

Food access and obesity

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Background

Human diet and nutrition has long been known to influence health outcomes. The major focus of research during the last hundred years has been on the relationship between nutrient intakes and disease processes at a physiological level. In the post-war years, separate strands of research emerged primarily in the UK and the USA: on food retailing, from economic and planning perspectives; and on dietary patterns and dietary behaviour change, focusing on prevention of chronic non-communicable diseases such as coronary heart disease. Only with the emergence of interest in and, more recently, a UK policy focus on health inequalities, has the link been made explicitly between food retail access and dietary intake. From the early 1990s onwards, this research increasingly sought to answer the questions of whether urban 'food deserts' exist, and if so how they are caused and whether they can be tackled by modifying the food retail environment. In the last 5 years, this integrated strand of research has broadened and converged with a parallel strand of research on understanding the 'obesogenic environment'. This new field of research has predominantly explored the effects of the built environment on physical activity, but has now also started to explore the availability and accessibility of retailed foods. A recent addition to this strand is research on the spatial patterning of and food availability in restaurants and fast-food chains.

Little research on food access has explicitly looked at obesity as an outcome. However, the relationship between obesity and the 'healthiness' of diet, in terms of measures

such as fruit and vegetable consumption or fat intake, is strong. Evidence demonstrating effects of retailing on diet and food purchasing has therefore been deemed relevant to this review.

Current evidence on food access, diet and obesity

Dietary epidemiology

The nutritional quality of dietary intake is strongly patterned socioeconomically (1–13). A range of nutritional deficits, judged by current national recommendations in the UK, are more commonly found among those in lower socioeconomic groups, as well as among the elderly, teenagers, young adults and men. Many factors are known to contribute to dietary behaviour at a household or 'family' level, including disposable income; gender; the knowledge and skills of those purchasing, preparing, storing and serving food; influences such as advertising; and practical constraints within the household such as the availability and adequacy of facilities for preparation, cooking, cold and dry storage, and the consumption of food (1,2,14–24).

Such research on the social patterning of diet has been replicated in other countries, in particular, the USA (17,24–29). The most recent development in this field has been the emergence of studies focusing on wider 'environmental' determinants of diet outside the home.

In the early 1990s, the socioeconomic patterning of health variables, including health-related behaviours, were shown to have significant spatial patterning (30). In studies

from Scotland (30–33) and elsewhere (2,25,26,34), the influence of area of residence has been shown to be a potent predictor of dietary patterns, over and above individual or household socioeconomic factors. Most recently, the focus of research interest has shifted to the potential environmental causes of observed inequalities in diet, in particular, food retailing.

Retail geography and planning

Much research has documented the changing landscape of food retailing in the post-war era, both in the USA and the UK. There are no comprehensive reviews, although the work of several British authors provides useful summaries (35–40). In summarizing what is available, a complex set of relationships and developments will inevitably be oversimplified.

Research from the UK, as well as parallel work from the USA, documents a major retail revolution in food supply since the 1960s (41–51). The causes of these developments can be attributed to both supply and demand factors: changes in food retailing have been driven by the industrialization of agriculture and commercial forces, but these in turn have been influenced by socioeconomic and cultural shifts, such as the growing number of women in employment and increasing car ownership (52). Together, these factors have led to a greater demand for one-stop shopping and a greater willingness to travel to shops viewed as offering better value for money, quality and range of goods – a demand that was readily met by the major retailers (39).

The most visible change has been the rapid growth of large multiple/chain-owned supermarkets in out-of-town locations, usually on main arterial or circular roads near to major urban conurbations. This has resulted in a decline in the numbers of smaller general and specialist grocery shops in town centres and suburban areas, which were unable to compete with the higher turnover and lower prices of supermarkets. The emerging pattern of modern retailing in the UK has therefore been dominated by a small number of major retailers (e.g. Tesco, Asda, Sainsbury, Morrison, etc.) with a predominance of large, out-of-town supermarkets carrying a huge range of lines at low prices, and smaller local stores increasingly diversifying to become all-encompassing ‘convenience’ stores maintaining higher prices driven by their turnover in order to compete (35).

It was in this climate that concerns first emerged about the lack of food retail provision in some urban areas, and the term ‘food deserts’ was coined, linking the retail revolution inextricably with the socioeconomic patterning of diet highlighted above. The term is usually used to describe urban areas where it is difficult to buy a range of food necessary to eat healthily at a reasonable price (35,53–58). It is reported to have been used first by a resident of a

public sector housing scheme in the west of Scotland in the early 1990s (59). It was picked up and used by the Policy Working Group of the Government’s Low-Income Project Team of the Nutrition Task Force in 1995 (5). The concept was then investigated by the Social Exclusion Unit’s Policy Action Team 13, in its review of shopping access for people living in deprived neighbourhoods (60). The idea of food deserts had immediate appeal to the media and policymakers, and rapidly became enshrined in government policy (39,54): it was mentioned in the National Health Strategy (61) and the Government’s independent enquiry into health inequalities (62). However, it is important to recognize that it has little scientific basis (55).

By the mid-1990s, the economic climate had begun to change again. Two factors influenced further developments in the UK: the introduction of planning guidance aimed at revitalizing urban centres; and the rapid emergence of a new European-style ‘deep discounter’ (e.g. stores such as Aldi, Netto, Lidl), selling a limited number of lines at prices that undercut the major supermarkets (63). Together these factors led to a further change of track by the major retailers, with the introduction of new, smaller formats in a diverse range of settings (e.g. Tesco Metro and Tesco Express stores in city centres and petrol stations). Although this recent trend might have been expected to fill gaps in retail provision in urban areas, the major retailer’s smaller-format stores are invariably more expensive than their larger ones, a practice known as ‘price-flexing’ (63). This was one of the problematic issues identified by the Competition Commission in its review of supermarkets in 2000, but led to no more than a recommendation for self-regulation by the big players (64). Ultimately, the major retailers’ smaller stores retain a competitive edge over independent convenience stores by virtue of the economies of scale that underpin them (e.g. massive distribution networks, own brand products, etc.) (63).

One other area of development is worthy of note. As well as developing formats and pricing strategies to meet commercial demand over the last 30 years, the major retailers have responded to consumer demand by massively expanding the range and quality of foods available (65). A key development attributable to this sector (and to Marks and Spencer in particular) has been the ‘ready meal’. This concept has been developed by all the major supermarkets to include a diverse range of convenience foods. Such foods have been criticized for their ‘healthiness’, especially their high-fat, sugar and salt content, but have become hugely popular and profitable (63,66). Another development was the introduction of ‘economy’ lines (such as Tesco ‘Value’ products) by all the major supermarkets in direct response to the commercial threat posed by the discount supermarkets (63,67). Some supermarkets (notably Sainsbury and Tesco) have also introduced ‘quality’ ranges (e.g. Sainsbury ‘Taste the Difference’) in order to compete with the major

high-end retailers, such as Marks and Spencer. These developments, as well as huge diversification in non-food sales and a large number of mergers and acquisitions, have enabled the key competitors to retain market domination and maintain generally low food prices (63). This is a critical issue because, although the big players have been blamed for the demise of local, independent grocers, they have also been responsible for delivering considerable value to consumers.

Food retail access

With the emergence of concerns about 'food deserts', a new strand of research evolved in the UK (and more recently in the USA), aimed at assessing food retail access for individuals and households. While the focus of research on retailing had been on the number, type and size of stores, this new work focused, in addition, on assessing the range, cost and quality of foods available in stores in geographically defined neighbourhoods. Early work defined methods, using a range of 'healthy food basket' methods (68–75) and definitive studies then started to demonstrate a mix of findings. Although some early studies suggested that 'healthy' foods may be more expensive and less available in poorer areas (74), more recent studies have failed to replicate these findings, showing instead that 'healthy' foods tend to be as, if not more, available in poorer areas and are lower in price (39,63,72,73,76–78). However, these studies have demonstrated consistent differences between types of store – larger grocery shops, not surprisingly, generally have greater availability, lower costs and better-quality fresh produce than smaller grocery stores. Nevertheless, some small specialist stores (such as greengrocers and market stalls) appear to offer even cheaper prices for fruits and vegetables than supermarkets (78).

Another strand of work has explored modes of transport used and physical proximity to food stores by socioeconomic variables, as well as the attitudes and preferences of low-income consumers. This research consistently demonstrates that car ownership and use of a car to buy food is socioeconomically patterned and that this is a key determinant in choice of main food stores (15,49,50,52,56,68,73,78–85). It also shows that carrying shopping, as well as the problems of storage, remain important barriers to accessing supermarkets by the poor (50,52,56,73,78–80,84,85). Nevertheless, the poor demonstrate sophisticated strategies for 'economic' shopping, utilizing a wide range of store types including markets, discount stores, supermarkets and convenience stores to buy the food they need to feed their families from one payday to the next (86,87). Although a huge majority use a car or public transport to travel to shops in the UK, those who walk or cycle to shops travel relatively small distances

(78), suggesting that mode of transport may only contribute a small amount to daily energy expenditure.

The cost of a healthy diet

One of the key concerns in the 'food deserts' debate has been the question of whether a 'healthy' diet costs more than an 'unhealthy' diet. There has been a modest amount of research on the cost of a nutritionally adequate diet, including studies to define a 'modest but adequate' diet (69), but no reviews. In a study in the Hampstead area of London, Mooney showed that two diets, one meeting and one not meeting contemporary nutritional guidelines, differed in cost, with the 'healthier' diet consistently costing more (68). However, she also showed that both more and less healthy diets were consistently cheaper in more deprived than in more affluent neighbourhoods, but failed to draw attention to this in her conclusions. Perhaps for this reason, her study has been widely misquoted as demonstrating that healthy food costs more in more deprived areas.

More recent research using more 'realistic' family food baskets has confirmed these findings and showed that availability of a 'healthy' diet increased from 1990 to 1994 and the cost declined in supermarkets. Availability and cost in local grocers remained poor (83).

One interesting analysis of cost relates to 'economy' line products (mentioned above). Cooper and Nelson analysed a range of such products for nutritional content and found them to be as healthy as, if not healthier than, equivalent standard products and excellent value for money (67). While many regard such products as inferior on grounds of taste, they clearly can play a role in eating healthily on a low income.

One of the few studies to come from outside the UK or the USA presented an economic analysis aimed at predicting the food choices individuals might make in order to reduce their food budget (by simulating the choices made by low-income French consumers) (88). Increasing cost constraints decreased the proportion of energy contributed to diet by fruits, vegetables, meats and dairy products, replacing these with cereals, sweets and added fats, thus reducing overall nutrient density – a pattern similar to that observed in the diets of lower socioeconomic groups. The authors concluded that economic measures would be needed to effectively promote healthier diets among the poor as, no matter how good the level of access, the poorest, ultimately, cannot afford the healthiest diet.

Does retail access affect what we eat?

So far, reference has only been made to separate bodies of work that have looked at retail access and the social

patterning of dietary intake. Only a small number of studies have attempted to assess whether food retailing directly influences diet. This body of work can be divided into three groups: ecological studies that compare food retail access and diets within geographical areas, but do not look at where individuals buy their food; studies that explore cross-sectionally the relationship between food retailing and dietary intake in individuals; and experimental studies that explore whether changes in retail provision result in changes in the diets of individuals who live near to and/or shop in specific retail outlets.

Ecological studies

This group of studies has typically looked at the correlation between a measure of food access in geographical areas and a separate measure of diet in the same areas and drawn conclusions about causality. For example, Morland *et al.*, analysing data from the Atherosclerosis Risk in Communities (ARIC) study, demonstrated that both black- and white-American fruit and vegetable intake was higher in census tracts with more supermarkets, and concluded that the local food environment is important for diet (89). However, they did not have data on where people bought their food and only accessed data on a limited range of grocery stores. Thus, they assumed that everyone bought their food at supermarkets in their own census tract – a fact that we know from other retail research is highly unlikely (52,78,85,90).

Individual level studies

A small number of studies have measured socioeconomic factors and food purchasing (with or without self-reported details of store type, proximity, etc.) in individuals (91,92). These studies, while shedding light on the socioeconomic (and in some cases spatial) patterning of food purchasing, do not answer the question of whether differential food retail access leads to differential consumption.

A study from Newcastle remains the only epidemiological study that has collected data simultaneously on the diets of individuals and retail availability and access (78). Using a range of analytical techniques, the authors were unable to demonstrate that retail parameters, including availability, proximity or price, were statistically associated with dietary patterns. The factors that predicted healthiness of diet, in terms of fruit and vegetable or fat intake, were dietary knowledge; other aspects of a healthy lifestyle such as being more active or drinking less alcohol; age; sex; ethnicity; and socioeconomic factors. They demonstrated that retail access is generally good in all parts of the city, with some advantages in poorer areas (e.g. more and cheaper fruit and vegetables). However, they confirmed the findings of others that availability, price and quality are

advantageous in supermarkets, compared with convenience stores. While providing some of the strongest evidence yet that retail availability has only a weak effect on dietary patterns, this study was limited by its cross-sectional design.

Experimental studies

Two studies have taken advantage of ‘natural experiments’ involving the development of a new, large supermarket (in both cases, a Tesco store) in previously poorly served areas of the UK. The Leeds ‘Seacroft’ study suffered from a weaker design, having no control area and a sample size too small to detect small changes in behaviour (93). The authors reported a positive impact on fruit and vegetable consumption, particularly among those who switched to the new store. A controlled study from Glasgow, in contrast, showed little effect on fruit and vegetable consumption among local residents or ‘switchers’ (94). Unadjusted changes were similar in magnitude to those seen in Leeds, supporting the suspicion that the effects measured in Leeds, without a control group, were confounded by a secular change (37).

The Glasgow study (94), together with the Newcastle study (78), provides the most robust and convincing evidence to date that food retail access *per se* does not have a profound effect on dietary consumption, in the UK at least.

Can food retail access, or lack of it, make us fat?

The research presented so far does not provide strong evidence that food retailing in isolation affects diet and it is therefore reasonable to conclude that it is also unlikely to have a profound impact on obesity. That is not to say that other factors, such as price, are not important, but in the overall scheme of things, concern about retail availability and access may not be the most profitable direction for thinking about modifying diets in the future.

One recent review has summarized much of the evidence here, coming to similar conclusions (37). The authors suggested that a systematic difference between the findings of studies from the USA and other developed countries points towards important contextual differences between the USA and elsewhere. The implicit suggestion here is that the USA is a more unequal society, where issues such as food retail access are genuinely worse for the poor and, in particular, African Americans. Evidence from a range of studies of health inequality, as well as studies of the retail environment, tends to support such a hypothesis.

There is also one recent US study that has explicitly looked at the relationship between food retailing and obesity. This is another study from Morland *et al.*, involving secondary analysis the ARIC data (95) and suffers from

the same methodological limitations as its predecessors (25,29,34,89,96,97). Obesity among black and white Americans was associated with lower numbers of supermarkets and higher numbers of convenience stores in census tracts. However, there was no evidence that individuals shopped within their own census tracts, and these results may be confounded by the socioeconomic characteristics of neighbourhoods, indicating that fatter people live in poorer areas, served by fewer supermarkets and more convenience stores.

In our study from Newcastle, we have recently re-analysed the data to explore the association between retail factors and obesity [measured by body mass index (BMI) from self-reported height and weight]. We have found no evidence of an effect of food retailing, although further work is ongoing (M. White, unpublished results).

One other, relatively new, area of research deserves a mention here. Recent studies have begun to explore the role of food prepared (and sometimes eaten) outside the home in predicting obesity. While ready-prepared food purchased outside the home can be nutritionally inferior to home-prepared food and can contribute significantly to energy intakes, an association with BMI has not been demonstrated (98). However, two areas have been explored: in the USA, restaurant provision of healthy menus, as well as take-away (fast-food) provision; and in the UK and Australia, location of fast-food outlets.

From the USA, Thomson *et al.* have shown, longitudinally, a relationship between frequency of consumption of food from fast-food restaurants in American girls (aged 8–19 years) and development of obesity (99). Two studies have shown there to be more fast-food restaurants in poorer, predominantly black areas (100,101), and one has demonstrated fewer healthier options available in restaurants in such areas (100).

In the UK, Macintyre *et al.* failed to find socioeconomic patterning by small area of out-of-home food outlets in Glasgow (102), but did find that McDonald's fast-food restaurants were more likely to be found in more deprived areas in England and Scotland (103). In Australia, Reidpath *et al.* (104) found the density of fast-food outlets to be greater in more deprived areas.

Key questions and barriers

Can we demonstrate that food access independently predicts dietary intake?

The huge volume of research on this issue has only begun to answer satisfactorily the question of whether retail access independently predicts dietary intake. A key barrier seems to be that cross-sectional studies and secondary analyses are easier to do and evaluations of natural experiments or major epidemiological studies are very costly. It is also

difficult to achieve satisfactory control within the natural experiments that present themselves. Considerable co-operation from the retail sector is also needed to mount such studies successfully.

Can we untangle the dietary-intake component of the energy-balance mismatch associated with obesity?

Obesity results from positive energy imbalance, but it is unclear to what extent this derives from excess energy consumption or from inadequate energy expenditure (acknowledging that these are relative and dynamic concepts). If we can be clearer about the extent to which diet is implicated in obesity, the task of pursuing explanations relating to food access may become easier.

The cutting edge in this field

The cutting edge in this field presently are studies where both retail factors (e.g. access, availability and price) and diet are measured as applicable to individuals, preferably longitudinally, so that the direction of causation can be inferred, and preferably with an experimental component, so that change in diet can be observed, contingent on change in retail access. Only one such experimental study has been conducted to date (94) and further studies are warranted in a range of contexts before firm conclusions can be drawn. More research is also needed to clarify the role and importance of prepared food purchased and eaten outside the home in fast-food and other restaurants.

Future research and future understanding

Figure 1 illustrates the relationships that have emerged from the research evidence to date. Space does not permit a full discussion of all aspects of this model. For example, there is a significant body of qualitative and sociological research that highlights the difficulties experienced by the poor in acquiring a healthy diet (74,79,80,81,86,87,105–107), and there is further quantitative research on access to facilities for the storage, preparation and serving of food in homes (78). There is also further intervention research focusing on 'point of purchase' interventions using educational methods and price incentives that may be relevant to the prevention of obesity (108–110). A more thorough and systematic review of all the relevant research so as to enable the further development of such an evidence-based model would be of value. Continuing to develop clearer understanding of causal mechanisms will remain important, but should proceed in parallel with research to develop and evaluate effective interventions where causal pathways are already established.

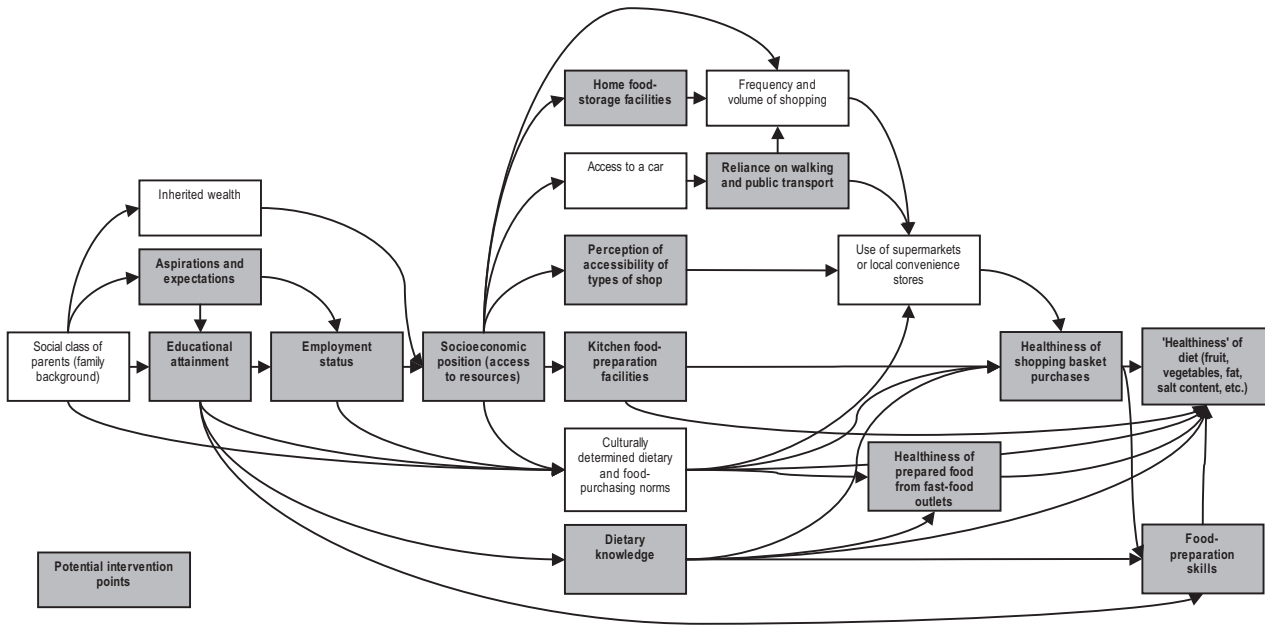


Figure 1 Hypothesized causal model for relationship between socioeconomic factors and dietary intake, mediated by food retailing.

Potential intervention points are highlighted in bold in Fig. 1. Some of these have been the subject of evaluative research (e.g. educational interventions to increase dietary knowledge and improve dietary skills), but a range of other areas remains unexplored. Dietary knowledge, skills and preferences remain important cultural determinants of the healthiness of diet and should not be ignored. A review of the extensive literature on food security and food budget standards was beyond the scope of the present review. However, given the research evidence demonstrating the strong socioeconomic patterning of diet and the evidence regarding the effects of cost constraints on dietary choices (irrespective of access), research exploring the potential for economic interventions, such as providing welfare rights advice to low-income families, may yield potential benefits. Further research on increasing access to material and other resources could also be of benefit. The scope for involvement of food retailers in developing interventions involving price incentives may be more limited, but is also worth exploring.

Others have developed models focusing on the supply/demand equation of food retail access (52). Such an approach takes a different view from that presented here, but does serve to draw attention to other potential avenues for intervention for obesity prevention, such as legislation on food formulation and supplementation (111), fiscal policy (e.g. 'fat tax') (112), regulation of advertising (113) and education of food retailers, caterers and other food handlers (109,110).

Conflict of Interest Statement

No conflict of interest was declared.

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