



Determinants of takeaway and fast food consumption: a narrative review

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Abstract

Out-of-home foods (takeaway, take-out and fast foods) have become increasingly popular in recent decades and are thought to be a key driver in increasing levels of overweight and obesity due to their unfavourable nutritional content. Individual food choices and eating behaviours are influenced by many interrelated factors which affect the results of nutrition-related public health interventions. While the majority of research based on out-of-home foods comes from Australia, the UK and USA, the same issues (poor dietary habits and increased prevalence of non-communicable disease) are of equal concern for urban centres in developing economies undergoing 'nutrition transition' at a global scale. The present narrative review documents key facets, which may influence out-of-home food consumption, drawn from biological, societal, environmental, demographic and psychological spheres. Literature searches were performed and references from relevant papers were used to find supplementary studies. Findings suggest that the strongest determinants of out-of-home food availability are density of food outlets and deprivation within the built environment; however, the association between socio-economic status and out-of-home food consumption has been challenged. In addition, the biological and psychological drives combined with a culture where overweight and obesity are becoming the norm makes it 'fashionable' to consume out-of-home food. Other factors, including age group, ethnicity and gender demonstrate contrasting effects and a lack of consensus. It is concluded that further consideration of the determinants of out-of-home food consumption within specific populations is crucial to inform the development of targeted interventions to reduce the impact of out-of-home foods on public health.

Key words: Obesity: Dietary intake: Factors influencing consumption: Out-of-home foods

Introduction

Takeaway, take-out and fast foods are common terminology used for various 'out-of-home' foods. 'Takeaway foods', commonly used in the UK and Australia, are defined as hot meals made to order and take away from small, independent outlets^(1,2) whereas in the USA 'take-out' shares a similar definition. 'Fast food' mainly defines foods from national/multinational fast food chains (such as McDonald's, Domino's Pizza, Subway, Burger King, Pizza Hut, Kentucky Fried Chicken and Taco Bell)^(3–5) and can include dining in. However, 'out-of-home' foods do include multiple definitions and can come from a number of sources including vending machines, convenience stores, fast food outlets, takeaway food outlets, coffee shops, schools, etc.⁽⁶⁾ For the purpose of the present review, the terminology from the original articles reviewed has been maintained to represent the subtle differences between studies. Therefore, the terminology used by the authors has also been used interchangeably dependent on the literature in review. In instances of critique and where multiple studies are being discussed, 'out-of-home foods' has been used as this term broadly covers takeaway and fast food. Out-of-home foods have become increasingly popular over the past few decades and are thought to be one of the key proponents driving increasing levels of overweight and obese individuals⁽⁷⁾. The causes of obesity are complex⁽⁸⁾ but the overconsumption of food and sugar-sweetened beverages, along with increased portion sizes, are also undoubtedly strong determinants⁽⁹⁾. A recent UK study found that 27% of adults and 19% of children consumed meals outside the home

once per week or more and 21% of adults and children ate takeaway meals at home once per week or more⁽¹⁰⁾. Similar consumption patterns are common in other high-income and urban societies; particularly those in Europe, the USA and Australia^(11,12). Kant *et al.*⁽¹³⁾ found that more than 50% of US adults reported consuming three or more out-of-home meals per week and more than 35% reported consuming two or more fast food meals per week. While the majority of the research based on out-of-home foods has been undertaken in Australia, the UK and the USA, the same issues (poor dietary habits and increased prevalence of non-communicable disease) are of equal concern for urban centres in developing economies undergoing 'nutrition transition' in other parts of the world, such as Asia, Africa, the Middle East and Latin America⁽¹⁴⁾. Out-of-home foods tend to be less healthy, because they are more energy dense and nutrient poor, than foods prepared at home^(7,15). They often contain high quantities of unhealthy ingredients, including fat, salt and sugar, which are associated with weight gain and a variety of negative health outcomes^(2,16,17). Frequent consumption of fast food and takeaway food has been associated with higher BMI and biomarkers of greater cardiometabolic risk^(13,16,18). While there is a consensus that being overweight (BMI 25–29.9 kg/m²) and obese (BMI ≥ 30 kg/m²)^(19,20) is associated with high consumption of energy-dense and nutrient-poor foods, the factors influencing their consumption are not well understood. Furthermore, there is no single causative factor to becoming overweight or obese although unhealthy dietary patterns are considered a key factor⁽⁸⁾ that warrant intense investigation.

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Recommendations and interventions have been implemented across the globe to challenge the rise in diet-related non-communicable diseases. In the UK, local government initiatives have aimed to tackle the impacts of takeaway food in local communities by working with the takeaway food industry to reformulate foods; reducing the amount of fast food consumed by school children; and addressing the proliferation of hot food takeaway outlets through planning regulations^(21,22). In Australia, the methods used to impede out-of-home food consumption have included a ban of fast food advertisements between 06:00 and 21:00 hours, a ban on takeaway outlets opening within 400 m of schools or leisure centres and taxes on high-fat fast foods and sugar-sweetened beverages⁽²³⁾. Alternative interventions have been implemented in the USA; menu labelling of energy became law in 2010 as part of the Affordable Care Act⁽²⁴⁾. In New York, consumer awareness of the energy information was assessed pre- and post-intervention and indicated that menu labelling on fast food generated a 2-fold increase in the percentage of customers making energy-informed choices⁽²⁵⁾. Nonetheless, the US Food and Drug Administration extended the compliance date to 5 May 2017, due to non-compliance in some states. In order to create effective public health interventions in relation to out-of-home food and obesity, it is necessary to explore the determinants of their consumption. Individual food choices and eating behaviours are influenced by many interrelated factors including cultural, environmental, demographic, biological, cognitive and behavioural^(26,27). Therefore, the overall aim of the present narrative review is to collate the existing research and provide a holistic overview of the key areas that make an impact on out-of-home food consumption, with a view to suggest future directions and recommendations.

Methods

Literature searches were performed using the following electronic databases: PubMed, Web of Science, Science Direct, Google and Google Scholar up to February 2017. The findings of the literature, retrieved from searches of computerised databases, were then disseminated into a coherent narrative review. The following key words were used: 'fast food', 'takeaway food', 'take-away food', 'takeout', 'Western diet', 'obesity', 'food outlets', 'factors of consumption', 'determinants of consumption', 'foodscape', 'food environment', 'out-of-home food', 'consumers', 'socio-demographic correlates', 'socio-economic differences', 'food availability', 'food choice', 'food behaviour', 'unhealthy eating' and 'nutrition transition'. Additionally, key words were supplemented via a 'snowball method' in which references from relevant articles were reviewed and selected to find other studies. Articles were limited to human participants only and papers in the English language only were included. Despite slight variations between some of the definitions of fast food and takeaway food, the nutritional composition of both types of food is predominately unfavourable; therefore, literature on both definitions was included. The terminology used in this review fluctuates to represent the original studies. Therefore, the terminology used by the authors is dependent on the literature in review; in instances where both 'takeaway' and 'fast foods' are discussed, the term

'out-of-home foods' has been used. The different thematic factors associated with out-of-home food consumption were identified according to the Foresight obesity system map (Fig. 1)⁽²⁸⁾. Themes were adjusted to be more applicable to out-of-home food and significant factors including demographic and socio-economic differences were added. Recommendations for future research in this area are also presented.

Out-of-home food consumption

Numerous studies have shown increasing trends in frequency of out-of-home food consumption, predominately in Europe, USA and Australia^(11,12). Yet, emerging research from low- and middle-income countries including Brazil⁽²⁹⁾, Chile⁽³⁰⁾, India⁽³¹⁾, Iran⁽³²⁾, Malaysia⁽³³⁾, Kenya and Tanzania⁽³⁴⁾, among others, have presented similar findings; suggesting a transition to a 'Western diet'. The Western-type diet pattern comprises overconsumption of sweets, desserts, soft drinks, red meat, processed meats and high-fat dairy products, with a lower consumption of fish (*n*-3 fatty acids), whole grains, fruit and vegetables⁽³⁵⁾. Western-type diet patterns have become deeply embedded within many societies and despite pressing health-related issues continue to grow^(36,37). In the UK, a government report based on cross-sectional data indicated that 22% of residents purchased takeaway food at least once per week and 58% a few times per month⁽³⁸⁾. When analysed longitudinally, time devoted to eating and drinking away from home increased significantly in the UK between 1975 and 2000⁽³⁹⁾, which concurs with the increased prevalence of out-of-home eating establishments seen in parts of the UK between 1980 and 2000⁽⁴⁰⁾. Similarly, a US study showed fast food consumption in children increased 300% between the period of 1977 to 1996⁽⁴¹⁾. Times of relative scarcity (lack of readily available foods) have receded into an era of availability (abundance of readily available high-energy-dense foods) and although most Western societies have managed to successfully reduce the burden of infectious disease, the current environment promotes a whole spectrum of dietary induced diseases⁽⁴²⁾. That said, low- and middle-income countries with existing undernutrition and infectious diseases, that are undergoing development, urbanisation and nutrition transition, are now also experiencing a double burden of non-communicable diseases^(43–45), therefore, highlighting the urgency of research on out-of-home foods.

Diet is a modifiable determinant of health; however, societies portraying a 'Westernised' lifestyle are consuming diets high in out-of-home foods and experiencing a prevalence of obesity^(16,46). The challenges in considering the effects of fast foods are not solely related to the nutritional composition, but are also dependent on expanding portion sizes⁽⁴⁷⁾. Poor diet and obesity in turn predispose humans to CVD^(18,48,49), type 2 diabetes^(50,51) and various cancers⁽⁴⁶⁾. Interestingly, obesity rates can vary substantially between nations: England had a prevalence of 24.8% in 2011; however, neighbouring European countries demonstrated much lower rates such as France (12.9%; 2010), Belgium (13.8%; 2008) and the Netherlands (11.4%; 2010)⁽⁵²⁾; suggesting that cultural differences could be a contributing factor. Urban and rural communities in developing

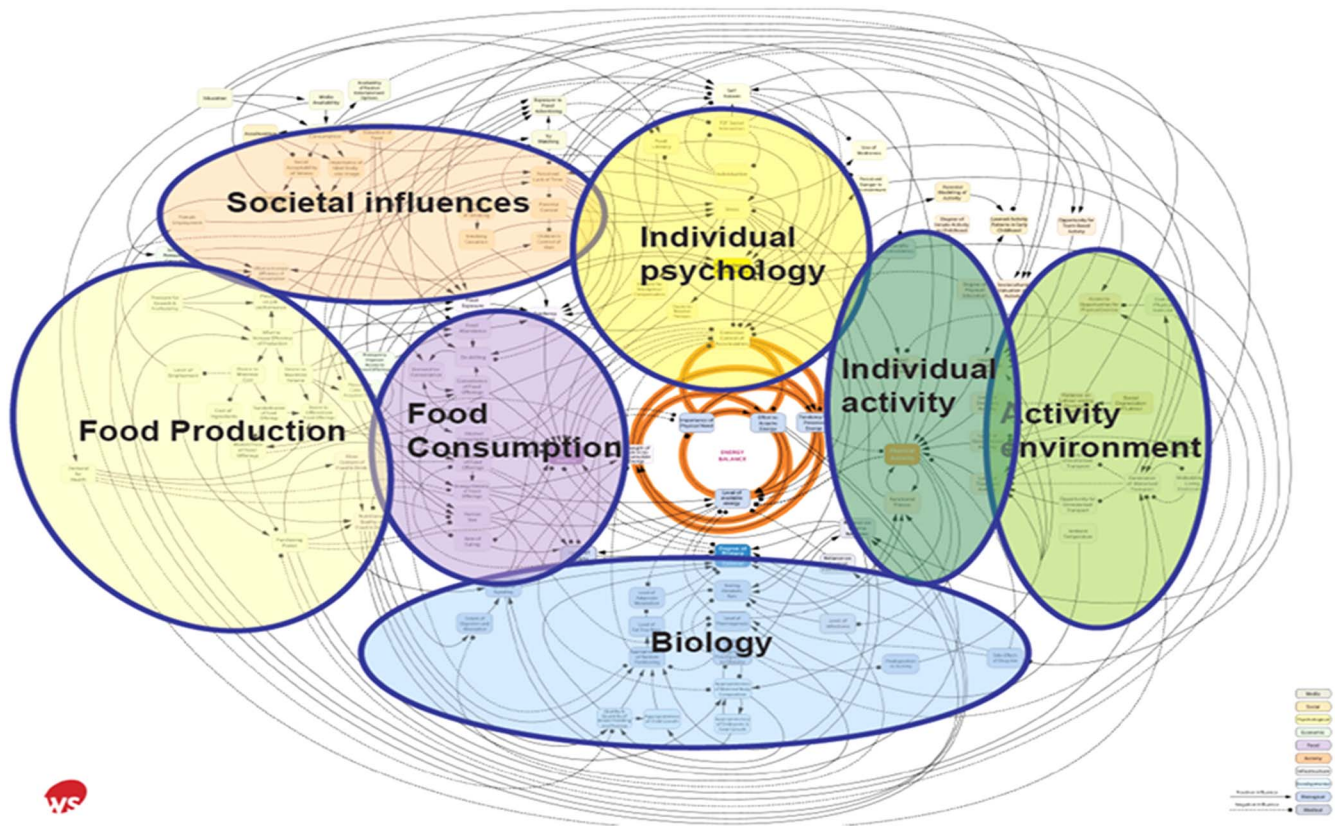


Fig. 1. Foresight obesity system map with thematic clusters⁽⁸⁾.

economies have also shown contrasting dietary patterns and consequent obesity⁽⁵³⁾.

Societal influences

Food messages are delivered to a wide demographic through multiple techniques and channels including advertisements and television⁽⁵⁴⁾. The trend emerging in the dietary patterns of the world has particularly encouraged an obesogenic culture of eating among adolescents⁽⁵⁵⁾. Fast food has been seen as a key aspect of youth identity, a way of expressing a youthful self and lifestyle image, whereas healthy food has been shown to conflict with the normal image of being young⁽⁵⁶⁾. Food identity refers to individuals choosing or feeling pressured to eat in a manner that is influenced by others; to project a social or political statement within certain groups. According to Stok *et al.*⁽⁵⁷⁾, subjective peer norms play an important role in adolescent eating behaviour, above and beyond sociodemographic variables (Table 1). A recent review on dietary behaviour in youth found consistent evidence that suggested that individual unhealthy food consumption was associated with peer unhealthy food consumption⁽⁵⁸⁾. Nonetheless, it must be noted that out-of-home food consumption can be affected by individual experiences, behaviours and attitude (which are discussed in later sections). Contrary to this, healthier eating practices are becoming increasingly popular among younger age groups due to appearance pressures⁽⁵⁹⁾.

Other individuals chose fast food restaurants as a way to spend time with friends, family or someone special⁽⁶⁰⁾.

Studies have suggested culturally agreed norms where individuals consume more when in a group or with friends, rather than alone^(61,62). A recent study by Higgs & Thomas⁽⁶²⁾ also explored the social influences of eating including the phenomenon of 'modelling' food consumption, when the norm is set by another individual with or without their presence. Environmental cues such as empty food wrappers and contextual information such as providing information about what others have eaten can all trigger increased consumption⁽⁶²⁾. Finally, individuals can be pressured by others to make certain food choices. In New Zealand, Maubach *et al.*⁽⁶³⁾ researched the considerations of parents when shopping for their families, and found that price, marketing and children altered food choice (Table 1). Thus parents may experience family pressure to purchase out-of-home foods, despite having other views based on nutritional knowledge⁽⁶³⁾. Findings from the discussed studies suggest that social influences on food consumption could play an important role in the development and maintenance of obesity.

Individual activity

Over the past few decades the development of convenient out-of-home food has competed successfully against home-prepared food in Western societies^(11,64). Economic development and rapid urbanisation in non-Western areas of the world, such as China, have also driven a change in consumption patterns and eating and cooking behaviours⁽⁶⁵⁾. A large-scale study by Smith *et al.*⁽⁶⁶⁾



Table 1. Summary of studies investigating the effects of societal influences and/or individual activities on out-of-home food consumption

Authors, type of study	Country	Study aim	Participants and setting	Methods	Results	Limitations
Welch <i>et al.</i> (2009) ⁽⁷⁷⁾ , cross-sectional	Australia	Examine the perception of time pressure as a barrier to healthy eating and physical activity	1580 women (aged 18–70 years) from 45 neighbourhoods within approximately 25 km of Melbourne's central business district	Self-reported frequency of dietary intake including questions on fast food intake, international Physical Activity Questionnaire	41 % of the women sampled reported time pressure (due to long hours in work or study) as a barrier to healthy eating. The same individuals were more likely to consume fast food more often	Cross-sectional design precludes the ability to infer causal relationships, results may not be applicable to men or other populations, objective measures such as length of work were not included
Botonaki <i>et al.</i> (2010) ⁽⁷⁹⁾ , cross-sectional	Greece	Examine the way personal values are associated with convenience food consumption	729 adults (aged 18+ years) responsible for food purchasing and preparation, and not working in market research or advertising	Questionnaire survey and Schwartz theory of values; power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity and security	Individuals with the orientation to consume convenience foods were associated with motivations to seek new experiences, act independently and enhance their own personal interests	Cross-sectional design precludes the ability to infer causal relationships, small study area (Thessaloniki in Greece); therefore results may not be generalised, food choice is often habitual and impulsive and not correlated with values
Maubach <i>et al.</i> (2009) ⁽⁶³⁾ , cross-sectional	New Zealand	Elicit factors influencing food purchases by parents and explore their understanding of nutrition labels	15 parents (four men, 11 women) who had children aged 5–12 years in their care in April/May 2007	Face-to-face semi-structured interviews about a typical shopping expedition with thematic analysis	Pleasing their children, completing shopping quickly, selecting familiar brands and maintaining routine all impacted use of nutrition labels	Parents recruited from one geographic area in New Zealand and may not be generalised to other populations, participants in the study were literate whereas about half of New Zealand adults have low literacy levels
Stok <i>et al.</i> (2014) ⁽⁶⁷⁾ , cross-sectional	Poland, Portugal, UK and the Netherlands	Investigate associations of subjective peer norms with adolescents' healthy and unhealthy food intake	2764 European (pre-) adolescents (aged 10–17 years) from 24 schools in four countries	Five-point Likert scale for subjective norms and healthy eating intentions, food intake measured as servings per d, theory of planned behaviour	Subjective peer norms were associated with adolescents' healthy eating intentions and self-reported intake of healthy and unhealthy food	Cross-sectional design precludes the ability to infer causal relationships, self-reported food intake may not be reliable, findings may not be generalised to all adolescents
Lowry <i>et al.</i> (2015) ⁽⁷¹⁾ , cross-sectional	USA	Describe the association of sedentary behaviour and physical activity with dietary behaviours of US high school students	11429 students (aged 14–17 years) from private and public high schools in 50 US states plus District of Columbia	Data from the 2010 National Youth Physical Activity and Nutrition Study	Physical activity behaviours and dietary behaviours are strongly related and do not vary by sex, race/ethnicity, grade, body-weight status, or weight management goals of students	Cross-sectional design precludes the ability to infer causal relationships, youth from US high schools may not be representative of other individuals in this age group, self-reported data may incur under-/over-reporting



showed a shift in dietary patterns and food preparation since 1965 due to a significant decline in time spent cooking in the home and growing trends in out-of-home food consumption. It is now thought that US adults consume two-thirds of their daily intake from home sources and the remaining third from out-of-home sources, including fast food and restaurants⁽⁶⁶⁾. A UK study aiming to document the prevalence of time spent cooking in 2005 showed that 60% of women and 33% of men reported spending 30 min of continuous cooking daily⁽⁶⁷⁾. Less time spent cooking could be an indicator of increased consumption of convenience foods⁽⁶⁸⁾. The findings also suggested that being female was the main determinant of time spent cooking, with little influence from older age, greater education, unemployment, lower social class and living with others⁽⁶⁷⁾. Nevertheless, the level of attrition within the study was substantial and could introduce bias. Furthermore, data collected in 2005 may not represent accurately more recent trends.

The shift in out-of-home food choice coupled with an increase in sedentary behaviour has contributed to an obesity epidemic in the 21st century^(7,69,70). Lowry *et al.*⁽⁷¹⁾ reported a positive association between television/computer screen time and consumption of fast food and sugar-sweetened beverages in a sample of students (Table 1). The findings suggested a pattern of unhealthy behaviours, which support previous research stating that television viewing and fast food consumption were positively associated with BMI⁽⁷²⁾. The use of out-of-home foods may also be attributable to individuals working more and experiencing feelings of time scarcity^(73,74); this has been especially evident among women (Table 1)⁽⁷⁵⁻⁷⁷⁾. Urbanisation, economic growth and educational achievement in low- and middle- income countries have all been shown to influence the consumption of energy-dense nutrient-poor foods⁽⁷⁸⁾. One study presented findings that individuals seeking professional success wanted to avoid spending time and effort clearing up after meals, to create time for other activities (Table 1)⁽⁷⁹⁾. As a result, it would appear that the time constraints of working long hours coupled with the advances of new technology may contribute to an increase in people's consumption of out-of-home energy-dense foods⁽⁷⁰⁾.

Food environment

The food environment (or 'foodscape') has been extensively studied over the last 20 years, with a major increase in out-of-home food establishments that is concordant with the proliferation of obesity⁽⁸⁰⁾. A review by Albuquerque *et al.*^(81,82) acknowledged the importance of genetic factors in the aetiology of obesity and inferred that natural selection has assisted the spread of genes that increase the risk for an obese phenotype. However, cumulatively all genomic markers along with their presumptive genes have only been shown to have small effects on BMI (less than 5% of the total heritability)⁽⁸³⁾ and risk of obesity⁽⁸⁴⁾, further suggesting that obesity is more likely to be contextual (environmental influences that cause its inhabitants to become obese). Environments that encourage the consumption of food and/or discourage physical activity have been labelled 'obesogenic' (Table 2)⁽⁸⁵⁾. In Norfolk, UK, the number of takeaway outlets was reported to have grown by 45%

between 1990 and 2008, a trend which has been reflected across the rest of the UK⁽⁸⁶⁾. This abundance of unhealthy and energy-dense food in the environment, noted by Feng *et al.*⁽⁸⁷⁾, has been shown to disrupt an individual's ability to make healthy food choices⁽⁸⁶⁾. A number of US studies have demonstrated that neighbourhood exposure to fast food outlets increased consumption near the home in addition to contributing to a poor diet (Table 2)^(88,89). A prospective study across a 1-year period found that neighbourhoods with a high density of fast food outlets promoted an increase in weight and waist circumference in those who visited frequently⁽⁹⁰⁾. Nevertheless, the link between neighbourhood availability of out-of-home food and a higher BMI and greater odds of obesity^(40,80,91) has been challenged. For example, Turrell & Giskes⁽⁹²⁾ reported no relationship between the purchasing of takeaway food, road distance to the closest takeaway outlets and the number of takeaway outlets in the local food environment of Brisbane, Australia. They found that dietary inequalities between socio-economic groups appeared to have a stronger influence on the purchasing of takeaway food⁽⁹²⁾. This suggests that the food environment may be more complex, with economic and sociocultural factors potentially influencing food consumption and food-related behaviours⁽⁹³⁾. Whilst many of these studies may not capture the full complexity of the food environment it must be noted that an additional layer of research involving individual interactions or response to that environment⁽⁹⁴⁾ also requires further investigation.

The many studies referring to 'obesogenic environments' make simple correlations between environment and obesity and do not explore the sociological and behavioural determinants of food consumption. For example, a large study by Pieroni & Salmasi⁽⁷⁰⁾ stated that there was a clear correlation, but no causal relationship, with the higher availability of fast food outlets and increased BMI (Table 2). In a more recent study, Polsky *et al.*⁽⁹⁵⁾ reported an increase in obesity figures among adults living in close proximity to a number of fast food outlets, suggesting that a food environment with a high occupancy of fast food outlets is most likely to make an impact on weight status (Table 2). Overall, the literature suggests that the food environment is an important factor to consider when contemplating the reasons for out-of-home food consumption and is a potential target for change. However, other factors including age group, socio-economic status and culture are considered important influences and it is often impossible to differentiate the cause and effect, especially within a cross-sectional design study. Likewise, the food environment is regarded as merely one factor in the causes of obesity, which are complex and multifaceted⁽⁸⁾.

Socio-economic differences

An unequal distribution of health – geographically, ethnically and socially – has detrimental effects on those of low socio-economic status⁽⁹⁶⁾. In the USA, research has shown that the rates of obesity and poor health were most prevalent in the least educated and poverty-stricken population groups^(97,98). Studies in the UK investigating neighbourhood deprivation and access to fast food outlets have found an association with

**Table 2.** Summary of studies investigating the effects of the food environment and/or socio-economic differences on out-of-home food intake

Authors, type of study	Country	Study aim	Participants and setting	Methods	Results	Limitations
Miura <i>et al.</i> (2012) ⁽¹⁾ , cross-sectional	Australia	Examine the socio-economic differences in types and frequency of takeaway food consumption	903 adults (aged 25–64 years) from Brisbane, Australia found on the electoral roll	Overall consumption and 22 specific takeaway foods measured using a FFQ, takeaway foods grouped as healthy and less healthy and compared with SES; education, household income	The least educated participants were more likely to consume takeaway food >4 times/month and made unhealthier food choices compared with their highly educated counterparts, household income was not associated with overall takeaway consumption	Possible nutrient variation between healthy or unhealthy takeaway foods when grouped, 22 takeaway items not representative of all takeaway foods, FFQ prone to bias, Brisbane participants not representative of other populations
Reidpath <i>et al.</i> (2002) ⁽⁶⁵⁾ , cross-sectional	Australia	Examine the association between an area measure of SES and the density of fast food outlets	Populations from 267 postal districts obtained from the Australian Bureau of Statistics' 1996 Census data	Location of outlets identified by telephone directory, density of fast food outlets within an income category was combined population of all postal districts in an income category divided by total number of fast food franchises within those districts	Those living in the poorest areas were 2.5 times more exposed to fast food outlets than those in wealthier areas and those living in the very richest areas had no exposure to fast food outlets within their postal districts	Cross-sectional design precludes the ability to infer causal relationships, the greater density of fast food outlets in lower SES areas cannot be a definite cause of the observed obesity, the existence of possible confounders, no individual data
Polsky <i>et al.</i> (2016) ⁽⁹⁵⁾ , cross-sectional	Canada	Absolute and relative densities of fast food v. other restaurants in relation to weight status	10199 adults (aged 18+ years) residing in urban, residential areas of four cities in southern Ontario, Canada, from Canadian Community Health Survey	Data on restaurant locations were from a commercial database, fast food restaurant defined as locally owned or chain limited-service restaurant, restaurant density calculated using GIS	Where fast food was the predominant type of restaurant, obesity figures for those living close to ≥ 5 fast food outlets was 2.5 times greater than the average	Cross-sectional design precludes the ability to infer causal relationships between restaurant exposure and weight, individuals with high BMI and who like fast food may self-select into neighbourhoods that have high exposure to fast food
Schneider & Gruber (2012) ⁽¹⁰⁴⁾ , cross-sectional	Germany	Neighbourhood deprivation and outlet density for tobacco, alcohol and fast food	92000 inhabitants from 18 social areas in four districts in Cologne, Germany	Total number of fast food outlets recorded and visualised using GIS, area affluence measured by the percentage of parents with children of nursery or school age with joint annual taxable income <12272 euros	The lower the income district the significantly higher availability of health-damaging sources including fast food ($P=0.009$), tobacco ($P=0.012$) and alcohol ($P=0.049$); this correlation was strongest for fast food	Cross-sectional design precludes the ability to infer causal relationships, individuals may self-select to live in areas where they have access to their preferred products, absence of data on intake or frequency of fast food consumption
Pearce <i>et al.</i> (2007) ⁽¹⁰²⁾ , cross-sectional	New Zealand	Neighbourhood deprivation and access to fast food retailing	38350 Meshblocks across New Zealand, each representing approximately 100 individuals	Data were geocoded and GIS used to calculate travel distances from each census meshblock (i.e. neighbourhood), and each school, to the closest fast food outlet	Access to fast food outlets in New Zealand was significantly higher ($P<0.001$) in more deprived neighbourhoods, distance was at least two times further for the least deprived compared with the most deprived areas	Cross-sectional design precludes the ability to infer causal relationships, lack of data on individual dietary intake or anthropometrics
Barton <i>et al.</i> (2015) ⁽¹¹¹⁾ , longitudinal	UK	Explore the association between diet and SES and investigate trends in SES inequalities in the Scottish diet	11374 individuals from 5020 Scottish households (over the period 2001–2009)	UK food purchase data to estimate household-level consumption data, detailed 14 d diary of all foods and beverages purchased for consumption both in and out of the home	Consumption of takeaway foods was significantly higher ($P=0.008$) in the most deprived quintile (24.2 g/individual per d in the most compared with 18.3 g/individual per d in the least) of the Scottish Index of Multiple Deprivation	Lower mean consumption for 'healthier foods' (for example, wholemeal bread and oily fish) in more deprived quintiles was due to large numbers of non-consumers than was found in less deprived quintiles
Pieroni & Salmasi (2014) ⁽⁷⁰⁾ , cross-sectional	UK	Examine the role of fast food consumption on body weight	13230 individuals each year (2004 and 2006) from UK involved in the British Household Panel Survey	Quantile regression approach to estimate correlations of body weight with several socio-economic determinants	Individuals with higher BMI, especially women, were more likely to live in areas with increased fast food exposure, relative prices of takeaway meals were correlated with obese/overweight adults	Cross-sectional design precludes the ability to infer causal relationships, a number of confounding variables were present

Table 2 *Continued*

Authors, type of study	Country	Study aim	Participants and setting	Methods	Results	Limitations
Athens <i>et al.</i> (2016) ⁽⁸⁹⁾ , cross-sectional	USA	Test the independent relationship of access to fast food outlets and full-service supermarkets on frequency of fast food consumption	3335 adults in Philadelphia and Baltimore in 2009 and 2010	Random-digit-dial telephone survey to compare respondent results, weekly fast food dining frequency recorded, residential intersections were geocoded and location of fast food outlets was calculated	Supermarket access was associated with declined fast food outlet use in telephone survey participants. >1 fast food outlet within a 1-mile (1.6 km) buffer was an independent predictor of increased fast food consumption among point-of-purchase participants	Cross-sectional design precludes the ability to infer causal relationships, level of attrition and location misclassification during geocoding may have caused bias in the data
Moore <i>et al.</i> (2009) ⁽⁸⁸⁾ , cross-sectional	USA	Examine links between fast food consumption and diet, neighbourhood exposure to fast foods and consumption near home	5633 men and women (aged 45–84 years) from six study sites across the USA	Self-administered 120-item FFQ, diet quality measured against Alternate Healthy Eating Index and the Western-type dietary pattern, fast food neighbourhood density using GIS	Non-fast food consumers were 2–3 times more likely to have a healthy diet than those eating fast food > 1 times/week, greater fast food exposure; consumption of fast food near home increased 11–61% and healthy diet decreased 3–17%	Self-reported data susceptible to recall bias, FFQ may not capture diet variability, causation cannot be inferred from these results, no data on types and quality of foods eaten at fast food outlets

SES, socio-economic status, GIS, geographic information system.

increased levels of obesity^(86,99,100). A recent report showed a strong link between deprivation and density of fast food outlets, with deprived areas having more fast food outlets per 100000 of the population⁽¹⁰¹⁾. These findings corroborate those in Australia⁽⁸⁵⁾, New Zealand^(102,103), Germany⁽¹⁰⁴⁾, Canada⁽¹⁰⁵⁾ and the USA⁽¹⁰⁶⁾, where it has been observed that those living in the poorest areas had a higher exposure to fast food outlets than those in less deprived areas (Table 2). In contrast, high socio-economic status and urban residence were associated with the consumption of energy-dense foods in adolescents in China⁽¹⁰⁷⁾, suggesting accelerated nutrition transition within communities experiencing economic growth. However, in West Africa⁽¹⁰⁸⁾, Bangladesh⁽¹⁰⁹⁾ and Indonesia⁽¹¹⁰⁾, income inequality and economic development have been shown to increase the odds of a double burden of malnutrition; the coexistence of both under- and overweight. In Scotland, UK, consumption of takeaway food was significantly higher in the most deprived quintile⁽¹¹¹⁾. Research from Australia investigating the frequency and types of takeaway foods consumed by disadvantaged groups were consistently consuming less healthy takeaways than those from advantaged groups (Table 2)^(1,112). Lake *et al.*⁽¹¹³⁾ explored perceptions and practice of healthy eating and reported that individuals from a higher socio-economic group were more likely to agree with the statement 'my eating patterns are healthy'. Despite some conflicting findings between the effects of socio-economic status on the food environment and out-of-home consumption, the greater part of the literature suggests that those from lower socio-economic groups would be more susceptible to inequalities in diet and as a result obesity and chronic disease.

Other studies on the socio-economic disparities in the food environment have concentrated on the notion of food security; defined by the 1996 World Food Summit as 'a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'⁽¹¹⁴⁾. Food insecurity, on the other hand, refers to the limited access to affordable, quality and nutritious food, but also with restrictions on the facilities to store, cook and consume those foods⁽¹¹⁵⁾. A mail survey on adults from disadvantaged suburbs of Brisbane city, Australia, reported that approximately one in four households were food insecure based on results from an eighteen-item food security screening questionnaire⁽¹¹⁶⁾. The economic and physical access constraints to nutritious food in deprived areas have contributed to what are sometimes defined as 'food deserts'^(117,118). A particularly interesting finding from the Brisbane study was that food-insecure households were two and a half times more likely to report more frequent hamburger consumption compared with those who were not food insecure⁽¹¹⁶⁾. These findings support the notion that food insecurity may encourage the purchasing of out-of-home food, especially in deprived areas⁽¹¹⁹⁾. Thus, targeting areas of high deprivation and ensuring food security may be a strategy for facilitating healthy eating⁽⁶⁴⁾.

Less healthy takeaway food choice has been shown to be associated with a poorer level of education^(1,112). However, research suggests that poor health literacy is a stronger

predictor of health than variables such as age, ethnicity, income, employment status and education level⁽¹²⁰⁾ and is recognised as a cause of health inequalities in both rich and poor countries⁽¹²¹⁾. Health literacy refers to an individual's knowledge and skills in matters of health and illness⁽¹²²⁾. Boulos⁽¹²³⁾ stated that most written resources containing health information were deemed too advanced for the general UK population, with an average reading age of nine. Thus, it was found that limited health literacy was related to unhealthy lifestyle behaviours such as poor diet⁽¹²⁴⁾. An emerging concept is food literacy that encompasses individual food skills, community food security and health literacy⁽¹²⁵⁾. Carbone & Zoellner⁽¹²⁶⁾ specified that literacy was a determinant of dietary patterns and that increased food literacy was positively associated with healthier eating practices. For example, a study on young adults reported that those with low levels of health literacy used food labels significantly less⁽¹²⁷⁾, suggesting that their food choices were less informed by nutrition information. Therefore, it would appear crucial to consider literacy levels when conducting any out-of-home food intervention or research. Some nutrition studies include validated health literacy assessments to understand participant knowledge of aspects, such as nutrition facts labels, and how they might interpret or act upon the information⁽¹²⁸⁾. Conversely, even if the population had increased health or food literacy, conflicting food messages from a myriad of sources means making healthy choices challenging for society.

Food production and cost

The growing success of the fast food industry is based upon food that is quick, convenient and uniform in production⁽¹²⁹⁾. Competing consumer demands and preferences could also be responsible for increased out-of-home food intake. The combined use of sugar, fat and salt is common in the food industry to enhance palatability and can also act as cheap bulking agents⁽¹³⁰⁾. Developed economies are known to be using high levels of salt, fat and sugar in takeaway food⁽²⁾ but a similar global trend has also been seen in populations from developing economies such as South East Asia⁽¹³¹⁾. Those on a lower income have argued that higher-energy-dense food is cheaper than lower-energy-dense food⁽¹³²⁾. Yet, in the USA, Davis & Carlson⁽¹³²⁾ found no statistical support that higher-energy-dense food was cheaper and stated that the relationship between price and energy density was indeed the opposite (Table 3). Similarly, a study in Sweden stated that the cost of nutritious food did not increase, between 1980 and 2012, more than the cost of food in general (Table 3)⁽¹³³⁾. However, both sets of results were not without limitations; the studies may not be universally representative, suggesting that alternative studies using the same method, during other time periods, locations and foods, could yield different findings.

The argument that healthy food costs more also relies on how to measure cost, since energy from different sources is not equal. Monsivais & Drewnowski⁽¹³⁴⁾ evidenced that energy-dense foods were least expensive and most resilient to inflation. Monsivais *et al.*⁽¹³⁵⁾ then furthered this research by using a sophisticated technique to investigate food cost based on nutrient density across a 4-year time period (Table 3). The results showed an increasing disparity between the price of nutrient-dense foods

and less nutrient-dense foods⁽¹³⁵⁾. An additional study analysing the macronutrient content of 106 foods reported that protein increased the cost of food and carbohydrate reduced the cost of food (Table 3)⁽¹³⁶⁾. Furthermore, a recent UK study found that healthy foods were approximately three times more expensive than unhealthy foods per 100 kcal (418 kJ) and that the rise in price over the 10-year period was steeper for healthy foods (Table 3)⁽¹³⁷⁾. A systematic review and meta-analysis of twenty-seven studies concluded that healthier diet patterns were on average about \$1.50/d more expensive⁽¹³⁸⁾. Findings from the above studies suggest that healthier foods and beverages have been consistently more expensive than less healthy ones. A cross-sectional study on fast food consumption and body weight in the UK stated that lower-priced fast food meals and snacks were positively associated with increased weight, especially for the overweight and obese⁽⁷⁰⁾. Moreover, exposure to increased numbers of out-of-home food outlets in economically deprived areas in conjunction with higher levels of food insecurity may exacerbate purchasing of out-of-home foods. It is important to note that the majority of the literature on cost of out-of-home food has been sourced from high-income countries, highlighting a need for similar studies in low- and middle-income nations. One systematic review on general food prices in 162 different countries suggested that those from poorer countries or the poorer households would be most adversely affected by a rise in cost⁽¹³⁹⁾; however, out-of-home foods were not debated.

Demographic

Previous research has categorised out-of-home food consumption according to gender. A study on Australian adults found that men consumed takeaway foods more frequently than women (Table 4)⁽¹⁴⁰⁾. This could be explained in part by findings showing that gender was the strongest determinant of time spent cooking at home (as mentioned previously), with women more likely to be proponents⁽⁶⁷⁾. Nevertheless, the same Australian research group reported an increased risk of cardiometabolic disease in young women who consumed takeaway foods twice per week or more⁽¹⁸⁾. A recent study suggested that older men's dietary patterns were associated with cues for fast food outlets (Table 4)⁽¹⁴¹⁾. Other studies observed that men received a higher proportion of their energy intake from foods prepared and consumed out of the home^(142,143). However, a UK study found that the only gender difference was seen in children; boys consumed more takeaway meals at home than girls (Table 4)⁽¹⁰⁾. This suggested that alternative patterns of out-of-home eating existed in the UK or had altered in recent years⁽¹⁰⁾. Other findings have suggested that women and older adults are more vulnerable to being overweight and obese, and inverse associations of nutritional biomarkers including vitamins D, E, C, B₆, B₁₂, folate and carotenoids, with increased consumption of out-of-home foods⁽¹³⁾. Therefore, despite some studies suggesting that males consume out-of-home foods more frequently, the health implications may not be as severe as those seen in females. The increased risk to females may be attributable to lower amounts of physical activity and/or a lower BMR than males. However, this is a speculation and thus requires further investigation.

Table 3. Summary of studies investigating food prices of energy-dense and/or nutritious foods

Authors, type of study	Country	Aim	Foods	Methods	Results	Limitations
Brooks <i>et al.</i> (2010) ⁽¹³⁶⁾ , cross-sectional	Australia	Study of food prices in relation to energy content	106 foods readily available in supermarkets in both the USA and Australia	Obtained nutrient content per 100 g from US Department of Agriculture's HealthTech Search tool, priced each food online at SafeWay supermarkets in the USA and Coles Supermarket	Higher food prices were associated with higher protein content (each MJ/g of protein raised cost by \$3.26) and lower carbohydrate content, whereas fat content was not significantly associated with food price	Cross-sectional design means data may not reflect those of other countries and different time periods
Håkansson (2015) ⁽¹³³⁾ , cross-sectional	Sweden	Construct a price index describing the cost of a nutritional diet for a rational and knowledgeable consumer	101 predefined food items, identified from the detailed categories of a large national dietary survey	Minimum cost of a nutritional and cultural meal was measured and compared with a diet with minimum deviation from current consumption (disregarding price)	The cost of nutritious diets did not increase more than the cost of food in general between 1980 and 2012	Data may not be generalisable to other countries, other time periods, locations and foods could yield different results
Jones <i>et al.</i> (2014) ⁽¹³⁷⁾ , longitudinal	UK	Examine the change in price of more and less healthy foods over time by using government data on national food prices and nutrient content	94 foods and beverages from the UK Consumer Price Index (based upon a basket of goods)	Changes in the price of foods were compared with food and nutrient data, from the UK Department of Health's NDNS (2002–2012), foods were categorised using a nutrient-profiling model developed by the Food Standards Agency	Healthy foods were three times more expensive than unhealthy foods/100 kcal (418 kJ), rise in price over 10 years was steeper for healthy foods, price/kcal highest for fruit and vegetables, lowest for grains, and second lowest for 'foods and drinks high in fat and/or sugar'	All energy is not equal, therefore, require more sophisticated analysis than simply looking at the relationship between price and energy density
Monsivais <i>et al.</i> (2010) ⁽¹³⁵⁾ , longitudinal	USA	Determine whether the cost of nutritious foods increased disproportionately over 4 years relative to less nutritious foods	378 food and beverage prices obtained from major supermarket chains in Seattle for 2004–2008	Nutritional quality was based on energy density (kcal/g) and two measures of nutrient density, calculated using the Naturally Nutrient Rich score and the Nutrient Rich Foods index	The mean cost for most nutrient-dense foods was \$27.20/1000 kcal (4184 kJ) with a price increase of 29.2% while the foods with the lowest nutrient density cost \$3.32/1000 kcal (4184 kJ) and endured almost half the price increase of 16.1%	Food prices in the study only reflect those from select retail outlets in the Seattle metropolitan region, thus they cannot be generalisable to other regions
Davis & Carlson (2014) ⁽¹³²⁾ , cross-sectional	USA	Develop and conduct a statistical test for the null hypothesis that the relationship between price per energy density and energy density is spurious	4430 observations of consumed foods from 4578 US adult participants (aged 19+ years and were non-institutionalised)	Data on foods from the NHANES with corresponding prices from the CNPP Food Prices Database, simple regression model used to test if the relationship between food price and energy density is 'real' or 'spurious'	Two cases where the inverse relationship was not spurious with the majority of non-spurious relationships between food price and energy density being positive, not negative, higher energy-dense foods were not cheaper	Simple framework – much more realistic and sophisticated economic models and arguments that need to be utilised and explored, results may not be universally applied

NDNS, National Diet and Nutrition Survey; NHANES, National Health and Nutrition Examination Survey; CNPP, Centre for Nutrition Policy and Promotions.



Table 4. Summary of studies investigating out-of-home food consumption and demographic influences

Authors, type of study	Country	Study aim	Participants and setting	Methods	Results	Limitations
Smith <i>et al.</i> (2009) ⁽¹⁴⁰⁾ , cross-sectional	Australia	Examine takeaway food consumption in a national study of young Australian adults	2862 (1277 men, 1585 women) aged 26–36 years involved in The Childhood Determinants of Adult Health Study	127-item FFQ to record habitual food intake and takeaway food consumption, dietary intake compared with recommendations in the Australian Guide to Healthy Eating, anthropometrics measured	More men (37.9%) consumed takeaway food frequently than women (17.7%; $P < 0.001$), men and women eating takeaway food at least twice per week had a higher prevalence of abdominal obesity	Level of attrition was high, therefore, sample bias may have occurred, underestimated and overestimated dietary intake results from FFQ
Mercille <i>et al.</i> (2016) ⁽¹⁴¹⁾ , cross-sectional	Canada	Examine associations between exposure to neighbourhood food sources/consumption and diet knowledge of older women and men	722 women and men living in Montreal and Laval islands (2003–2005)	78-item FFQ to record usual diet, PCA to derive dietary patterns, person-level data on dietary knowledge from the Longitudinal Study on NuAge cohort, GIS for location mapping	Lower healthy diet scores associated with increased exposure to fast food outlets in men ($\beta -0.18$; $P = 0.02$), the same relationship was present among women with low dietary knowledge ($\beta -0.22$; $P < 0.01$)	Cross-sectional design precludes the ability to infer causal relationships, older adults in NuAge cohort not representative of other adults in Canada, FFQ dietary assessment prone to bias
Srivastava (2015) ⁽⁶⁰⁾ , cross-sectional	India	Examine demographics of Indian consumer perception with respect to fast food chain restaurants	542 (379 males, 163 females) aged 12+ years consisting of baby boomers, X generation, and Y generation, living in Mumbai	Theory of the trust–commitment–loyalty explanation chain, ten-point semantic differential scales on quality, price, food, etc., systematic sampling, demographic profiles recorded	Women, individuals with higher income, age group 19–25 years and west Indians were more likely to visit global fast food chains than Indian chains, loyalty towards global brands due to a sense of increased quality	Small sample size, only India studied, therefore results may not be representative of other nations
Adams <i>et al.</i> (2015) ⁽¹⁰⁾ , longitudinal	UK	Who eats out-of-home food; frequency and sociodemographic correlates of eating meals out and takeaway meals at home	2083 adults and 2073 children from the UK National Diet and Nutrition Survey waves 1–4 (2008–2012)	Interview with researcher on sociodemographics and shopping, cooking and eating habits; 4 d food diary; and nurse visit, parents or care providers gave information on children aged <11 years	Eating meals out was associated with being in the 19–29 years age group, over 20% of children and adults ate takeaway meals at home once per week or more, girls were less likely to consume takeaway than boys	Data from UK may not be generalisable to other populations, no information collected on the specific type of meals out or takeaway outlets visited
Hartmann <i>et al.</i> (2013) ⁽¹⁵⁶⁾ , cross-sectional and longitudinal	Switzerland	Develop cooking skill scale and examine relationship between cooking skill and consumption of various food groups	4436 (47.2% male) participants from the Swiss Food Panel (2010 and 2011)	FFQ to estimate habitual intake of various foods, cooking skills and psychological variables evaluated on a six-point scale	71% of women and 29% of men were responsible for meal cooking during the week, females had greater cooking skills than males, in men increased cooking skills correlated with cooking enjoyment rather than a responsibility	Cooking skills somewhat subjective as definition did not distinguish cooking from raw ingredients from cooking pre-prepared foods, results from FFQ may be biased due to under-/over-reporting
Fraser <i>et al.</i> (2012) ⁽¹⁶¹⁾ , cross-sectional	UK	Analyse association between food outlet location, deprivation, weight status and ethnicity	1198 pregnant women from the BiB Study	BiB dataset included age, ethnicity, height and weight, etc., food outlet details obtained from Bradford district council and business telephone directory, physical 'groundtruthing' to validate data, locations of fast food outlets mapped using GIS	Over 95% of all participants lived within 500 m of a fast food outlet, individuals in higher deprived areas had greater access to fast food outlets and other food shops, fast food access (within 250 m of residence) was inversely associated with BMI in South Asians	Cross-sectional design precludes the ability to infer causal relationships, large amounts of missing data especially in South Asian group, small sample in non-South Asian group
Dunn <i>et al.</i> (2012) ⁽¹⁵⁹⁾ , cross-sectional	USA	Examine the effects of fast food availability on consumption and obesity among non-white and whites	1000 (169 non-whites (self-reported black and Hispanic) and 831 whites) in Texas, USA	Data from the Brazos Valley Health Community Health Assessment Survey, frequency of fast food consumption, sociodemographic information recorded, fast food outlets mapped using GIS	Non-whites were associated with increased obesity rates (49.1% v. 31.4%; $P < 0.01$), greater access to (0.5 more outlets in 1 mile ($P < 0.01$) and 3.3 more outlets in 3 miles ($P < 0.01$)) and consumption of fast food, increased availability of fast foods for whites was not associated with increased consumption or obesity risk	Cross-sectional design precludes the ability to infer causal relationships, proportion of whites to non-whites not equal, no data on dietary intake to show what participants were consuming

Table 4 *Continued*

Authors, type of study	Country	Study aim	Participants and setting	Methods	Results	Limitations
Lachat <i>et al.</i> (2009) ⁽¹⁵¹⁾ , cross-sectional	Vietnam	Determine the nutritional contribution from 'out-of-home' foods and socio-economic factors in adolescents	1172 adolescents living in urban and rural areas of Vietnam	24 h dietary recall to record food intake, anthropometrics measured, SES identified from a subsample of the population	'Out-of-home' foods contributed to 42% increased consumption of fruit and vegetables, increased consumption of sugar products ($P < 0.001$), was positively associated with having pocket money ($P < 0.001$)	Schools were not randomly selected which may limit external validity, Vietnamese adolescents may not represent adolescents from other nations

PCA, principal component analysis; NuAge, Nutrition and Successful Aging; GIS, geographic information system; BIB, Born in Bradford; SES, socio-economic status.

In the UK, the consumption of meals out-of-home and takeaway meals at home was particularly widespread among the younger age groups and was shown to peak in those aged between 19 and 29 years⁽¹⁰⁾. Previous studies reported comparable findings in other European countries^(142–145), the USA^(11,146) and New Zealand⁽¹⁴⁷⁾. Likewise in Australia, consumption of takeaway was shown to increase from adolescence to young adulthood⁽¹⁴⁰⁾ and a relatively high consumption of fast food occurred between the ages of 18 and 45 years (Table 4)^(148–150). In Vietnamese adolescents out-of-home food consumption was positively associated with residence in urban areas and amount of pocket money (Table 4)⁽¹⁵¹⁾.

Many diet-related health issues stem from adolescence, a time when young people require an increase in nutrients^(152,153) but often make unhealthy choices^(154,155). Fast food is considered important to adolescents because it is one of the limited types of food that is affordable amongst that group. Furthermore, the types of food consumed by young people are an important symbol of social and cultural belonging⁽⁵⁹⁾ and relate to food identity discussed earlier. A Swiss study that examined the importance of balanced food choices suggested that lack of cooking skills may play a part in driving younger age groups to consume more convenience foods (Table 4)⁽¹⁵⁶⁾. Statistics have shown a downward trend in consumption of both meals out and takeaway meals at home in older adults⁽¹⁰⁾. Older age groups may have less disposable income⁽¹⁵⁷⁾ and may find out-of-home foods unfamiliar, with a lack of exposure in younger years when eating habits develop⁽¹⁴⁶⁾. It must be noted that other reasons are also likely to be relevant and are yet to be discussed in this review.

In Los Angeles, USA, areas with a high population of immigrants lacking acculturation were associated with healthier dietary behaviour⁽¹⁵⁸⁾. Yet, according to Block *et al.*⁽³⁾, fast food outlets in New Orleans, USA, were geographically associated with predominately black and low-income neighbourhoods after controlling for environmental confounders (commercial activity, presence of highways, and median home values). Correspondingly, a study in Texas, USA, found that non-whites exhibited higher obesity rates, increased availability of fast food establishments in their local environment and higher consumption of fast food meals than their white counterparts⁽¹⁵⁹⁾. In the USA, one Puerto Rican immigrant described a feeling of 'Americanness' and belonging when dining out at fast food restaurants⁽⁹⁶⁾, suggesting a 'Westernised' identity through the consumption of fast food. A study on the variations in fast food consumption in India reported that Indians preferred fast food from global chains compared with Indian fast food because they said that global brands were of better quality (Table 4)⁽⁶⁰⁾. Likewise, minority ethnic groups of females living in the UK have incorporated the less healthy aspects of the Western diet including fast foods (such as fried fish, pizza, fries and fatty snack foods) into their diet when time was limited⁽¹⁶⁰⁾. However, a study in Bradford, UK, found a negative association between BMI and fast food outlet density in a South Asian group of women (Table 4)⁽¹⁶¹⁾, which would indicate a lack of acculturation. El-Sayed *et al.*⁽¹⁶²⁾ stated that there was a lack of consensus regarding the aetiology of obesity and relative risk among large ethnic minority groups when compared with Caucasians in the UK. In a review, Fraser *et al.*⁽¹⁶¹⁾ argued that

there was little research conducted outside of the USA to explain whether ethnicity was related to access to and consumption of fast food. Additionally, ethnic minorities are disproportionately represented in low-income areas, thus socio-economic status is a confounding variable. Therefore, the limitations related to current research on ethnicity as a determinant of out-of-home food consumption warrant further investigation.

Biological

Humans have biological needs and adequate nutrition is regarded as essential, enabling a number of vital mechanisms to occur, to maintain homeostasis within the human body⁽¹⁶³⁾. Genes have been shown to exert multiple and subtle influences on overall levels of nutrient intakes, meal sizes and frequencies⁽¹⁶⁴⁾. For example, internal and external cues can activate ghrelin, identified as the hunger hormone, which can affect appetite and adiposity, among other factors⁽¹⁶⁵⁾. Hunger is known to increase motivation to seek out food, but, coupled with the bountiful availability of food in today's environment, may trigger the brain reward system that evolved in environments of relative scarcity⁽¹⁶⁶⁾. A review on neuroimaging studies in obese participants provided evidence of altered control over appetite and the reward system, due to insulin resistance, reduced leptin secretion and other abnormal hormonal signals⁽¹⁶⁷⁾. The reward deficiency syndrome, which represents a dysfunction or deficiency in the dopamine D₂ receptor (a possible mediator of the rewarding property of palatable foods) has been considered a factor in the development of obesity, with many individuals demonstrating psychological dependence⁽¹⁶⁷⁾. Other psychobiological personality traits including the 'sensitivity to reward' have been shown to make an indirect impact on weight status due to the availability of dopamine and level of activation in the mesocorticolimbic (reward) pathways in the midbrain (Table 5)⁽¹⁶⁸⁾.

A cross-sectional study in the USA reported that fast food consumption and BMI were correlated with impulsivity in adults (Table 5)⁽¹⁶⁹⁾. Previous studies have found a tendency to choose lesser immediate benefits of fast food intake over the longer-term health risks associated with unhealthy eating (Table 5)^(63,149,150). Neuroimaging studies in human subjects have shown activation sites in regions of the brain during impulsive moments, indicating a potential biological mechanism⁽¹⁷⁰⁾. Indeed, functional MRI studies show that the brain's response to hunger and satiety during exposure to appetising food is somewhat driven by hedonic mechanisms⁽¹⁶³⁾. 'Hedonic' hunger is a phenomenon which describes the way sensory factors including sight, smell and palatability combined with an availability of food can heighten appetite to a level that overwhelms the inborn control mechanisms⁽⁸⁾. Fast food advertisements, outlets and menus provide environmental cues that can influence desirability⁽¹⁷¹⁾. This aggressive style of out-of-home food marketing can lead to overindulging⁽¹⁶⁸⁾. The combination of food-associated cues, impulsive decision making and hedonic hunger is suggested to inhibit control over food cravings. A sample of students from an Australian university recalled their last food craving and revealed that visual imagery was the strongest determinant for food cravings, followed by gustatory and olfactory sensory triggers (Table 5)⁽¹⁷²⁾.

Psychological

The range of determinants of out-of-home food consumption is broad and varies when viewed on an individual basis. Taste has been a fundamental determinant of highly palatable foods such as fast food (Table 5)⁽¹³⁰⁾. The findings from a study conducted on Australian adults, between the ages of 18 and 45 years, suggested that fast food consumption was influenced by a general demand for meals that were tasty, satisfying and convenient⁽¹⁵⁰⁾. However, the assumption that individuals consider unhealthy foods, such as fast food, to be tasty has been challenged. A study in France reported that healthier foods were found to be tastier and more desirable due to a sense of increased quality when compared with unhealthy foods (Table 5)⁽¹⁷³⁾. Thus, it would appear that taste is relatively subjective and may vary cross-culturally and between nations. That said, food manufacturers utilise cost-effective ingredients, such as salt, fat and sugar, to meet consumer demand and boost sales⁽¹³⁰⁾. Food addiction studies have focused on palatable foods, such as fast foods, that contain fat, salt and sugar among other ingredients, which increase their desirability⁽¹⁷¹⁾. The combination of these three ingredients are used to optimise palatability which is regularly referred to as the 'bliss point'⁽¹⁷⁴⁾. A study in Connecticut used a twenty-eight-item self-reported measure to assess food cravings, defined as 'an intense desire to consume a particular food (or food type) that is difficult to resist' (Table 5)⁽¹⁷⁵⁾. Results showed significant positive associations with having a higher BMI and craving high-fat foods (including fast food), carbohydrates/starches and sweets⁽¹⁷⁵⁾. Complementary to this research, Gearhardt *et al.*⁽¹⁷⁶⁾ reported that addictive-like eating increased craving for food in general but most of all for processed foods (Table 5). However, only overweight and obese women were included in the study and the results may not be representative of lean and normal-weight individuals. These studies highlight an association between being overweight or obese and experiencing food cravings or addictive-like eating patterns. That said, the entire concept of food addiction is not without debate. Corwin⁽¹⁷⁷⁾ argued that food addiction may not necessarily be a true phenomenon, partly because food is a necessity of life, but also due to the role of economic deprivation and food environments that are saturated with large numbers of takeaway and fast food outlets.

Study limitations

The majority of the literature on out-of-home foods was sourced from Australia, the USA and the UK, with some literature addressing the emerging phenomena of nutrition transition in low- and middle-income countries. This has restricted the comparability of the prevalence of out-of-home food consumption between countries, limiting our understanding of the implications of out-of-home food consumption in other parts of the world, outside the USA, Australia and the UK. Results are also limited to the cross-sectional design of the studies and longitudinal studies are warranted to confirm patterns of relationships found. The quality of some of the research is also challenged as a result of small sample sizes or unrepresentative populations (such as undergraduate students). Due to the wide scope of the present review, the lack of robust data and the strict inclusion and exclusion criteria of systematic

Table 5. Summary of studies investigating biological and/or psychological effects of consuming palatable foods including out-of-home foods

Authors, type of study	Country	Study aim	Participants and setting	Methods	Results	Limitations
Dunn <i>et al.</i> (2008) ⁽¹⁴⁹⁾ , cross-sectional	Australia	Examine the rationale behind decisions to either choose or avoid fast foods	66 South Australian participants (aged 18+ years) from the North West Adelaide Health Study	Theory of planned behaviour, telephone interviews to discover types and frequency of fast food consumed, in addition to associated beliefs and perceptions	Fast food consumption positively correlated with impulsivity, common reasons for fast food consumption were convenience and to socialise	Definition of fast food varies between literatures, data may not be representative of other populations, small sample size, and no data on other foods
Tiggemann & Kemps (2005) ⁽¹⁷²⁾ , cross-sectional	Australia	Investigate the role of mental imagery in the experience of food cravings	130 undergraduate students	Recall and rate a previous food craving experience with reference to the involvement of different sensory modalities	Visual imagery was a key element in food cravings, craving intensity was related to the vividness of the food image	Sample of university students in a laboratory setting, thus data may not be generalisable, no experimental control for levels of hunger which may have had an impact on previous food craving experience
Davis <i>et al.</i> (2007) ⁽¹⁶⁸⁾ , cross-sectional	Canada	Examine whether STR was related to behaviours that contribute to excess body weight	151 premenopausal women (aged 25–50 years) from large Canadian city	STR measured by two self-reported questionnaires, overeating assessed using two scales, food preference questionnaire, BMI measured by researcher	STR and overeating association was strongly positive, STR was positively related to liking sweet and fatty food	Data from premenopausal women in Canadian City, limiting generalisability to other populations
Werle <i>et al.</i> (2013) ⁽¹⁷³⁾ , cross-sectional	France	Verify the intercultural differences in food perceptions between the USA and France	94 French undergraduate students (study 1), 111 French undergraduate students (study 2)	Implicit Association Test in a laboratory, foods were rated for healthiness and tastiness on seven-point scales	Unhealthy foods were associated with bad taste, while healthy foods were linked to tastiness, thus, healthy = tasty intuition predominates in France	Small sample size and undergraduate students, data may not be representative of French population, low BMI group – research in an obese and overweight sample may yield conflicting results
Garza <i>et al.</i> (2016) ⁽¹⁶⁹⁾ , cross-sectional	USA	Determine the association between impulsivity and consumption of fast food and reasons for consumption	478 adults (aged 21–76 years) employed at a large university in south-eastern USA	Items from the NHANES Flexible Consumer Behaviour Survey for dietary behaviours, impulsivity measured using binary choice delay discounting procedure	Majority of participants reported eating fast food during the previous 7 d, fast food consumption and BMI were correlated with higher impulsivity	Cross-sectional study design does not allow for establishment of causation, all measures were self-reported, data from convenience sample of university staff, limiting generalisability to other populations
Chao <i>et al.</i> (2014) ⁽¹⁷⁵⁾ , cross-sectional	USA	Determine the relationships between BMI and frequency of food cravings for different foods and self-reported intake	646 adults (aged 18–50 years) from New Haven, Connecticut between December 2007 and May 2012	Food Craving Inventory and a semi-quantitative FFQ, demographic data collected via questionnaire, trained research assistants measured anthropometrics	Significant positive relationship between BMI and food cravings, positive associations of cravings for sweets, high fats, carbohydrates/starches and fast food fats	Cross-sectional study means no causal inference can be made, food intake was self-reported and may be subject to recall bias, cravings may have occurred without followed intake and vice versa, craving intensity not recorded
Gearhardt <i>et al.</i> (2014) ⁽¹⁷⁶⁾ , cross-sectional	USA	Examine the nomothetic impact of sugar, fat and processing on food craving and liking	105 overweight and obese women (aged 18–50 years)	Completed craving and liking ratings for 180 foods, Eating Disorders Examination Questionnaire, Yale Food Addiction Scale, self-reported hunger rating	Food craving was associated with fat, but not sugar, addictive-like eating was associated with overall food craving and craving for processed foods	No results for men or lean participants, small sample size, data solely for fat/sugar/processing and no other food components, single method to measure craving and liking whereas multi-method approach could increase accuracy

STR, sensitivity to reward; NHANES, National Health and Nutrition Examination Survey.

reviews, including study populations, study design, comparison groups and measured outcomes, it is currently impossible to compare information systematically. With further future studies this may then be possible to allow a more representative survey of the research 'landscape'.

Implications for policy and practice

There is currently much debate over the potential avenues for diet-related disease intervention and findings from the present review have highlighted some of the main factors influencing out-of-home food consumption, for instance, use of planning regulations to restrict the opening of new out-of-home food outlets in deprived areas to help individuals from lower socio-economic backgrounds. Other potential interventions include fiscal policies (incentives and taxation); however, research suggests that taxation of fast food would adversely affect the poorest of Western societies⁽¹⁷⁸⁾. This is evident as food insecurity is particularly widespread among deprived communities, with healthier food substitutes not always being readily available⁽¹⁷⁹⁾. Despite these concerns, the lack of relevant literature on taxation in different populations indicates that the impact is relatively unknown⁽¹³⁹⁾. An alternative action would be to target those producing and selling out-of-home foods, with help and guidance for food product reformulation and labelling or 'sign-posting' of healthier food options⁽¹⁸⁰⁾. On a positive note, the WHO Global Action Plan for the Prevention and Control of Non-Communicable Diseases 2013–2020⁽¹⁸¹⁾ has aimed to reduce the impact of unhealthy diets through multisector action. The array of actions include reducing advertisement of unhealthy foods, promoting healthy foods by increasing accessibility and affordability, economic interventions, recipe reformulations to reduce sugars, salt and fats in processed foods, and improving food security⁽¹⁸¹⁾.

Conclusion

Food, whether out-of-home food or home-made meals, is linked to all aspects of life and most importantly health; thus the food consumed will either keep individuals in good health or increase pressure on already exhausted health systems. With obesity being endemic in many of the World's countries, most notably those adopting modern 'Westernised' diets and lifestyles, it is suggested that today's diet contains an overabundance of energy-dense foods. There is not one sole reason why people eat out-of-home foods and this narrative literature review presents some key factors that influence consumption, many of which are intertwined. Economic disadvantage in the food environment appears to be a strong determinant of access to out-of-home foods and consequent intake. However, further research is warranted to understand socio-economic differences between types and frequencies of out-of-home food intake. In addition, the biological and psychological drives combined with a culture where overweight and obesity are becoming the norm makes it 'fashionable' to consume out-of-home food. Further research to understand this complex interplay is essential. Lastly, there are a limited number of qualitative studies

regarding out-of-home foods; therefore, extending previous research with more in depth studies may aid the understanding of the underlying reasons and motivations of out-of-home food consumption.

Overall, there is a strong warrant for further research into the out-of-home food phenomenon; to strengthen knowledge on the determinants of out-of-home food consumption within populations (and if this varies between countries); to assist the formation of a coherent body of evidence; and to support the development of effective interventions to reduce the impact of out-of-home foods on public health.

Acknowledgements

The views expressed in this paper are those of the authors.

This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

The submitted article represents the original work of the authors. H. G. J. was responsible for researching, writing and preparing the manuscript. I. G. D., L. D. R. and L. S. provided intellectual input, proof reading and corrections.

The authors declare that they have no competing interests.

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