} In an Australian study of 16 interviews...
Participants discussed how meal kits for exam-
the per-
interviews were also conducted. The authors reported that almost all participants felt that the meals provided through meal kit subscription services were high quality, fresh, healthy, and aligned with nutritional guidelines.

In the two Danish studies, interviews were also conducted with 13 primary family meal providers. Both studies used the same dataset of individual interviews, observations of participant food preparation, and focus group responses. Halkier found that meal kit sub-
scriptions presented a new hybrid model of food preparation, a combination of convenience with the health benefits of cooking homemade meals. Participants also discussed how they believed meal kits to be a “huge help” by outsourcing some of the labor of meal preparation and grocery provisioning to the meal kit suppliers.

Similarly, the study by Hertz and Halkier found that participants reported feeling less stressed about preparing family dinners and felt that meal kits provided relief from the daily planning of meals and grocery shopping. Participants also reported that they found the meals from the meal kits added variety to their diet and helped their family to eat more vegetables. Participants also discussed using meal boxes as a way to provide care for their children and socializing with them during meal preparation. The researchers reported that it was difficult to recruit low income participants due to the relatively high cost of meal kit subscriptions compared with usual grocery prices.

4 | DISCUSSION

This is the first systematic scoping review to synthesize literature on multiple aspects of the digital food retail environment and the potential ways that they may influence population diets and therefore health. Our synthesis of 57 studies published between 2007 and 2023 shows that existing literature on this topic is fragmented with diverse potential impacts on health and many knowledge gaps. This is likely due in part to these digital food retail environments, and therefore research in this area, being relatively novel. Evidence suggests that online grocery retail may reduce the purchase of unhealthy food and beverages compared with shopping in-store, despite nutritional information commonly being incomplete for online products. Similarly, meal kit subscription services may have positive population dietary impacts, whereas online food delivery platforms appear to sell and promote predominantly unhealthy foods and beverages, using promotional strategies such as price discounts and marketing images.

Overall, the influence that meal kit subscription services have on public health is likely to be relatively minor compared with other digital food retail platforms. Nevertheless, while we only found two studies describing the nutritional quality of online meal kit subscription services, these were consistent in the finding that online meal kit subscriptions provide mostly healthy meals containing a substantial contribution towards recommended intakes of vegetables, though sodium content was found to be higher than recommended limits.

These findings align with evidence that cooking food at home leads to higher diet quality compared with regularly eating foods that are prepared away from home. Another potential benefit of meal kit subscriptions is the opportunity they may provide adults to socialize with their children. There have been concerns that children are not learning cooking skills as they grow up, due partly to the increased time pressure faced by working parents. Cooking in childhood can lead to greater confidence with food preparation as an adult and associated increases in diet quality. Meal kit subscription services may provide a convenient option that increases food literacy, confidence with food preparation, and self-determination skills by making cooking feel more achievable by using pre-measured ingredients and photos for each step of the recipe.

For online food delivery platforms, our review highlights the increased accessibility to unhealthy food that these platforms provide. The “neighbourhood food environment,” previously defined as a 1-km radius of an individual’s home or workplace, is much greater when considering the digital food retail environment. For example, Partridge et al. found that 90% of food deliveries available from online food delivery platforms originated outside of a 1-km radius. Similarly, Keeble et al. noted that the “neighbourhood” food environment must be thought of as broader than what is in a consumer’s immediate vicinity due to the increasing ubiquity of online food delivery platforms. The term “food swamp” has been used to describe a food environment where unhealthy food and drink retailers overwhelm healthy offerings and make it difficult for consumers to choose healthy foods. The unbalanced healthiness of foods promoted and available through online food delivery platforms is creating a “digital” food swamp. When combined with heavy promotion of unhealthy options on online food delivery platforms, it is not surprising that users most frequently purchase unhealthy offerings.

Our review found that the main users of digital food retail environments have a higher socioeconomic position. Low-income shoppers were found to be wary of using online food retail to purchase perishable groceries such as meats or vegetables. These results are supported by studies conducted in-store, where low-income shoppers have reported to place high importance on being able to carefully examine perishable groceries such as fruit for freshness and value having the ability to personally inspect their food. The risk of purchasing spoiled or poor quality produce and needing to repurchase is larger for low compared with high income groups, because food is a large proportion of their household budget. While convenience is a motivator to use online grocery retail for some shoppers, the perceived risk of inferior quality groceries may outweigh a desire for convenience in lower income groups. Low income shoppers are also more price sensitive and may be deterred from shopping online for groceries because of delivery fees and the possibility of higher prices than in-store. Nevertheless, some studies have found that the price...
of foods available through online grocery stores and traditional in-store supermarkets are similar.\textsuperscript{105} In contrast, our review also suggested that those living in areas of greatest deprivation also have greater access to food outlets through online food delivery platforms, which we suggest are mostly unhealthy.\textsuperscript{80} Given those with a low socioeconomic position generally have poorer diets and diet-related health compared with those with a higher socioeconomic position,\textsuperscript{106–108} it will be important to understand the health equity implications of the digital food retail environment as it evolves in the future.

It is important to note that many studies included in our review were conducted prior to the COVID-19 pandemic, and it is unclear if the digital food retail environment has changed due to the increased consumer demand associated with the pandemic. For example, online sales of food, across all three digital food retail domains (grocery, food delivery, and meal kits), were reported to increase in Australia and elsewhere over the course of the pandemic.\textsuperscript{109–112} It is possible that these increases in demand may drive changes in the digital food retail environments; however, it is difficult to ascertain if or how this has occurred without regular monitoring. Standardized monitoring frameworks for these three different digital food retail domains are required, with monitoring conducted at regular intervals. There are some emerging frameworks for online grocery retail monitoring,\textsuperscript{113} which could be extended and adapted to monitor meal kits and online food delivery platforms.

Currently, the digital food retail environment is largely operating with little government oversight, despite calls from public health advocacy groups for tightening of regulations.\textsuperscript{114–116} Given the increasing use of these digital food retail environments, it is important that they promote public health. As a first step, recommendations and actions that are currently applied to the physical food environment could be extended to also include the digital food retail environment. An example of doing so was highlighted recently in the United Kingdom where the government introduced legislation to restrict high fat, salt, sugar (HFSS) foods and beverages from being price promoted (using volume based price promotions, e.g., "2 for the price of 1") and from being placed in prominent store locations (e.g., end of aisle displays or checkouts).\textsuperscript{117} Importantly, the policy explicitly includes “online marketplaces” (as well as in-store supermarkets), to prohibit promotion of HFSS foods and beverages with volume based price promotions or by positioning them in high traffic areas, such as “home” or “checkout” webpages when shopping online.\textsuperscript{117} Other offline actions that could be applied online include nutritional labeling (such as kilojoule labelling) of menus, as is currently mandated for large chain out-of-home food stores in Australia and the United Kingdom. However, it is important to note that the digital food retail environment is rapidly evolving, and their unique features are also likely to require unique policy provision.

This review identified several key gaps in the literature on the potential effect of the digital food retail environment on diets and health. First, as mentioned previously, given the rapidly evolving nature of the digital food retail environment, it will be important that these are monitored over time. Standardized tools for doing so will be important to enable compatibility across jurisdictions and across time. Second, to ensure our digital food retail environments promote public health, we need a better understanding of the unique aspects of these environments that influence health most and how these can be changed to better support healthy purchases. For example, algorithmic amplification of certain products and prices on landing pages and targeted marketing techniques towards individuals are possible in digital, but not in-store, food retail environments. The digital food retail environment may therefore require unique regulatory conditions. There is also currently little insight into the relationship between ways that marketing and purchasing cues for unhealthy food and beverages in the built food environment are augmented through additional purchasing influences as part of the digital food environment. Additionally, there is limited understanding of the ways in which aspects of the digital food environment (including digital food retail, pricing, and marketing, among others) interact with each other to influence food purchasing behaviors. Although beyond the scope of this review, these interactions are likely important in understanding the effects of the digital food environment on public health and could be explored further in subsequent research.

Our review had several limitations. Overall, the quality of the studies was low, with only 11 of the 57 studies considered “good” quality. Methodological issues affecting study quality decreased their informativeness, with common weaknesses including participant inclusion criteria not being adequately described and study subjects and settings not being described in detail. Further, the literature to date is very heterogeneous in nature, making it difficult to draw conclusions on how healthy the digital food retail environment is and how it could be improved to better promote health. Our decision to limit the inclusion criteria to focus only on health-related studies may also mean that some relevant literature is not captured in this review. For example, while we report on the types of people using online food delivery platforms (i.e., those with a high BMI and those with higher educational attainment), our review lacks data about potential user information for meal kits. These data are available in the broader literature and show that in multi-person households, meal kit users are most likely to be female, between 30 and 39 years old, and highly educated.\textsuperscript{118} Our study was also limited in that we did not consider all aspects of the digital food environment, instead choosing to contain the scope of the review to the retail aspects, but we acknowledge that there are many interrelated aspects of the digital food environment that influence shoppers’ experiences with food and therefore their diets, such as food marketing through social media platforms. Further, the screening of titles and abstracts for this review was primarily conducted by one author, with approximately 7% of titles and abstracts screened by two authors to check consistency. This may lead to misclassification of articles at this early stage of the review process, meaning some potentially relevant articles may have been missed for inclusion in our review. However, in the early screening process, we took a conservative approach where articles were only excluded based on title and abstract if they were clearly irrelevant to the research question, with all other articles progressing to the next stage of review. We are therefore confident that any misclassification is
likely to be minor and unlikely to change the overarching findings from this review.

Our review also had several strengths. The systematic scoping methodology allowed a research question that was sufficiently broad to capture a wide range of studies from diverse fields including public health, marketing, and environmental research while employing robust methods to ensure rigor.

5 | CONCLUSION

Digital food retail environments are an increasingly relevant avenue for procuring foods and beverages and are likely to have an increasing influence on population diets and health. While our review provides initial evidence to suggest that shopping online for groceries may lead to healthier purchases compared with in-store shopping and that meal kits generally provide healthy and convenient options, much more could be done to ensure that all digital food retail environments promote healthy and affordable choices, particularly for online food delivery platforms.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to disclose.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.