RESEARCH ARTICLE

Healthiness of food products promoted through placement strategies in Australian online supermarkets: a cross-sectional study

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Abstract

Background Prominent product placement is a core promotional tactic in retail food environments. How this practice has been adapted for online supermarkets, and the extent to which it is applied to healthier and less healthy food products in this setting, is largely unknown. We aimed to investigate placement-type promotions of food products in Australian online supermarkets.

Methods We developed a new method to assess placement promotions and applied it to the online stores of the two largest supermarket retailers in Australia. Each online store was audited across six 'locations' (input prior to data collection), including a randomly selected high socio-economic position area and low socio-economic position area from each of the three largest Australian cities. The names, page locations and type of placement strategy of promoted food products were captured, with product healthiness assessed using the Health Star Rating (HSR) nutrient profiling system. Descriptive statistics summarised the page locations of promoted products and the placement strategies used to promote them, and chi-squared tests applied to compare product healthiness by retailer and socio-economic position.

Results We recorded 12,152 food products promoted through placement strategies, 99% of which were eligible for a HSR. Overall, 44% of products promoted through placement strategies were unhealthy. Cross-promotions and recommendations was the most common strategy recorded overall (55.9% of all strategies), and advertisements and site content was the strategy most likely to promote unhealthy products (53.7% of products unhealthy). One retailer was more likely to promote unhealthy products (46% v 43%, $p = 0.004$) and unhealthy products were more likely to be promoted in more disadvantaged than less disadvantaged locations (45% vs 43%, $p = 0.05$), though the magnitudes of difference were small.

Conclusions A considerable number of unhealthy products are likely presented to online grocery shoppers in Australia. Public health policies targeting unhealthy food promotions may need to be updated, including with consideration of the different ways that products can be prominently displayed online, to avoid exacerbating risks of diet-related disease and health inequalities. Our novel methodology could be used for ongoing monitoring of online supermarkets in Australia and elsewhere to inform such policies.

Keywords Online supermarkets, Product placement, Food environments, Product promotions

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Background

Products are strategically positioned on the shelves, floors and counters of retail stores to boost sales, as a core retailer marketing strategy [1–3]. Retailers use consumer browsing and sales data as well as psychological insights to inform place-based techniques such as conspicuous lighting and end-of-aisle bins that more subtly influence consumer purchasing decisions than through overt advertising, though these strategies are often used together [1, 2]. The practice of product placement in physical retail stores is well understood, and this approach can be applied to encourage both unhealthy and healthy food purchases [1–10].

Online grocery shopping is becoming increasingly popular in many countries. By 2020, online sales already made up around a quarter of all expenditure on groceries in China and South Korea [11] and are projected to comprise one-fifth of total grocery sales by 2030 in some West European countries [12]. In Australia, just under half of consumers already do at least some grocery shopping online [13]. Whether there is any differential application of product placement strategies to healthy and unhealthy products in online grocery stores is largely unknown to date [14–17].

The layout of an online store is fundamentally different to a physical store, and marketing techniques are being adapted for the online setting [14, 18, 19]. Product placement may be particularly important in online stores; unlike in physical stores, if a product is not in a prominent position online, a consumer may not see it at all [19]. With the increase in uptake of online shopping, it is essential to understand how retailers are using product placements in these increasingly important food retail environments.

The primary aim of this study was to investigate the placement of healthy and unhealthy food products on the online stores of Australian supermarket retailers, including an assessment of the types and locations of placement strategies applied. We hypothesised that unhealthy products would be heavily promoted through prominent product placement overall, as has been seen in assessments and monitoring of Australian physical stores [20–23] and in emerging international research into online retail settings [24]. There were two secondary aims. The first was to assess whether the healthiness of product placements differed by user area-level socio-economic position; we hypothesised that unhealthy products would be more commonly promoted when accessing the supermarket websites from more socio-economically disadvantaged areas, as there is some evidence that physical stores in such areas are more likely to promote unhealthy products using placement strategies in Australia [20–23]. The second secondary aim was to assess whether the healthiness of product placements differed between major retailers; while only marginal differences in the healthiness of products promoted through placement strategies have previously been found between retailers in physical stores in Australia [21–23], understanding and comparing individual food company commitments and actions forms an important part of accountability mechanisms, encourages competitive improvements in practices, and supports advocacy to improve government regulations [25, 26].

Methods

Data collection

Two supermarket retailers in Australia, Woolworths and Coles, dominate the sector with 37% and 30% of the total market share, respectively [27]. Both offer online grocery shopping and were selected for data collection. The next largest retailer, Aldi, accounts for only 9% of the total market share [27] and does not offer online shopping.

To the best of our knowledge, there is not yet a widely accepted best practice for assessing online retail product placement strategies [14, 16]. As such, drawing upon a recently developed framework for assessing online food retail environments [14] and insights into consumer behaviour in online grocery stores [28], the lead author (DM) developed an initial data collection protocol in consultation with two senior colleagues (KT, JW). Subsequently, two researchers (DM, MdC) pilot tested the data collection protocol across the online stores of both retailers included in this study, with potential issues identified and resolved by consensus with KT and JW; across $n = 1160$ products collected through the pilot there were few (< 10) discrepancies. This informed the final data collection protocol described below.

See Fig. 1 for an overview of the data collection process and Additional File 1: Supplementary Fig. 1 for examples of how data was collected. In brief, the two retailers' online stores were audited six times each, with the names of products promoted by different placement strategies recorded and the healthiness of those promoted products assessed using the Health Star Rating (HSR) system, a government-endorsed front-of-pack nutrition labelling scheme in Australia and New Zealand. We generated descriptive statistics to summarise the page locations of these promoted products, the placement strategies used to promote them, and their healthiness.

Store 'location', timing of collection, user accounts and computer settings

Data collection was conducted across six urban locations (suburbs) where both Woolworths and Coles stores are physically present. We focussed on Sydney, Melbourne and Brisbane, as the three largest cities by population in
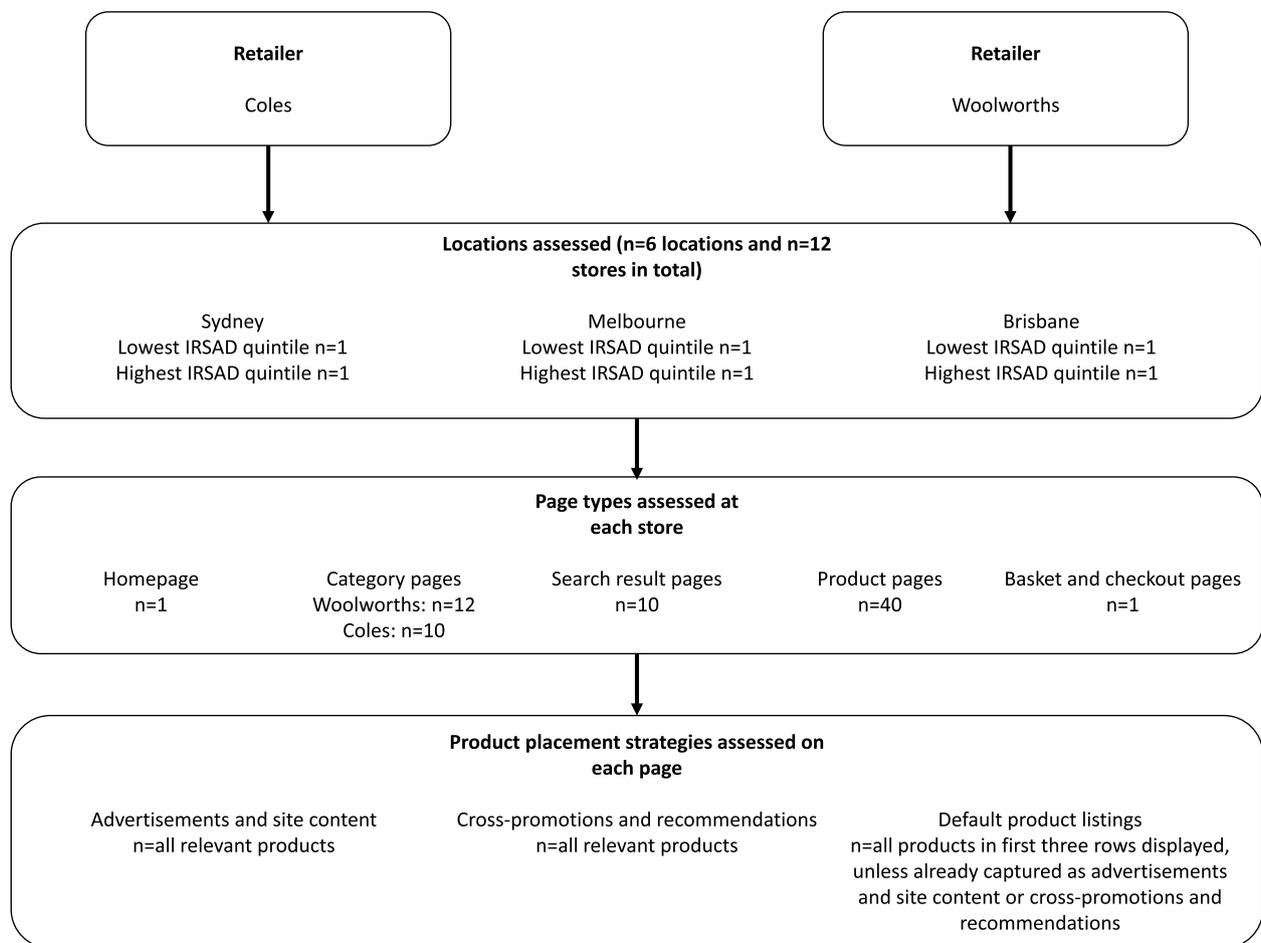
Fig. 1 Data collection process. Note that not all strategies may be applied by all retailers across all page types. IRSAD, Index of Relative Socioeconomic Advantage and Disadvantage

Australia, together accounting for 49.9% of the total Australian population [29]. Within each city, we randomly selected two suburbs, one each from the highest and the lowest quintile by the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD), which assesses both the presence and absence of several social and economic factors to summarise area-level socio-economic advantage and disadvantage [30]; a low score indicates relatively greater disadvantage and a lack of advantage, and a high score indicates a relative lack of disadvantage and greater advantage. Randomisation was performed by assigning a number generated using the 'randbetween()' function in Microsoft Excel against a list of suburbs, sorting those numbers from smallest to largest, and selecting the top results (with replacement with the next suburb if both Woolworths and Coles stores were not present in that suburb, as determined using each retailer's respective online store locator function). For each city and suburb, we assessed both Woolworths' and Coles' online stores (i.e. 12 store postcodes/locations in total). Data

were collected over 8 days in early-October 2023, when no significant public dates or events that might lead to potential outlier effects nationally or in any state or territory were current or imminent.

Personal user accounts were set up for each of the collections using generic email addresses and gender-neutral names (e.g. Alex Williams, Kim Smith), with the location of the store set using the pre-determined suburbs. As dates of birth were required by one retailer they were input for both retailers, determined according to the median age of residents in each suburb [31]. Neither retailer required any other demographic information to be provided to begin data collection.

To limit the influence of internet history and other tracking on the products presented to the researchers, browsing history and cookies were cleared prior to commencing data collection for each store, websites were viewed in incognito browsing mode, a new tab was opened for each store collection and browser-based location tracking was disabled. Data were captured by one

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investigator (DM). Data for each 'location' was collected in full in one sitting, without using that computer for any other purpose.

Online supermarket pages assessed for product placement strategies

For each store location, we assessed product placement promotion strategies across five distinct displays/pages commonly available in online supermarkets [14, 28]: homepage (as the first screen users are presented with), category pages (selecting retailer-determined food categories to view products), search results pages (entering keywords into the search function), product pages (the individual pages for a specific product) and basket and checkout pages (as the final pages users are presented with). These were assessed in the following manner:

Homepage—we entered the retailer's web address into the web browser address bar to access the store homepage.

Category pages—we navigated from the homepage to each of the retailer's major (i.e. first-level) category pages (e.g. pantry, bakery), including categories which may contain both food and non-food products (e.g. baby) but excluding those that did not contain any food products (e.g. household items such as cleaning products), stand-alone alcoholic beverages categories (e.g. liquor) and promotions-only categories (e.g. specials).

Search result pages—we pre-defined a list of ten generic product categories that have both more healthy and less healthy options (Health Star Rating ≥ 3.5 and < 3.5, respectively; see below for further information) to use as specific search terms (milk, soft drink, water, bread, juice, chicken, meat, yoghurt, cheese, sauce). These are amongst the categories with the highest per capita consumption (grams per day) in Australia according to the Australian Bureau of Statistics' 2020–2021 Apparent Consumption of Selected Foodstuffs data [32] and, with the exception of plain water, the highest contributions to total energy, sugars, saturated fat and/or sodium intakes according to the 2011–2012 Australian Health Survey (the most recent data available) [33]. The search terms were entered, one-by-one, into the search bar, with the returned search results examined for product placement strategies.

Product pages—we randomly selected four products available across both retailers from each of the 10 aforementioned categories ($n = 40$ products in total). For each category, at least one private label (i.e. supermarket home/generic branded) product was included to approximate the product split (25% private label v 75% branded products) seen across both Coles and Woolworths in a study using 2022 online data [34]. Products were randomly selected from a set of $n > 20,000$ products collected

online quarterly in 2023 [35]. Category-specific random numbers were firstly generated and assigned to all products. These numbers were sorted from smallest to largest, with products then selected from the smallest number downwards, ensuring those selected were available and comparable (in terms of their size and price) across both retailers. To navigate to the appropriate individual product page for collection, the specific URL for each product was entered. See Additional File 2: Supplementary Table 1 for a full list of products randomly selected in this step.

Basket and checkout pages—each of the 40 randomly selected products was added to the shopping cart. If the specific product was out of stock, the first alternative suggested by the retailer was added. The shopping cart and subsequent page/s (e.g. delivery, payment, final review) were then navigated to and product placement strategies assessed.

Product placement strategies assessed in the online stores

We appraised three types of promotional strategies relying on prominent product placement: advertisements and site content, cross-promotions and recommendations, and default product listings, drawing upon a recently developed framework for assessing online food retail environments and other insights into consumer behaviour in online grocery stores [14, 16]. These were assessed as below (also shown in Additional File 1: Supplementary Fig. 1):

Advertisements and site content—we recorded all identifiable products in banners and other advertisements, displaying promotional flags not directly included in default product listings, or otherwise embedded in product pages or navigation (e.g. links to categories that display a specific product), including those requiring additional action such as scrolling in any direction.

Cross-promotions and recommendations—we captured all suggested or highlighted products ostensibly tied to individual products or categories selected by the user and/or by other purported users (e.g. complementary, bundled, most popular), including those requiring additional action such as scrolling in any direction.

Default product listings—we recorded all products appearing in the top three rows of the default results list, except for those products already captured under other strategies above, as appearing on the relevant page using the Google Chrome browser operating on a Windows OS, with medium font size and 100% zoom and maximised to fit screen, on a single monitor displayed in 1920×1080 resolution in landscape. Though this may not capture all product listings under a category or returned through a search, when browsing online consumers may focus most of their attention to the immediately visible

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information displayed at the top of webpages and be less likely to scroll down [36, 37].

For each product identified, we recorded the page where it was found and the relevant product placement strategy applied, the product's brand and name to assist with subsequent assessment of product healthiness, and, where provided, the product's HSR. Each individual product identified was captured. Each repeat display of the exact same product across the retailer, store location and/or page was recorded. The same product displayed in multiple package sizes or formats was also recorded multiple times (e.g. milk 200 mL, milk 500 mL), whereas a single product comprised of multiple bundled items was counted only once (e.g. six-pack of milk 200 mL).

Included and excluded products
Categories and products were included if they were foods or non-alcoholic beverages. Alcoholic beverages and infant formulas were excluded as they are not general-purpose foods (i.e. generally consumed by the broader population regardless of age). Non-human foods and non-food items were also excluded.

Data analysis
Assessment of product healthiness
Our assessment of the healthiness of promoted products was based on product HSR. Here, we defined a product as 'unhealthy' if it had a HSR < 3.5; previous assessments have found good alignment between the HSR system, using this threshold, and relevant Australian guidelines [38, 39]. Products recorded in our placement promotion audit that did not display a HSR were searched for in the Australian FoodSwitch database [40, 41], a comprehensive database of nutritional information of products available in Australian supermarkets, including Woolworths and Coles, to obtain the applicable HSR. If the product was not available in FoodSwitch we calculated the HSR based on publicly available product data (nutrition information and ingredients list) using the official HSR Calculator [42]. Certain products (plain tea and coffee, chewing gum, plain salt and spices), where captured, were not included in assessments of healthiness as the HSR system is considered 'not appropriate' for those products [42].

Statistical analyses
The proportion of promoted products categorised as unhealthy is reported overall, by high-/low-IRSAD locations and for each retailer. Differences in the proportion of promoted products considered unhealthy were compared (1) between retailers in total and by high- and low-IRSAD locations and (2) between high- and low-IRSAD locations in total and by retailer, using chi-squared tests.

We further compared differences between retailers after adjusting by location and between locations after adjusting by retailer using linear regression. A conventional significance level (two-sided $\alpha = 0.05$) was adopted, without adjustment for multiple testing (n = 8 comparisons in total tested). The mean (SD) number of promoted products, median (IQR) HSR, distribution of strategies and proportion of unhealthy promotions is also disaggregated by page, for both retailers combined and separately. Statistical analyses were conducted using StataBE v18.

Results
Number of products promoted through placement strategies, the types of strategies used, and overall healthiness of products promoted
In total, we captured 12,152 products promoted through placement strategies ($n = 7810$ for Woolworths, $n = 4342$ for Coles), of which 12,032 (99%) were eligible for a HSR ($n = 7728$ for Woolworths, $n = 4304$ for Coles).

Overall, homepages displayed the most product placement promotions, with 46.0 ± 18.5 (mean $\pm$ SD) products promoted per homepage assessed, whereas basket and checkout pages showed the fewest promotions (0.2 ± 0.3) (Table 1). Cross-promotions and recommendations was the most common strategy recorded (55.9% of all strategies), followed by default product listings (26.6%) and advertisements and site content (17.5%). Distinct patterns emerged when assessing strategies across pages: advertisements and site content formed the majority of placement promotions on homepages (61.8%) but were not displayed at all on product pages and in basket and checkout pages; cross-promotions and recommendations constituted all promotions on product pages and in basket and checkout pages but were not common on category pages (16.6%); and default product listings provided over half of all promotions on search pages (59.7%) but were not displayed on homepages, product pages and basket and checkout pages.

Overall, 44% of products promoted through placement strategies were categorised as unhealthy, with the median HSR of promoted products 3.5 (IQR 2.0–4.0) (Table 1). However, there appeared to be a bimodal distribution of HSRs amongst promoted products, with 0.5 and 3.5–4.0 HSR products the most frequently promoted through placement strategies (Additional File 3: Supplementary Fig. 2). A subsequent manual examination of products receiving 0.5 HSR revealed the promotion of a large number of sugar-sweetened beverages and confectionery items.

Amongst placement strategies, advertisements and site content were the most likely to promote unhealthy products (53.7% of products unhealthy), with less than half of cross-promotions and recommendations (43.5%)

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Table 1 Food products promoted through prominent placement on online stores of two retailers, Australia, 2023, all stores searched (*n* = 12)

	Mean (SD) number of promoted products	Proportion of all strategies (%)			Median (IQR) HSR of promoted products[a]	Proportion of products < 3.5 HSR (%)[a]			
		Advertisements and site content	Cross-promotions and recommendations	Default product listings		Total	Advertisements and site content	Cross-promotions and recommendations	Default product listings
Total (*n* = 756 pages)	21.0 (17.8)	17.5%	55.9%	26.6%	3.5 (2.0–4.0)	44.0%	53.7%	43.5%	38.9%
Home-page (*n* = 12 pages)	46.0 (18.5)	61.8%	38.3%	0%	2.5 (1.0–4.0)	54.0%	51.8%	57.9%	N.A.
Cat-egory page (*n* = 132 pages[b])	24.6 (7.0)	35.5%	16.6%	47.9%	3.5 (2.0–4.0)	42.9%	53.4%	35.7%	37.7%
Search results (*n* = 120 pages)	23.0 (5.7)	22.1%	18.2%	59.7%	3.5 (2.0–4.0)	45.6%	55.2%	52.3%	40.0%
Product pages (*n* = 480 pages)	11.5 (4.8)	0%	100.0%	0%	3.5 (2.0–4.0)	42.9%	N.A.	42.9%	N.A.
Basket and check-out pages (*n* = 12 pages)	0.2 (0.3)	0%	100.0%	0%	0.5 (0.5–0.5)	100.0%	N.A.	100.0%	N.A.

HSR Health Star Rating, *N.A.* Not applicable (as the particular product placement strategy was not used)

[a] After excluding products such as plain tea and coffee, chewing gum and plain salt and spices for which the HSR system is considered 'not appropriate' according to official guidance (*n* = 120 in total, across all stores searched)

[b] For Woolworths, *n* = 12 categories were assessed per location: Fruit & Veg; Bakery; Poultry, Meat & Seafood; Dairy, Eggs & Fridge; Deli & Chilled Meals; Lunch Box; Pantry; Freezer; Snacks & Confectionery; Drinks; Health & Wellness; Baby (promotions in the Health & Wellness and Baby categories were predominantly non-food). For Coles, *n* = 10 categories were assessed per location: Back to School; Meat & Seafood; Fruit & Vegetables; Dairy, Eggs & Fridge; Bakery; Deli; Pantry; Drinks; Frozen; Baby (promotions in the Baby category were predominantly non-food)

and default product listings (38.9%) overall promoting unhealthy products (Table 1). Different strategies dominated different pages, and though the proportion of promoted products that were unhealthy differed across pages and strategies, at least a third (>35%) of products promoted on any page and by any strategy were unhealthy.

The prevalence of placement product promotions for each retailer

For Woolworths, the greatest number of promotions were found on category pages (mean ± SD, 30.7 ± 0.1), and the least on basket and checkout pages (no promotions identified across any location) (Additional File 4: Supplementary Table 2). For Coles, the homepage displayed the greatest number of promotions (61.7 ± 7.1) and basket and checkout pages had the least number of promotions (0.3 ± 0.5). For both retailers, the most

common placement strategy was cross-promotions and recommendations (Woolworths: 61.3% of total, Coles: 46.0%), followed by default product listings (Woolworths: 23.9%, Coles: 31.5%) and advertisements and site content (Woolworths: 14.8%, Coles: 22.4%).

The healthiness of placement product promotions by area-level socio-economic position

Unhealthy products were more likely to be promoted in low-IRSAD than high-IRSAD locations overall (unadjusted: 45% vs 43%, $p = 0.05$; adjusted by retailer: 45% vs 43%, $p = 0.106$) (Fig. 2). However, there were no statistically significant differences found by location within retailers (Woolworths: low-IRSAD 44% v high-IRSAD 42%, $p = 0.096$; Coles: low-IRSAD 47% v high-IRSAD 45%, $p = 0.270$). Placement promotions per page, strategies applied and product healthiness across strategies
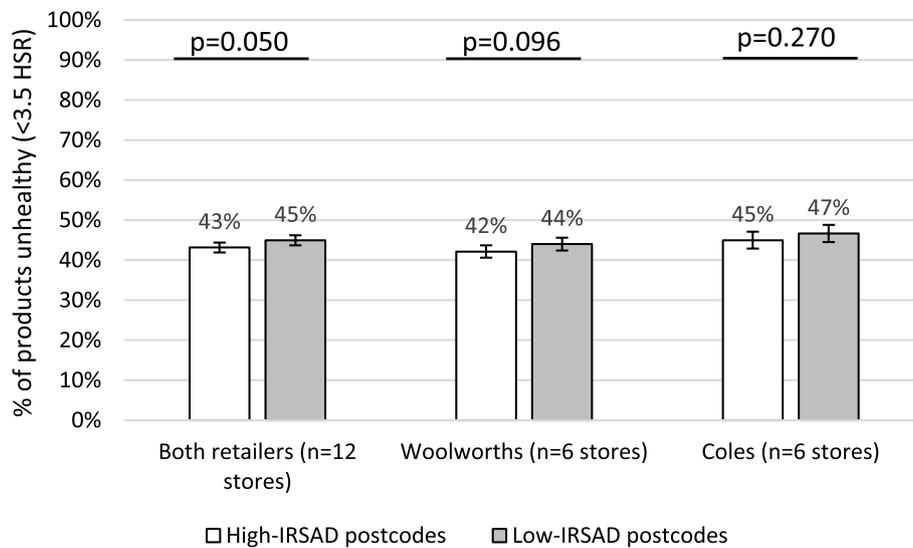
Fig. 2 Proportion of products promoted through prominent placement on the online stores of two retailers in Australia that were unhealthy (HSR < 3.5), by retailer and location. Error bars represent 95% confidence intervals. HSR, Health Star Rating; IRSAD, Index of Relative Socioeconomic Advantage and Disadvantage

and pages were very consistent between both Woolworths' high- and low-IRSAD stores and Coles' high- and low-IRSAD areas (results not shown).

The healthiness of placement product promotions for each retailer

Coles was overall statistically more likely to promote unhealthy products than Woolworths (unadjusted: 46% v 43%, $p = 0.004$; adjusted by location: 46% v 43%, $p = 0.019$) (Additional File 5: Supplementary Table 3). This was the case for both low-IRSAD and high-IRSAD locations (low-IRSAD: Coles 47% v Woolworths 44%, $p = 0.05$; high-IRSAD: Coles 45% v Woolworths 42%, $p = 0.032$) (results not shown).

By strategy, patterns were similar between retailers, with advertisements and site content most likely to be unhealthy (Woolworths: 49.6% unhealthy, Coles: 58.5%), followed by cross-promotions and recommendations (Woolworths 43.6%, Coles: 43.3%) and default product lists (Woolworths: 37.8%, Coles: 40.6%) (Additional File 5: Supplementary Table 3). Results differed by page, however. For example, in Woolworths' online store, the page type with the highest proportion of unhealthy products was search results (47.0% of products unhealthy) and the page type with the lowest proportion of unhealthy products was category pages (39.0%), while for Coles basket and checkout pages were most likely to feature unhealthy products (100.0% of products unhealthy) and product pages the least (41.7%).

Discussion

This study assessed the online stores of the two dominant supermarket retailers in Australia and found that over two-fifths of all products promoted through placement strategies were unhealthy. While we identified differences in the healthiness of promoted products by area-level socio-economic position and between retailers, the magnitude of differences were small. Across both retailers, cross-promotions and recommendations was the most common placement strategy, and advertisements and site content were most likely to feature unhealthy products. Results within retailers by area-level socio-economic positions were very similar, suggesting that at the time of collection both retailers likely applied a similar approach to placement promotions in their online stores regardless of customer location.

To our knowledge, this was the first study to investigate placement strategies in Australian online supermarkets. Overall, a typical start-to-finish shopping event would likely result in a consumer being presented with a considerable number of unhealthy products, regardless of retailer. Drawing explicit comparisons to studies conducted in physical supermarkets in Australia [20–23] is difficult as consumer experiences of shopping and viewing the environment are fundamentally different in these settings, thus methods to assess placement strategies are inherently different. However, as hypothesised, we did find heavy promotion of unhealthy products through such strategies overall. This is apparent when comparing our results to that of a recent study of products available in Australian online supermarkets, with the

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data presented indicating that 30% of all products would score < 3.5 HSR [34]. An additional comparison can be made between the distribution of HSRs for promoted products in our study, where products scoring 0.5 HSR were commonly promoted (14% of all placement promotions), to that recently seen for all products in Australian (physical) supermarkets, in which relatively few products (∼ 7%) scored 0.5 HSR [43]; the heavy promotion of confectionery and sugar-sweetened beverages online likely explains this contrast.

Similar to the findings here, recent research in-store has found that the proportion of products promoted through prominent placement that were unhealthy differed only marginally between Woolworths and Coles, though diverging results were seen for other, smaller chain and independent retailers [21–23]. Our findings on differences by area-level socio-economic position, while not conclusive, do not contradict other evidence on the potential differential promotion of unhealthy products according to location in physical stores in Australia; the inclusion of additional 'stores' (locations) in subsequent studies of online food retail environments may help explore this potential effect further. One study found that island bins near checkouts and elsewhere in store were 14.1% and 15.6% more likely, respectively, to display unhealthy food in stores in the most disadvantaged areas compared to stores in the least disadvantaged areas [22], while another found an additional 9.7% of shelf space was dedicated to unhealthy products in the most disadvantaged areas compared to the least disadvantaged areas [23].

In our study, the differential promotion of unhealthy products through place-based strategies by location seems to be less apparent in online settings. However, online environments have other novel and unique features such as personalised marketing [14], which were not considered in our assessment but may play a key role in exposure to unhealthy placement promotions online. This may be particularly important in light of associations between socio-economic position and diets in Australia [44, 45]; our limited findings regarding differences by location may result from not capturing personalised marketing of unhealthy products that is tied to tracking of regular shopping patterns and other internet use. Future research could capture product placement promotions following the intentional, repeat collection of representative selections of products, according to patterns seen in Australia by socio-economic position, to better investigate potential personalised and differential marketing. Alternatively, actual use by representative samples of consumers could be recorded, which would also facilitate the identification of 'typical' online grocery shopping experiences; we discuss this in more detail below.

Internationally, there has been limited research conducted into the use and healthiness of placement strategies in online supermarkets, with methods varying considerably. A study of 21 retailers in the United States of America found that placement strategies, similar to those assessed in the current study, were common and frequently applied to unhealthy products with, for instance, 60% of all products promoted through recommendations classified as unhealthy [24]. An English study found, across three large retailers, that 73% of products highlighted on homepages were unhealthy [46]. Unhealthy products constituted 21.6% of total non-monetary (i.e. placement-based) promotions across a range of marketing strategies and pages in a survey of six online supermarkets in Scotland [19].

Interestingly, this Scottish study found that placement promotions were more common than promotions involving pricing, with the authors hypothesising that the former are more important than the latter online as "[w]hile in a physical store, a shopper can see many products on a shop's shelves, even if they are not promoted, an online shopper will only see a product if it appears on the website (and therefore is promoted), or if they specifically search for it. Therefore, placing promoted goods on a grocery retailer's website in areas that shoppers must visit while shopping online (i.e. main page, product landing pages or checkout) is a logical strategy" [19]. This suggests the critical importance of understanding, identifying and addressing placement promotions online, as well a future line of inquiry to understand the relative or combined application of price and placement promotions in Australian online supermarkets. Findings from an earlier study of price promotions in an Australian online supermarket [47] cannot be directly compared to our results due to considerable differences in methodologies, highlighting the need for further research and methodological development to investigate both pricing and placement strategies.

We have found that a considerable proportion of products prominently located in the default order of category pages and search results were unhealthy. Whether the placement of some or all of these products is paid for is unknown, though there is evidence of this practice in physical stores [48]. Other relevant drivers may be sales, profit margins or novelty, rather than the healthiness of products per se; regardless, the outcome remains of primary concern to us. However, the potential diversity of promotional strategies, coupled with our findings which do not indicate common priority locations or strategies, suggests that any restrictions on unhealthy product marketing online must be comprehensive to ensure that products are simply not promoted through other strategies. Multi-faceted government policies that consider

not just advertisements and other overt product placement, but also other strategies (e.g. how default product lists are set), may be required to control the promotion of unhealthy products in online food retail environments. Regulation to restrict placement promotions of unhealthy products, explicitly including online settings, came into force in England in October 2022 [49] and is also being considered by the Scottish Government [50]. These are a good first step, with the English regulation intending to limit the display of certain products across a range of locations in online supermarkets (e.g. homepages and other equivalents of high-traffic in-store locations such as checkouts and aisle ends) [49]; noting that studies assessing the impact of this policy are not yet available. However, in a clear attempt to navigate issues with the need to intentionally display products to consumers in online stores (as opposed to shoppers being able to walk past all products available on shelves instore), considerable exemptions have been set, highlighting difficulties when considering options to protect and support consumers in online food retail environments. An alternative to regulation of promotions by locations and/or strategies could be the mandatory display of relevant front-of-pack nutrition labelling, though existing labelling-based strategies may not prove effective in the context of online shopping as they may not be visible on or applicable to the promotions identified here and could be circumvented by adding products to cart directly from listings or other promotions [34]; a potential solution could be to require a relevant summary indicator of healthiness to be clearly visible in all instances where the product is displayed online.

While some of our approaches correspond, even if roughly, to other assessments of placement promotions in-store and online, we have also developed and tested novel methods through this study. It is, to our knowledge, the first study to specifically look at the healthiness of default product listings, in addition to more obvious placement promotions. We have also set out a broader methodology for conducting a comprehensive, detailed assessment of a range of pages and strategies online. Repeat assessments of the online supermarkets assessed in this current study and evaluations in other countries will provide further context to the findings reported here and support benchmarking and accountability mechanisms.

Strengths of our study include the use of multiple collections, which led to the identification of thousands of relevant product promotions. We have intentionally minimised the impact of search and browsing history, both within and outside of the online supermarket, in an attempt to control the influence of cookies, location tracking, previous purchases etc. and to facilitate comparable collections in what can be a rapidly changing environment; noting however that additional or residual tracking remains a possibility (via, for example, devices, users and networks), and the approach we have taken may also be considered a limitation (see below). The use of pre-set displays and products/categories similarly aimed to enable a standardised and replicable collection. Finally, this study used data from the two duopolistic supermarket retailers in Australia, likely representing most Australian online grocery shoppers at the time.

There are also some limitations to our study. These are partly to do with the representation of a 'typical' online shopping experience and reproducibility of results. For example, some promotions may change according to search, browsing and purchase history, while using online supermarkets in other formats (e.g. mobile app) and/or with different display settings (e.g. larger/smaller computer screen) is likely to alter what is seen on-screen. Furthermore, the online environment changes rapidly, whether week-to-week, day-by-day, or even with a refresh of the screen; this may be mitigated somewhat in our study by the use of multiple collections over multiple locations and days, and our study does provide a general representation of the online supermarket at a point in time. In addition, results of analyses of the prevalence of strategies should be interpreted with caution, as these are influenced to some extent by our methodology.

As such, our study is unable to suggest what a hypothetical typical user would be presented with across a typical shopping event; to some extent, this is due to the novelty of this research and a lack of supporting data regarding online shopping behaviours to inform the methodology. Rather, we have simply captured the prevalence of strategies, their location, and their application to unhealthy products. This also means that reproducibility for duplicate or subsequent collection is extremely difficult; the use of a sole data collector in this study is acknowledged as a limitation given the potential for biases or errors to be introduced. The current analysis also cannot indicate the association of placement promotions with actual purchases and intakes, though it can be presumed that the promotion of products by retailers is intended to influence purchases [48]. While audits of the prevalence of certain features of food environments, as per our methods, are a standard approach to assessing the healthiness of food environments [51], we suggest as a priority for future research an investigation of the typical, actual display of placement-type promotions in online supermarkets, and potentially the influence of such displays on purchases, using data collected by or via regular online grocery shoppers; screen-recording may be a viable approach [52–54]. This would also assist with providing evidence on the categories most commonly

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browsed or purchased online in Australia, which may inform improvements to the methods applied in this study and particularly decisions regarding the inclusion of product and/or category pages.

Additionally, though the use of HSRs as a categorical arbiter of healthiness has been used in multiple studies [39, 55, 56] and in government guidelines [57] to categorise food according to healthiness, and is applied by Access to Nutrition Initiative to assess company portfolios globally [58], the approach is also contested as the calculation of a summary output that balances 'negative' and 'positive' components may result in ultra-processed products and/or products with high levels of added sodium, unhealthy fats and sugars receiving high scores [59]; further research in this area may need to consider other or additional food classification systems relevant to the Australian context. Finally, the use of yet more sophisticated and covert strategies such as artificial intelligence-driven 'dark nudges' [18] may be far more common than outsiders can reveal, including through the present assessment. Further investigation of strategies that rely on personalisation may assist to uncover some of these practices, while consideration will also need to be given to the matter of identifying the extent to which algorithms and artificial intelligence are embedded and influential within retail settings.

Conclusions

Novel methods for assessing placement strategies in online supermarkets have been developed and tested. We have identified that consumers are likely presented with a considerable number of prominently placed unhealthy products when shopping in the online stores of the two leading supermarkets in Australia. Comprehensive public health policies that cover a range of placement promotional strategies should be considered to ensure that online food retail environments do not exacerbate existing trends toward unhealthy dietary patterns and dietary inequalities.

Abbreviations
HSR   Health Star Rating
IRSAD   Index of Relative Socioeconomic Advantage and Disadvantage

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12916-024-03557-y.

Additional file 1: Supplementary Fig. 1. Example of product placement strategies assessed on different online supermarket pages, including A: homepage, B: category pages, C: search result pages, D: product pages, and E: basket and checkout pages

Additional file 2: Supplementary Table 1. Products used to assess placement strategies on product pages

Additional file 3: Supplementary Fig. 2. Distribution of Health Star Ratingsfor all food products eligible for a HSRpromoted through prominent placement on the online stores of two retailers in Australia, all stores searched.

Additional file 4: Supplementary Table 2. Placement-based food product promotions on the online stores of two retailers in Australia, all stores searched.

Additional file 5: Supplementary Table 3. The healthiness of food products promoted through prominent placement on the online stores of two retailers in Australia, all stores searched.

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