Consumer responses to food labelling: A rapid evidence review

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Executive Summary

The Food Standards Agency (FSA) aims to be a modern and accountable regulator. As part of this, the FSA is considering how labelling can support the public health and consumer protection agenda. As a result, the FSA aims to understand if, and how (when they do) people use food labels to make consumer choices. In order to prepare for this rapid review, the search strategy adopted involved entering specific terms (for example nutritional labelling, eco labelling, health claims) as well as more general terms (behavioural change methods, behavioural change techniques, food labelling) into Google Scholar, Web of Science, ResearchGate, as well as the FSA webpages. This generated over 450,000 articles. To reduce this to a manageable set of articles, and to focus the review on empirical work, the sample was further reduced based on titles and abstracts, so that the review only included empirical studies and meta-analyses (years between 2000 to 2021). Moreover, the authors of this review have expertise in several core areas of this review, which was applied to the filtering process so that the most relevant empirical findings were included. Importantly, studies included were those which focused on labelling as a behaviour change intervention, rather than from a food safety/transparency perspective(for instance, in relation to best before or use by dates). The conclusions about labelling are in the context of the current labelling and policy landscape. The review does not consider the question of how food information can be developed and deployed alongside other interventions in future to better influence consumer behaviour.

This rapid review addresses four questions: (1) What impact (if any) does food labelling have on consumer decision-making? (2) What are the most persuasive aspects of food labelling that impact consumer decision-making? (2a) What are the reasons behind the persuasiveness of some food labelling to change behaviour? (2b) Which factors limit the persuasiveness of food labelling on behaviour change?

To contextualise the empirical findings that have been reviewed, the early part of this review provides details of core psychological research and theoretical insights for understanding consumer behaviour. In order to understand the potential impact of labelling, it is important to establish what the consumer landscape is when making food purchasing decisions (for example what people typically attend to, how long they have to attend to food labelling information, their shopping habits), and what the key motivational drivers are for making these decisions. In addition, it is important to establish the theoretical basis of behavioural change, and what claims are made, along with the techniques used to encourage behavioural change. In the language of behavioural change, labelling is a form of information provision. Informed by behavioural change theories, the rationale for treating labelling as a behavioural change intervention is that by providing decision-makers with a succinct and easy to process symbol that encapsulates core information, this can out-compete other information in the informational environment so as to persuade a choice in a predictable and beneficial direction. For example, presenting nutritional details of a food product in the form of traffic lights from red (indicating unhealthy) to green (indicating healthy) is designed to help decision-makers to

gauge the nutritional value of food products, so as to select the products that are healthiest.

In the main, the answers to the four central questions that the findings from the reviewed literature addressed are as follows:

(1) What impact (if any) does food labelling have on consumer decision-making? In laboratory and field studies which approximate real life consumer experiences, the role that food labels play in persuading decision-makers choices is limited. A subsidiary question that this finding raises is, why is food labelling limited in its persuasive value? Based on the work reviewed, there are five reasons: a) decision-makers are trading off all other information on food products against price, value for money, and quality, which are consistently the most salient information that impacts consumer food choices; b) the informational profile of any food item contains a multitude of information and multiple labels that compete with marketing information for the most salient space on the front of packaging; c) if extended out to other food consumption environments (for example takeaways, lunch time canteens, restaurants), decision-makers' selection of food from menus is driven by social factors that take precedent over factors communicated in food labels (for example sustainability, calorific content) and other information on menus; d) consumers struggle to interpret specific labelling information, either because there is ambiguity in what the labels communicate, or because consumers have varied interpretations of what the labels mean, e) there are a multitude of labelling elements contained on any single prepackaged food product, and consumers are time efficient in the amount of attention they dedicate to reading labels, which is why they likely focus on the most salient information (for example price, brand, promotional offers)

(2) What are the most persuasive aspects of food labelling that impact consumer decision-making? Given that the findings addressing question 1 suggest that in the main food labelling (for example nutritional content, sustainable consumption) has limited behavioural impact, this has implications for answering question 2 and 2a. What the findings reveal is that, when studied under artificial laboratory conditions, food labels can be instructive in directing behavioural change. For instance, traffic light labelling methods that indicate the nutritional value of food items can be shown to inform hypothetical food choices (i.e. that is, after presentation of a traffic light system, compared to before, people change towards more nutritional options). However, these findings rarely generalise to real world shopping contexts. Nonetheless, when surveyed, people report on aspects of food labels that could be improved, such as making them uniform across products, and standardised across countries. For instance, the range of labelling that is referred to in the literature, and that consumers take to collectively mean sustainable or environmentally friendly include: "eco-friendly", "environmental safety", "recyclable", "biodegradable", "ozone-friendly", "carbon-trust", "low-pesticides", "fair-trade", "animal-welfare", "organic", "free-range". For each term there are different labels included on food products, each of which have different associations with regards to sustainable consumption.

(2a) What are the reasons behind the persuasiveness of some food labelling to change behaviour? In the reviewed work, which includes meta-analytic studies, systematic reviews, as well as individual empirical studies examining the direct impact of a particular label on consumer behaviour, findings all point to the fact that: a) food labelling does not reliably generate behavioural change in real world decision contexts, outside of laborary context (where this is also unreliable), and outside of labels carrying information about price, brand, promotional offers. Therefore, the reason that labels on food products have any persuasive function in influencing consumer choice behaviour primarily concerns information that informs economic decisions (for example price, value for money, and quality). Moreover, where other food labels are persuasive, they inform consumer choices for particular groups of consumers (e.g, safety related labelling such as allergens for food hypersensitive consumers). All of this points to a general conclusion that consumer choices concerning food are motivated primarily by economic factors, and where safety is a concern (for example food allergens).

(2b) Which factors limit the persuasiveness of food labelling on behaviour change? The range of factors that present barriers to the persuasive function of food labels can be divided into those that generalise across the food labelling landscape, and those that are specific to particular types of food labels. As discussed, labels that contain information that informs economic decisions (for example price, value for money, and quality) are highly persuasive. This means that other labels that inform the consumer about the nutritional content, health claims, sustainability, and safety of food products competes with information consumers priortise when making choices regarding food consumption. This also extends to front of pack information, particularly promotional offers, branding, and other marketing methods that are shown to be highly persuasive.

In conclusion, any effort to promote healthy, safe and sustainable diets requires acceptance of the limitations of food labelling to substantively perform a behavioural change function. That is, food labelling alone is unlikely to lead to any substantive changes in behaviour for the reason that in any consumer context, a multitude of factors will inform a consumer’s choice behaviour, along with the broader contextual factors (for example social values, cultural norms, socio-economic circumstances). Efforts to promote healthy, safe and sustainable diets require a significant co-ordinated effort from multiple disciplines and use of multiple interventions (i.e. choice-preserving (behavioural change interventions) and choice-incentivising (typical regulatory instruments)). This is not to say that there is no role for food labelling, for instance when it comes to food safety, their function is to communicate essential details and so the priority should be on devising the most accessible ways of communicating such details of consequence. Moreover, the quality of food labels is likely to become an even more important consideration for the future, given the probable use of recommender and automated decision-support systems which will require accurate labels to aid consumer decision-making.

Consumer Shopping Behaviour: Contextual Factors

This section considers three practical factors that will matter in determining the potential impact of any label on consumer behaviour:

1. The **total available information** that in principle consumers are faced with when shopping
2. The **average amount of time** that shoppers direct towards information that informs their consumer decisions
3. New **informational sources** available to consumers that they use to inform their choices

Without first outlining these background factors and how they impact consumer choice behaviour, any understanding of the impact of any particular label on pre-packed food items cannot be fully understood.

Informational Landscape: Any given pre-packaged food product on a supermarket shelf (or online) contains a multitude of information on the front and back of the packet[1]. The requirements generally are that a pre-packaged food product contains the following: 1) Name of the food; 2) List of ingredients; 3) Allergen information, 4) Quantitative declaration of ingredients (displayed as %)[2]; 5) Net quantity; 6) Storage conditions[3] and date labelling (for example best before date/use by date)[4]; 7) Name and address of manufacturer; 8) Country of origin or place of provenance[5]; 9) Nutritional declaration (displayed as %); 10) Additional labelling requirements (for example for certain foods details about the presence of sweeteners needs to be included).

Along with this, there are also formatting requirements[6] prescribed in law for the information presented on the packaging. Without taking into account additional **marketing information**[7] (for example nutrient claims, [for example “high fibre” or “rich in omega 3], premium offer promotions, and celebrity endorsements), **and price**, and **other additional labels** (for example carbon emissions), based only on the labelling informaton listed in the previous paragraph, a consumer selecting a pre-packaged food product will be presented with ten pieces of information.

Frequency/volume of decisions: Another factor to take into account is the scale of food choices a consumer faces in an average week. This can be considered by the proportion of time buying food that is consumed at home, and the remainder that involves consumption outside of the home. In the 2000s, for individual consumers in the UK, eating out accounts for 30% of food expenditure in an average week (eating out on average 3 times per week), with the rest accounted for by food shopping stores (for example supermarkets)[8]. Put another way, during this period over a quarter (27.1%) of adults and one fifth (19.0%) of children ate meals out once per week or more. One fifth of adults (21.1%) and children (21.0%) ate take-away meals at home once per week or more[9]. From 2008-2012, a quarter of UK adults ate out once a week or more often[10], and

more recent figures for 2016 suggest that 39% of UK adults reporting eating out at least once a week [11]. Thus, this gives some indication of the proportion of time spent purchasing and consuming food outside of the home, though food purchasing in the UK is still primarily oriented for consumption in the home.

Currently, with figures relating to 2019, an average weekly shopping basket contains approximately 33 staple items[12] (note that in other studies this is estimated at 57 items[13]), although this of course excludes smaller shopping trips that people now make during the week outside of a large weekly shop[14].

Figures also indicate that people spend on average (in bricks and mortar supermarkets) 41 minutes[15] (down from an estimated 47 minutes in 2012-2013)[16] in an average weekly shop (comparable with the US – 43 minutes[17]), and approximately 38 minutes online[8].

From this, it is then possible to determine some estimate of the average length of time that consumers will spend making a decision about a given food item they will purchase; accepting the fact that they will be somewhat inaccurate given various factors[18] [19] [20].

A conservative estimate then, taking some of the aforementioned factors into account, and estimated decision times, is approximately 9 to 17 seconds, with a grand average of 12 seconds. For a comparison, recent estimates for decision times on selecting food items during online weekly shopping purchases is 5-10 seconds[21].

A conservative estimate will be that 80% of the food items will be pre-packed[22] [23]; which may mean slightly longer decision times and other practical aspects. This means that, based only on Food Information Regulations 2014 (FIR) and Retained EU Law (REUL) Regulation (EU) No 1169/2011 on the provision of food information to consumers (EU, FIC), along with policy areas that regulate food safety (Department for Environment, Food and Rural Affairs, DEFRA), there are approximately 10 items of information that will appear on the packaging (excluding price, and other marketing information). The consumer would therefore have approximately ***1 second*** to process each item of information. Cognitively, this implies encoding, translating, and integrating each item of information with each other item of information[24]. Evidence[25] suggests that top two most salient factors that consumers attend to when making the purchasing decisions are **price** and **quality**.

Unplanned spending: One important area of research in the domain of shopping behaviour, whilst popular in the academic community (computer science, psychology, business management), but somewhat ignored outside of this, is the role that shopping lists play in determining what is bought, and how much more is bought outside of what is on the list[9]. This may seem somewhat tangential to the main focus of this report, but this area of work reveals two critical aspects that account for consumer shopping behaviour – without lists people use in-store products as memory cues of items they need, and that promotional offers play a critical role in informing the decisions people make about what to buy[26].

The incentives of any large food business operator, such as a supermarket, is to increase the time spent in the store, and increase time spent travelling across aisles to maximise the likelihood of exposure to more products, so as to purchase more items.

For this reason, work in the domain of unplanned purchases provides critical insights into the volume of unplanned items bought, and in turn, the marketing and advertising mechanisms that lead to this. The food industry is oriented toward innovating the ways it can increase sales, and work on planned and unplanned purchasing shows that, without a shopping list, a consumer will make many unplanned purchases. The factors that lead to this are highly driven by promotional offers that gain consumer's attention. In addition, an emerging trend that is gaining in uptake by consumers is in-store smart phone use [27] [28], which in turn informs their choice behaviours. Smart phone use often accompanies choices because this too is where consumers seek out promotions and coupons to determine offers that present value for money and which can be used to reduce the overall costs of their weekly shopping. Moreover, supermarkets are also utilising smart phones to increase the efficiency of shopping, and even replace typical cashier tills[29].

Why does all this matter? This work matters because all these contextual factors need to be understood in the context of the informational landscape that the consumer faces while carrying out their food shops. Several tactical in-store mechanisms (and online) are being used to encourage consumers to attend more to price critical information, which we already know from other work[20] is one of the most salient pieces of information that guides their choice behaviour.

Summary: Why do this kind of analysis? We need to consider what information is required to appear on pre-packed food items, and realistically consider the amount of available time people have to spend attending to it, along with the likelihood they would attend to it, and in turn use it to inform their choices. All of this will be considered in the next main section of this report.

A conservative estimate of 12 seconds, (most likely significantly less for online shopping), is arrived at, which means that this is the available time spent on any one food item in a supermarket. For online shopping, the time spent reviewing food items will be less because of differences between the physical presentation of food on shelves compared with the presentation of food items by category on webpages. In addition, previously stored preferences of food choices are retained on supermarket websites when completing online purchases, which also decreases the time spent reviewing food items to include when shopping online. We know that consumers prioritize that time attending to **price** to determine affordability, **brand/marketing information** to determine quality, and **promotional offers** to determine value for money (especially if they consult with their smart phone while shopping). The top most ranked sources of information are not included in the ten required items of information on pre-packed food.

Thus, to promote healthy, safe and sustainable diets through food product labelling (as well as labelling on menus), there are critical psychological and practical factors that need to be accounted for given the mental processing time available, along with the values and interests of an average UK consumer. To intervene effectively on consumer behaviour, the point at which an intervention is introduced is critical to maximise the chances of consumers attending to information that will encourage them to seek healthier, safer and sustainable diets.

Psychology of Consumer Behaviour and Behavioural Change

To begin to address the critical questions of interest posed in this rapid review which concern what impact food labelling has on consumer choices, what is most effective, and why, this section considers four behavioural scientific areas of importance in relation to food related shopping behaviours:

1. Habit and fluency
2. Behavioural economic factors (for example preferences, values, norms)
3. Behavioural change techniques
4. General impact of labels on consumer behaviour

Thus, the aim here is to present theoretical and empirical insights into the psychological mechanisms (cognitive, social and economic) that inform the way that consumers make decisions with respect to their food purchases, and the general understanding of the role of food labelling.

Cognitive Factors: Habit and Fluency

Given that the vast majority of decisions regarding food purchasing are conducted in supermarkets, and given that they are frequently occurring, they are repetitive, there is a vast array of options to choose from within each product category, and the choices are of low risk, together these present the core conditions for habit formation to occur[30 31]. Habits are highly practiced sequences of actions that have become automated over time in response to specific contextual and informational sources, and they are formed because they are able to efficiently serve a clear goal[32 33]. Thus, it can be expected that consumers that face the same decision context will make highly predictable repetitive choices in order to introduce efficiencies into their behaviour. In turn, it can also be expected that consumers also attend to the same information to inform their choice behaviour[25] because consumers are motivated to streamline the time they spend making repeated choices.

To illustrate just how influential habitual purchasing behaviour can be, empirical work using an eye-tracking field study[34] has shown that even when in-store signage is used to promote a particular food product (increasing consumers' visual attention to it), ultimately past product choices were still more predictive of final consumer choices over and above in store efforts to persuade consumers to purchase the promoted product. Crucially, the extent to which promotional in-store signage influenced purchasing decisions interacted with how familiar the consumers were with the store itself – the less familiar they were, the more in-store signage captured their attention and influenced their choice behaviour.

Habit formation is supported by fluency, a core cognitive mechanism that enables the efficiency of processing information to support decision-making that enhances the

subjective experience of ease[35]. In shopping contexts, we see two examples of this: perceptual fluency[28] and navigational fluency[36]. Familiarity increases fluency, so that the more often a consumer visits the same shopping store, the more they rely on visual cues (for example price[37], signage[38], brand information[39], reduced-price offers[40]) for perceptual fluency, and physical cues (for example location of food item on shelves[41], location of food in particular aisles) to travel easily and quickly across the store.

Summary – Cognitive Factors: Taken together, work examining habitual consumer behaviour shows that because of the highly repetitive nature of food shopping, consumers streamline their choice behaviour through mechanisms such as fluency via familiarity; this helps to efficiently determine what to look for and where to look for products that will be purchased.

This means that unless there are strong motivational reasons to change, those consumers highly familiar with a store will attend to the same information, attend to it in a shallow way, avoid making multiple comparisons between food products of a given category, and choose the same routes around a store. In cases where consumers are less familiar with the store, they are more influenced by a range of informational sources, though most often this is in-store promotional offers, along with branding and price. Strong motivational reasons to change behaviour include: health reasons (for example pregnancy[42], ill health[43], developing food allergies[44], obesity), financial circumstances (for example loss of earnings[45], changes in occupation[46]), and social factors (for example adopting food habits of a social group through changes in lifestyle[47], location[48], or religion[49]).

Cognitive, Social and Economic factors: Behavioural Economics Factors (for example preferences, values, norms)

Behavioural economic analysis of consumer choices combines insights from cognitive psychology, social psychology, consumer psychology, sociology, and economics[50]. In general, the different disciplines are combined to develop theories and frameworks to determine answers to questions regarding: **What works? Why does it work? What more needs to be done?** The latter of which will be addressed in the next section ‘Behavioural Change Techniques.

What works? The Basics: Basic understandings of consumer behaviour are informed by behaviourist models, such as those devised by Watson in the 1920’s[51] that outlines the association between stimuli (cues from the environment) and their effects on behaviour via reinforcement mechanisms. In particular, there was a new movement of applied scientific research that sought to understand how marketing and advertising was able to motivate needs, preferences and desires for goods (and services) that were not originally in the profile of needs, preferences and desires that a consumer had[52]. In answer to the question “What works?”, the findings from early research, and since, is that it was possible to direct, through behavioural engineering (i.e. early methods of behavioural

change), ways of influencing consumptive habits via conditioned emotional control responses. Through a variety of combinations of visual stimuli, verbal stimuli (messages), and other sensorial cues (for example sounds, tastes, odours), based on early theoretical work driven by behaviourists, it was possible to predict which stimuli would optimally drive consumer choices in carefully controlled conditions[53 54 55]. This work was then expanded[56 57 58] to take into account social cues (for example preferences, values, norms) that also inform the way in which consumers make their choices in asocial (for example stores, supermarkets) as well as social contexts (for example canteens, restaurants).

In what ways do these social cues influence consumer behaviour? Theories such as the Identity-based motivation (IBM) theory[59], Value-Beliefs-Norms (VBN) theory[60], as well as Social-Cognitive (SC) theory[61] help to highlight the salient social factors that motivate choice behaviour. IBM theory and relatedly VBN theory asserts that consumer behaviour is motivated by either individual or group associated norms and values. Identity salience motivates actions, such that when personal identity salience is present then there is an emphasis on achieving personal norms, values, goals and strategies, and achieving agency and control. This type of salience might be more likely triggered in situations where consumer choices are made in isolation of others, such as in a supermarket, or solo dining[62 63]. Social identity salience occurs where individuals are motivated to act in ways that are congruent with a group's norms, values, and goals, which might be more common in contexts where meal choices are made in the presence of others, such as in a canteen or restaurant. Familiar dining companions' values and norms will be a strong motivating factor in each group member's meal choices. To the extent that consumptive choices (for example sustainable consumption, healthy eating) are viewed as an important lifestyle choice by the dining group, and if collective action to surmount a social problem is seen as valuable and achievable, then pro-social meal options are chosen.

Economic factors: In addition to basic cognitive and social psychological research, consumer psychology and sociological factors, traditional economic theory informs behavioural economic research of consumer behaviour, which asserts that consumers are consistent in their preferences and values over time[64]. However, behavioural economics, based primarily on psychological research, suggests that consumers are not so consistent with regard to their preferences and values, which are largely informed by the various factors discussed thus far (for example visual information, textual information [for example labels], social cues). From the work discussed, it is clear that consumers have competing preferences, and the value they place on these preferences can vary significantly based on the consumer context, as well as taste and convenience, offer of immediate rewards, and financial factors. In regards to financial factors, what is clear is that any other factors that inform their choices (for example brand, labels, social cues) are traded-off against the price of any consumer product they purchase[65 66 67 68]. In particular financial factors are shown to take precedence over many other influential factors where there is a price decrease (for example through subsidies)[69 70], price increases (for example through taxing to disincentivise unhealthy choices)[71 72], and both[48 73].

Summary - Cognitive, Social and Economic factors: Both theoretical and empirical work in the area of behavioural economics of consumer choice behaviour suggests that there are multi-factorial influences on decision-making. At the most basic level, there are visual, verbal and sensorial sources of information that guide consumer choice behaviour. At a level up are social factors, such as salient social factors (for example group identity, for instance identifying with those that are proactive in reducing climate change, or vegans/vegeterians) that motivate choice behaviour, in particular the ways in which individuals associate their identity to social preference, norms, and values that in a social context inform the way individuals make choices based on other around them. This can be observed directly in social contexts when people make collective decisions about their consumptive choices (for example choosing what meals to eat at the home with others or in restaurants). Alternatively, this can be observed indirectly, where social identity (in the absence of others) is still triggered when consumers associate their choices with reference to general preferences, norms and values of a social group they identify with (for example family, friends, religion, culture, society). Finally, the cognitive and social factors are typically offset by financial factors that appear to be one of the most salient aspects driving choice behaviour in consumer contexts.

Behavioural Change Techniques

Another way in which behavioural economics and other disciplines intersect in the context of consumer choice behaviour is through behavioural change. Behavioural change (both the empirical and theoretical frameworks that have been devised) is a way of characterising the processes that ordinarily guide behaviour. From this understanding, it is then possible to develop behavioural techniques (for example nudges) to direct changes in behaviour in a predictable and positive manner (for reviews, see [48] [74] [75] [76] [77] [85]).

To guide researchers and practitioners to design a behavioural intervention, often the first port of call is to analyse the behavioural factors that are most relevant to the context, to then devise the appropriate levels to motivate change. Three of the most common behaviour change frameworks used by several established public institutions, such as the OECD, World Bank, and several governments are: The Behaviour Change Wheel (hereafter BCW)[78], the Behaviour, Analysis, Strategies, Interventions, Change (hereafter BASIC) toolkit[79], and the Easy, Attractive, Social, and Timely (hereafter EAST)[80] framework developed by the Behavioural Insights Team. BCW, EAST, and BASIC share several critical features in common. They are prescriptive in outlining the process of developing behavioural change interventions for targeting social policy issues. Also, in all three frameworks, the establishment of criteria for success of behavioural interventions is quite stringent, since the requirement is that a priori, the researcher and the practitioner need to assert a directional association, along with the magnitude and period in which the outcome following the intervention will be.

A critical limitation of the three common frameworks is that they do not give a precise answer as to whether and when a combination of behaviourally informed and regulatory

measures might be more suitable. In the main, the frameworks broadly tell researchers and practitioners what to look out for when designing public policy interventions based on behavioural insights, but crucially, none provide sufficient information on what to expect when combining behavioural interventions with regulatory instruments, such as taxes, even though a combination of choice preserving and choice incentivizing measures are used in many real-world situations.

Nonetheless, of the various different methods of behavioural change that the different frameworks outline, labelling falls under the category of **information provision**. For example, in the nutritional health domain, traffic light labelling (TLL) is often referred to as an example of information provision designed to inform and motivate behavioural change. In this review TLL does not necessarily refer to the Food Standards Agency (hereafter 'FSA') traffic light labelling system' traffic light labelling system. TLL is hypothesized to simplify information provision by facilitating relative comparisons between different levels of a product attribute, due to automatic associations between colours (for example green, yellow, red) and moral imperatives – that is, red is often associated with harmful outcomes, and green is often associated with good outcomes[81 82].

The psychological mechanisms that underpin the influence of labelling largely depend on the type and format that labelling takes on. For instance, with TLL, the idea is that the label supports easy decision-making where comparisons between similar food products can be made. That is a consumer can make simple comparisons of nutritional (and calorific content) information by comparing factors such as energy (for example unit -kilojoules), fat (for example unit -grams), saturates (for example unit -grams), sugars (for example unit -grams) and salt (for example unit -grams) bypercentage intake of the reference intake by either a portion or by 100grams. To ease the comparison based on traffic light coding of nutritional content of food, reference values can also be provided[83]. A reason for doing this is that making relative comparisons of nutritional content of food can be hampered by an absence of basic recommended daily values (for example daily calorie intake for men, women, children). To help make the values more salient, reference values can be presented in the form of physical activity associated with nutritional values, such as calories presented as the expenditure needed (for example average minutes or miles of walking) to expend calories in association with the TLLs[84]. However, the impact of reference values of this kind along with TLLs has been shown to have limited impact on changing consumer behaviour[68 85]. While there are good psychological reasons for hypothesising that reference values can support easier relative comparisons, the one most obvious reason for finding that it does not have any significant additive behavioural change effects is that (as discussed before) consumer attention is limited given the available time to make consumer choices. Thus, by swamping the consumer with multiple details on which to make comparisons, it is likely that consumers will default to the most salient relative comparison they can make, which is price.

Another method of behavioural change is to use a combination of labelling and social norms[48 86 87 88]. The idea here is that consumers are provided with critical information about a food product by signaling, especially when making relative comparisons, which of the compared items is the "better" option with reference to social norms[89]. The idea of providing social norm information is that it communicates behaviours of a target group (for example a peer group, or other shoppers). In this way, the idea is to invoke a social identity mode that motivates consumers to consider the values attributed by a group as to the preference of that group (for example "Customers' favourite"). In addition, social norms can also invoke a different salient social identity to that typically adopted by a group of diners in order to orientate them towards pro-social values. Stronger forms of this method include injunctive norms (which might be typical or atypical) which communicate (dis)approved of behaviours and which often have a tendency to fail or backfire [85]. What we know from the vast literature on social norming labelling is that several conditions need to be satisfied for social norm messages/labels to effectively lead to behaviour change: identification with the reference group; observability of the behaviour; and salience of the social norms[90 91 92].

Summary – Behavioural change techniques: Theoretical frameworks regarding behavioural change, as informed largely by work from psychology and economics, first try to characterise the principles that govern behaviour, and the factors that influence it, so as to develop interventions that can predictably change behaviour for the better. Behavioural change frameworks provide a generic guide to what could be used as interventions, though cannot, in the main, specify which intervention is best suited for the specific target behaviour that needs changing. Despite these limitations, the value of behavioural change frameworks is that they provide a range of previously tested behavioural interventions that can be trialled (with varying degrees of success – for a review see[85]).

The most common methods that are used in the context of consumer choice food behaviour is the provision of information, either in the form of labelling, or else through the use of social norming. For example, TLL used to communicate nutritional facts about products enables relative comparisons to be made between similar food products. To further assist in making comparisons, reference values (for example physical expenditure) and social norms (for example typical consumers choices) may be used. The overarching idea behind techniques of this kind is so as to make salient information that consumer may either ignore, or do not find useful, when making their choices, and to do this in a manner that makes the information visually and psychologically striking and easy to process. As a result, information that would otherwise not be attended to is then processed, which in turn is assumed to result in changes in behaviour in the direction of specific goals (for example to increase healthy eating, sustainable consumption).

General Impact of Labels on Consumer Behaviour

Before presenting a review of the impact of different types of labels on behaviour, this section presents an overview based on summary analyses conducted across multiple

studies. The aim here is to give a general impression of the findings overall, and what they reveal regarding the general impact of food labels on consumer behaviour. Thus, one way to assess the general impact of food labelling on consumer behaviour is to look to the many systematic reviews, and meta-analytic studies that have been conducted[93]. Meta-analytic studies differ from general systematic reviews in that they take a particular area (for example nutritional labelling) and statistically examine the overall effect sizes (for example the magnitude of the effect of the labelling on behaviour) based on a collection of empirical studies that have been conducted.

Nutritional and Calorie Labelling: For instance, a recent systematic review (2017)[94] of 53 empirical studies (both field and laboratory studies) on the impact of calorie labelling reported that to date, it is still unclear whether calorie labels on menus have any significant impact on consumer choice behaviour. One of the key reasons for this are methodological issues with the designs of the studies along with low statistical power to determine any reliable effects. Consistent with this, a meta-analytic study (2015)[95] examined the impact of calorific labels on menus on consumptive behaviours in restaurants. The meta-analysis included 14 studies applying strict criteria for inclusion for analytic purposes. In the analysis, before and after menu labelling outcomes were used to determine weighted mean differences in calories, saturated fat, total fat, carbohydrate, and sodium ordered/consumed,which were pooled across studies using random effects modelling. In laboratory settings, labels were found to reduce calorie consumption, however none of the field studies showed any impact of labelling on reducing quantity of carbohydrates, total fat, saturated fat, sodium, or calories consumed.

A recent meta-analysis (2015)[96] focussed on the effects of three types of food labelling schemes (‘Food labelling’, ‘traffic light labelling’, ‘traffic-light nutrition labelling’, ‘Nutrition labelling’, ‘Nutrition claims labelling’, ‘Nutrition claims regulation’, ‘EU regulation food labelling’, ‘EU nutrition labelling program’, ‘Traffic light label’, ‘Public health nutrition’, ‘Health logo’ ‘pick the tick’, ‘Guideline Daily Amounts’, ‘the Heart Symbol’, ‘the Choices logo’, ‘The Choices program in the Netherlands’, ‘The Keyhole program in Sweden’, ‘Program less salt is healthier’, ‘Green check marks’, ‘EU regulation food labelling’, ‘EU nutrition labelling program’, and ‘EU nutritional labelling program) on changing calorie intake. This was based on nine studies that met their criteria of experiments that used a randomised control design (RCT), as well as where possible a pre/post comparison where a RCT was not used. The findings showed that while calorie labelling led to minor increases in the selection of healthy foods, the labelling made little difference on overall calorific consumption. A further meta-analysis (2018)[97] examined the impact of calorie labelling and equivalent physical activity labelling (for example calories [229 calories] and an activity and length of time to complete it to burn off the calories [walking 44 minutes]) on calorie consumption). The analysis included eight studies which were a mixture of laboratory and field experiments, with the overall conclusion being that labels with physical reference points did not make any significant impact on food energy consumption.

A meta-analysis (2018)[98] made up of 28 studies followed similar strict inclusion criteria. . The studies examined nutritional labelling (for example recommended daily intake of sugar, salt, fats, calories and nutritional facts labels) of food and non-alcoholic beverages on calorific consumption, as well as whether there were unintended negative side effects (for example that the labels caused harm by increasing calorie intake - backfiring[99]). While none of the studies showed the presence of negative side effects, only the poorest quality studies showed evidence that labelling led to any positive changes in calorie consumption.

A meta-analysis of several types of food labelling (2019)[100] reported findings from 60 empirical studies (with over 2 million observations across 111 intervention arms in 11 countries). As with the systematic review[36], there was huge variability in the methods and designs of the studies, with multiple types of manipulations and multiple types of labels (for example salt, trans fats, nutrients, calories) being examined, and the length of the interventions determining the impact of labelling on behaviour also varied (between less than a week to a year). The conclusion of the meta-analysis was also quite damning. Nutritional labelling did not significantly alter consumer intakes of dietary targets (for example sodium, total carbohydrates, protein, saturated fat, fruits, or whole grains).

Front of Pack Labelling: A recent meta-analytic study (2020)[101] looking at 114 studies examining front of pack nutritional labelling, and a further meta-analysis looking at 19 studies examining sugary drinks warning labels (2020)[102] showed that labelling did not significantly result in positive behavioural changes in food consumption. Two further meta-analytic studies, one on nutritional labelling and physical activity reference points (2020)[103] and health warning labels (for example WARNING: Drinking beverages with added sugar(s) contributes to obesity, diabetes and tooth decay; WARNING: Excess calories cause obesity, which causes [heart disease, bowel cancer, type 2 diabetes]) on food and alcohol (2020)[104] did find positive changes in behaviour. But both these meta-analytic studies acknowledge that the empirical investigations included in the analysis were laboratory studies where, under idealised conditions, labelling is shown to impact hypothetical behaviours.

Eco Labelling: While labelling of nutritional details has gained the most attention, there are systematic reviews of the impact of eco-labelling on food consumption. A systematic review of 56 studies (2021)[105] revealed a positive impact of eco-labelling (i.e. organic, fair-trade, ethical food production, animal welfare, environmentally sustainable, greenhouse gas emissions). Here the positive impact was determined by increases in the selection of food options that were associated with lower carbon emissions, relative to a control (baseline without the presentation of the food labels). However, there are very few studies examining the impact of labelling on real world food choices in actual consumer settings, and of the four studies that did, the findings across them were mixed. The findings were mixed as a result of variations in sample sizes, whether or not the studies were conducted in the laboratory or in field settings, and whether a randomised control study design was used. Further work is needed to establish whether there is any interaction between the effectiveness of eco-labelling on different consumer groups in field settings, along with comparing different types of eco-labels in real world consumer

contexts. What we know from this work and other related work on eco-labelling [106] [107] [108] [109]is that, as with nutritional labels, the types of eco-labels that have been used vary hugely, and so this variability will impact effectiveness. Also, different types of labels are devised by different stakeholders (for example environmental organizations, governments, multi-national, and/or domestic firms) which will also impact effectiveness to change behaviour towards sustainable diets, because the labels will be evaluated according to usefulness and trustworthiness. Finally, as with nutritional labels, consumers vary according to their interests, values, beliefs and what they can afford, which also impacts the extent to which they attend to or use eco-labels to inform their decisions.

Trust in Labels: Finally, one matter of recent importance is how trust informs the way in which consumers make their decisions, particularly when interpreting labels [110] [111] [112]. Theoretical models, such as Tonkin et al. (2015) (see Figure 1), which have been informed by empirical work, suggest that the factors that influence trust in labels are often driven by the attributions of trust in regulatory bodies (for example food safety), food industry (for example marketing claims), brands, and topical news stories concerning food scares and scandals. These are background sources of information '*priors'* which guide the interpretation of understanding of literal information conveyed through food labels (Trust in the labels) and through association of the labels with food systems (Trust through the labels).

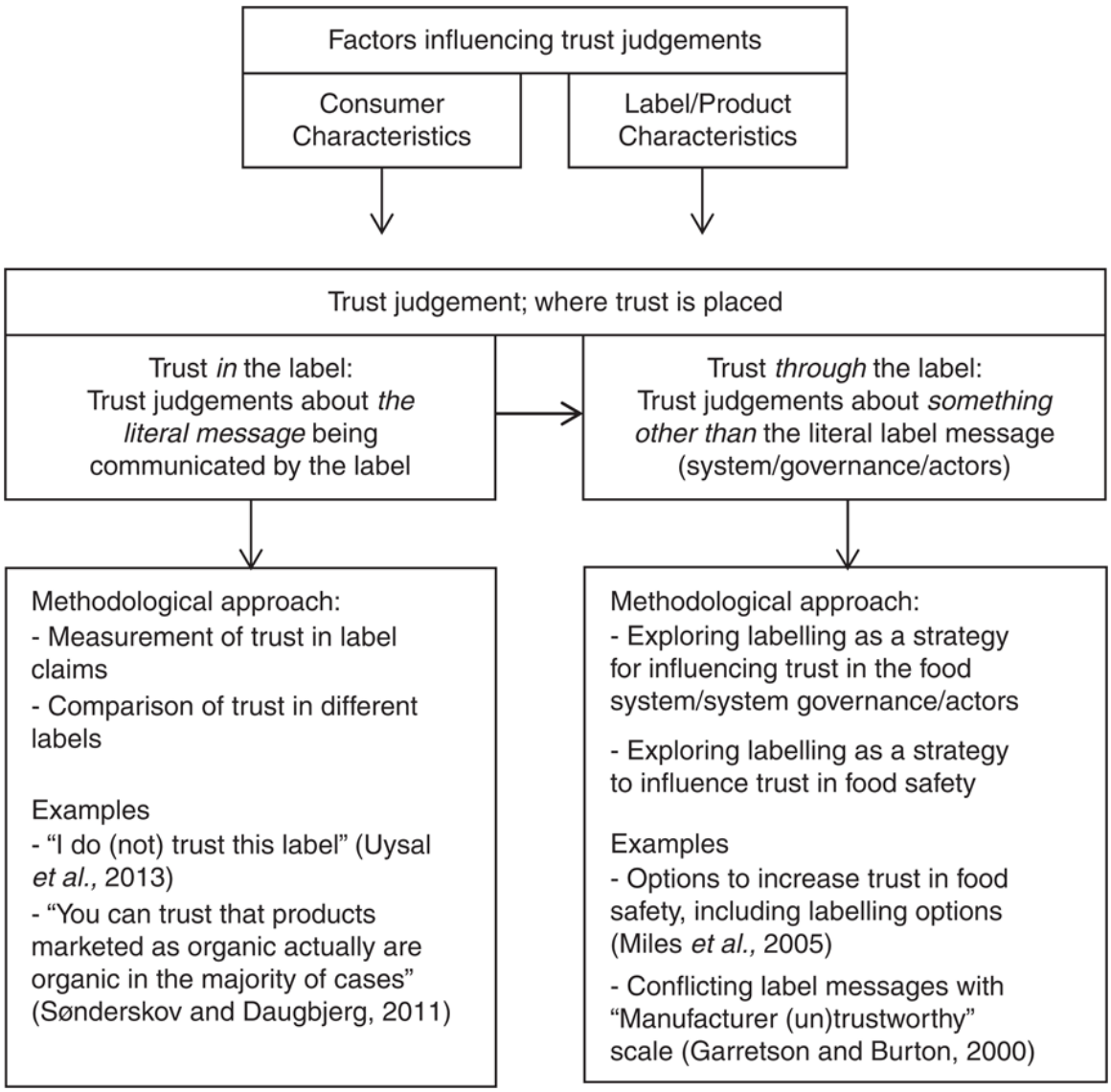


Figure 1. Tolkin, Wilson, Coveney, Webb & Meyer (2015). Conceptualisation of trust judgements made around food labelling.

As several studies suggest, food labelling is a mode of communication between the food system and consumers, in the absence of a face-to-face encounter. The value of theoretical work and the empirical findings that support it, is that a critical analysis can be conducted through a framework which describes the factors under which trust judgements are made around food labelling, such as the contextual factors that likely enhance trust in food labels, and inhibit attention to them.

Food labelling can enhance or undermine consumers' expectations of moral, ethical and safety matters in the food system and various agents that play a critical role in it (for example regulators, food manufacturers, food producers, retailers). For example, food scares and scandals can significantly impact the integrity of, and reliance on food labels to communicate honest information[113] [114] [115]. In fact, food scares and scandals can orientate consumers towards attending to labels that carry information about country of

origin of food products[116], meat production practices[117 118], and organic produce[119]. In addition, food scares can reduce overall trust in key actors in the system, which limits interest in and adoption of new dietary habits, which are signalled by various types of food labels (for example nutritional labelling, calorific content, eco-labelling)[120 121 122 123].

Summary - General impact of labels: Taken together, what we can draw from the systematic reviews and meta-analytic studies is that labels carrying information about nutrition, warnings, and the sustainability of food products do not significantly impact consumer choice behaviour in a meaningful way (for example reducing calorie consumption, increasing healthy eating, increasing sustainable consumption). Conditions under which labels are shown to have a significant positive impact on behaviour are based on studies run under laboratory conditions, and often feature hypothetical choices. Furthermore, methodological issues impact the likelihood of finding reliable positive effects of labels on consumer choice behaviour. These include variability in the types of labels used, and variability in the length of time that the labels are examined to have had an effect on choice behaviour. They are also often absent of any theory explaining the choice of formatting of labels and messages.

In addition to this, of the many practical barriers that exist that prevent labels from potentially influencing consumer choice behaviour the follow are identified: 1) the amount of available time/available attention to process the labels, 2) confusion in processing the labels because they are unclear, 3) limited interest in accepting the message of the label[124]. Also, discussed in the previous section ['Consumer Shopping Behaviour' - Frequency/volume of decisions], there are also particularly salient factors in the context of shopping that gain a high premium in consumers' minds. These are: price, indicators of value for money, and cues to quality. Also discussed are taste and cultural factors[125 126 127] which serve as valuable criteria for informing choice. Additional factors that have also been referred to are: economic incentives, novel technologies (for example smart phone usage), and environmental contexts (for example organisational innovations in schools, worksites, and communities that structure and inform the way consumers make food choices outside of food stores) along with attributions of trust in the food system and the various actors associated with it (for example regulators, food manufacturers, retailers).

Empirical Work Investigating Food Labelling

To examine more specifically responses to labels that communicate different features of food products, this section covers the following types of food labels:

1. Food labelling communicating sustainable consumption (for example carbon footprint labelling)
2. Nutritional labelling
3. Specific consumer groups
4. Front of pack labelling
5. Other mandated food labelling information:
   a) Country of origin or place of provenance
   b) Additives
6. Labelling of organic food products, fair-trade, ethical food production
7. Labelling of meat-free, synthetic meat, meat substitutes, and 50/50 (half meat and half meat substitutes)

For each type of food label, we summarise the key findings of empirical studies that have considered various consumer behaviours associated with the labels, including what features of the labels may be more or less persuasive in affecting decision-making and purchasing behaviour. In the main, we aim to examine the extent to which the labels were able to inform consumer behaviour such that it changed in line with incorporating the information contained within the labels. It is important to note that the literature on food labelling is vast, but to make our evaluation of the literature manageable and most relevant, we focused on studies that examined the impact of the labels on behaviour (even if hypothetical choice), so long as they included price of food in their analyses, and/or were field studies.

Sustainable Consumption

The most cited study on sustainability labels on food products (see Figure 2) is Grunert et al.'s (2014)[128] survey and choice experiment (interviews, n = 4408) on a European sample (UK, France, Germany, Spain, Poland, Sweden). The survey examined the motivations towards sustainable consumption, their general values and goals, and self-reported use of, and understanding of different types of labels. The choice experiment looked at which products they would buy depending on manipulations of price, nutrition labelling, ethical labelling and sustainable labelling of food products (i.e. breakfast cereal, soft drink, ready meals, chocolate, ice cream, coffee).

Figure 2. Sustainable food product labels (for example Rainforest Alliance Certified logo; Carbon Trust, EU Ecolabel, Fairtrade, Animal Welfare label).

Overall, regardless of whether behaviour is self-reported, or through the choice experiment, the findings show that ethical and sustainable food labels are not used. Moreover, the choice study shows that people rely on price and nutritional information substantially more than ethical and sustainable food labels. Motivation towards sustainable consumption does not account for this finding, since across the board, concern around sustainable consumption was high, but general. That is, people reveal general attitudes which show concern around issues of ethicality and sustainability, but when it comes to what people say they attend to when making their choices, price, brand, quality, quantity, and sell by date are by far the most important factors that people practically refer to when making their choices. Findings like this pose a problem for many behavioural change frameworks, especially those that aim to target motivation as a way to then trigger behavioural change (for example COM-B).

The findings have since been replicated in further choice experiments using multiple country samples (UK, US, Germany)[129] showing that price and nutrition are significantly more influential on food choices than ethical or sustainable attributions of the products. Additional complementary findings come from a recent ethnographic study (samples: US, Canada) by Fox et al. (2021)[130] combining semi-structured interviews, and a pile-sorting task. This involved sorting 42 food products into piles that grouped them according to similarity, and then rated on price, taste, convenience, familiarity, health and environment. When it came to connecting the findings from the interviews and the pile-sorting task, overall there appeared to be a strong consensus on price (as a factor of importance and consensus on rating food products), where environmental impact was fairly low down the list of considerations, and there was no consensus on how to rate foods by environmental impact, which is consistent with other studies[131].

Take home message - Sustainable consumption labels

While people report concern regarding issues of ethicality and sustainability of food, it is clear that people trade off multiple factors against price, because price is still the most salient factor that informs people's choices. Two factors that might account for why sustainable consumption labels do not make a significant impact on choice behaviour are the following. First, there appear to be a wealth of labels that consumers are confronted with. There are green labels, eco-labels, and ethical labels, which depending on the authority referred to, either fall under the general category of sustainable consumption labels or not. The range of labels are vast (for example "eco-friendly", "environmental

safety", "recyclable", "biodegradable", "ozone-friendly", "carbon-trust", "low-pesticides", "fair-trade", "animal-welfare", "organic", "free-range"). They do not all refer to the same thing, and each can have multiple associations, and different levels of relevance to a consumer[132]. So, given the range of labels associated with sustainability, where people care to differentiate them based on their own interests, they will. However, for the vast majority, these specific labels do not connect to general attitudes, which are just that – general, and do not connect to the matter of most relevance, which is price. Second, green/ethical/sustainable products are still more expensive than non-green counterparts[117], and so shifting choices towards sustainable consumption requires making structural price changes [48] [133] [134] [135]. If, as has been shown consistently, consumers are oriented towards the price of food products, then once they consider alternative food products that are sustainable, then price sensitivity is likely to be the next factor that informs their choice, because they will be making comparisons with their typical habitual food choices.

Nutritional Labelling

A highly cited study by Sachs et al. (2009)[136] examined the impact of front of pack traffic light (see Figure 3) nutritional labelling (on two product categories: ready meals, and sandwiches) on actual food purchases in a field study. The study was careful to only include food items under both categories that were not originally or during the study under promotional offers. Where price varied across products, this did not significantly impact the study, because the critical comparison was sales of items before the presentation of front of pack traffic light nutritional labelling, and sales increase after the presentation of this labelling. Sales data from a major UK food business operator (over 1000 supermarket stores) were compared for four food products under the ready meal category, and 12 food products under the sandwiches category, with variation in nutritional value of food products across categories. The comparison took place four weeks before the introduction of the new labelling scheme, and four weeks after. The findings showed that there were no substantial changes in the selection towards healthier items based on the introduction of the front of pack traffic light labelling scheme. The value of this study is obviously its ecological validity, along with access to a high volume of data across multiple regions across the UK.

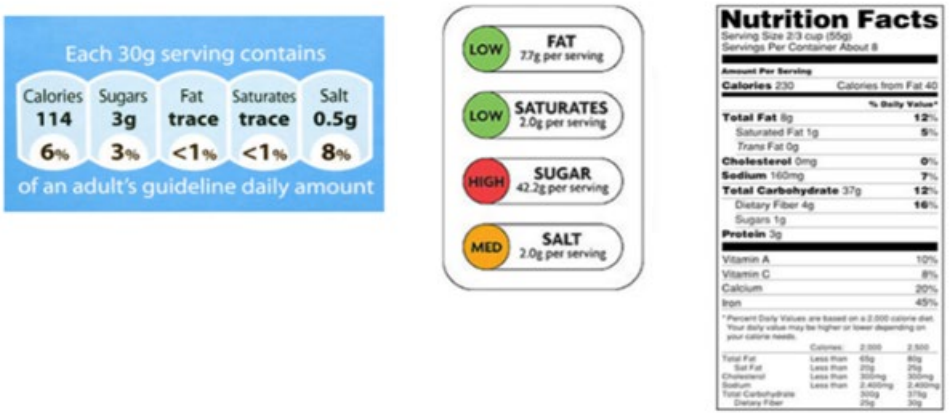
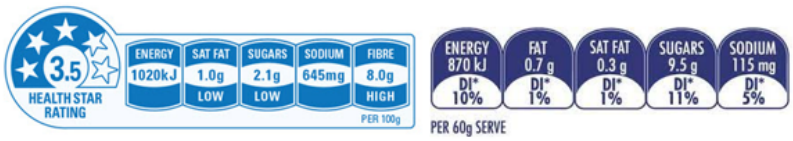


Figure 3. Nutritional labelling examples (Guideline daily amounts, Traffic light label, Nutritional facts label).

A recent field study in Australia by Neal et al. (2017, n = 1578)[137] aimed to extend work on the impact of front of pack traffic light labelling on healthy choices. They did this by using an innovative smart phone method to compare the effects of different types of nutritional labelling on choice behaviour. First people were provided with an app on their smart phone, where for a week they used the app to scan the barcode of pre-packed food items, along with a photograph of their till receipt. This established a baseline. After this, they were randomly allocated to one of five conditions (Health Star Rating (HSR) system, multiple traffic light labels (MTL), daily intake guides (DIG), recommendations/warnings (WARN)—or control (the nutrition information panel, NIP)) [see Figure 4]. For four weeks, when they made their food purchases, people were required to scan the products via their smart phone, and depending on which condition they were in, they would receive either HSR, MTL, DIG or WARN details. The findings suggest that, consistent with Sachs et al. (2009) and a comparable field study conducted in New Zealand by Mhurchu et al. (2017)[138], none of the different labelling systems were shown to have any reliable impact on consumer behaviour (i.e. changes towards healthier consumption) compared to the control condition.



Health Star Rating (HSR) Daily intake guides (DIG)

Recommendations/warnings (WARN)

Figure 4. Health Star Rating label (HSR), Daily Intake Guides label (DIG), Recommendations/Warnings label (WARN)

Figure 4. Nutritional labels used in Neal et al.'s (2017) study.

Moreover, these findings also generalise to studies that have examined the impact of front of pack traffic light labelling of nutritional details on carbonated soft drinks by Sandoval et al. (2019, n = 108)[139]. This study was based on an Ecuadorian sample, using an intensive interview schedule where data collection on each of the 108 households was collected each month for 20 months prior to the traffic light label intervention, and 16 months after.

While there seems to be strong evidence that nutritional labels alone do not shift dietary habits in several field studies, it is worth examining in brief whether, irrespective of efficacy, which types of nutritional labels are more easily interpretable than others. Much of the work that has conducted laboratory comparisons of different labels (HSR, DIG, WARN, TLL) suggests that warning labels (see Figure 4) are more visually impactful, easier to understand (across all consumer groups), and more accurately interpreted than traffic light labels and other labelling systems (HSR, DIG) (see Figure 3)[122 123 140 141], or are equally impactful as traffic light labels[142]. Another important factor when comparing different types of nutritional labelling systems is time available to process the labels[143]. Systematic comparisons across a variety of nutritional labelling systems is lacking. Nevertheless, when comparing guideline daily amount with traffic light labelling systems, guideline daily amounts outperformed traffic light labelling based on the key behavioural measure, which was to interpret nutritional information so as to select food options to build a meal that was healthiest. However, this was time dependent – if people were not under time constraints, the guideline daily amount was most effective, but when time was limited, and depending on what was asked of people, both systems were equally effective, or else the traffic light system had the edge[128].

Take home message – Nutritional labelling

When it comes to the use of front of pack nutritional labelling, the most common of which, at least in the UK, is the traffic light labelling system, studies consistently show that this labelling system does not appear to significantly shift consumer choices towards healthier items. Why might it be that nutritional labelling systems do not, in and of themselves, lead to substantive changes in dietary habits? Trust appears to be one consistent factor[144 145 146], that is, consumers can be highly suspicious of the labelling system and whether it can be depended on to provide accurate information about nutritional details, and this can have a cultural dimension to it[147], where the information conflicts with cultural values regarding traditional foods that form the dietary habits of consumers. Another related factor regarding the interpretability of nutritional labelling systems is that there is variation in the way the systems are understood, not only by consumers, and across countries, but also by dieticians[148]. When compared with other factors, as has been highlighted, given

the ambiguity of their interpretation, or the inconsistency of using nutritional details for decision-making, other salient factors will be much more salient, such as price[149], along with expiry date[150], and brand[151]. Also comparing own-brand and branded products for online purchasing and physical stores purchases reveals inconsistencies between the presentation of nutritional label designs (for example Guideline Daily Allowance (GDA) figure, Reference Index (RI%), TLL)[152].The study shows that for some supermarkets, 90% of the pages containing online product nutrition labels were inconsistent with in-store labelling. The inconsistencies concerning correspondence between online and in-store labelling were the colour of the labels (for example black and white, colour); as well whether all information was presented for online products compared to the full information presented on products in-store (for example TLL, GDA, RI). Five (Tesco, Sainsbury's, Waitrose, Morissons, Asda) UK supermarkets were included in the 2015 study.

Efforts to encourage consumers, especially dieters to utilise nutritional labelling systems has met with some success, but the trialled methods require the presentation of short videos, and implementing what was learnt to simulated shopping scenarios[153]. Finally, two other factors that have been discussed that are part of the recommendation for shifting consumer choices towards healthier diets, especially for low income groups, is the introduction of sugar taxes or fat taxes[154], which is likely to have an impact on reducing selections of branded high calorific foods and beverages[124]. While it is the case that consumers are price conscious, and so 'sin taxes' might be enough to shift them away from selecting some products, there are also concerns regarding the impact on households that are financially vulnerable. Moreover, fat and sugar taxes have not been shown to significantly impact the continuing growing rates of obesity, where sales taxes might be a expected to be a better solution[155]. One country that has tried to tackle obesity aggressively is Chile. It moved beyond the dissemination of nutritional information via labelling systems[156] to combine this with front of pack warning labels, restricted child-directed marketing, and a ban of sales in schools of all foods and beverages containing added sugars, sodium, or saturated fats that exceed set nutrient or calorie thresholds[157]. This has been shown to work based on a recent study by Tallie et al. (2020, n= 2383)[158]. In short, significantly shifting consumer behaviour towards healthier dietary habits requires a series of broad and long term measures, and where nutritional labelling systems alone have been used to shift behaviour, studies consistently show that this method alone has no reliable effects.

Food Labelling Targeting Specific Consumer Groups (for example allergens)

This section includes consumer groups that are especially motivated by medical reasons (specific food-allergic condition) or through lifestyle (for example vegan), to attend to food labels to inform their choices. Unlike the previous sections, this section focuses on the issues that consumers raise concerning the labels, since as self-motivated groups, it is fair to assume that they, by definition, are going to be attending to labels. Therefore, the

issue here is not attentional capture to motivate changes in behaviour but rather, given that labels are attended to, how can the labelling be improved.

Medical reasons: There are two types of labelling with respect to food-allergens, precautionary and mandatory[159] [160] [161] (see Figure 5). Precautionary allergen labelling (PAL), also referred to as advisory labelling, is voluntary and highlights to the consumer that one or more regulated allergens could be unintentionally (for example due to cross contamination) present in a product, and thus pose a risk to susceptible consumers (for example “may contain nuts”). For mandatory allergen labelling (MAL), as stated by the FSA[162], and in accordance with food law, food business are required to highlight (for example in underline and/or bold) the contents of packaged food that contain any of 14 allergens.

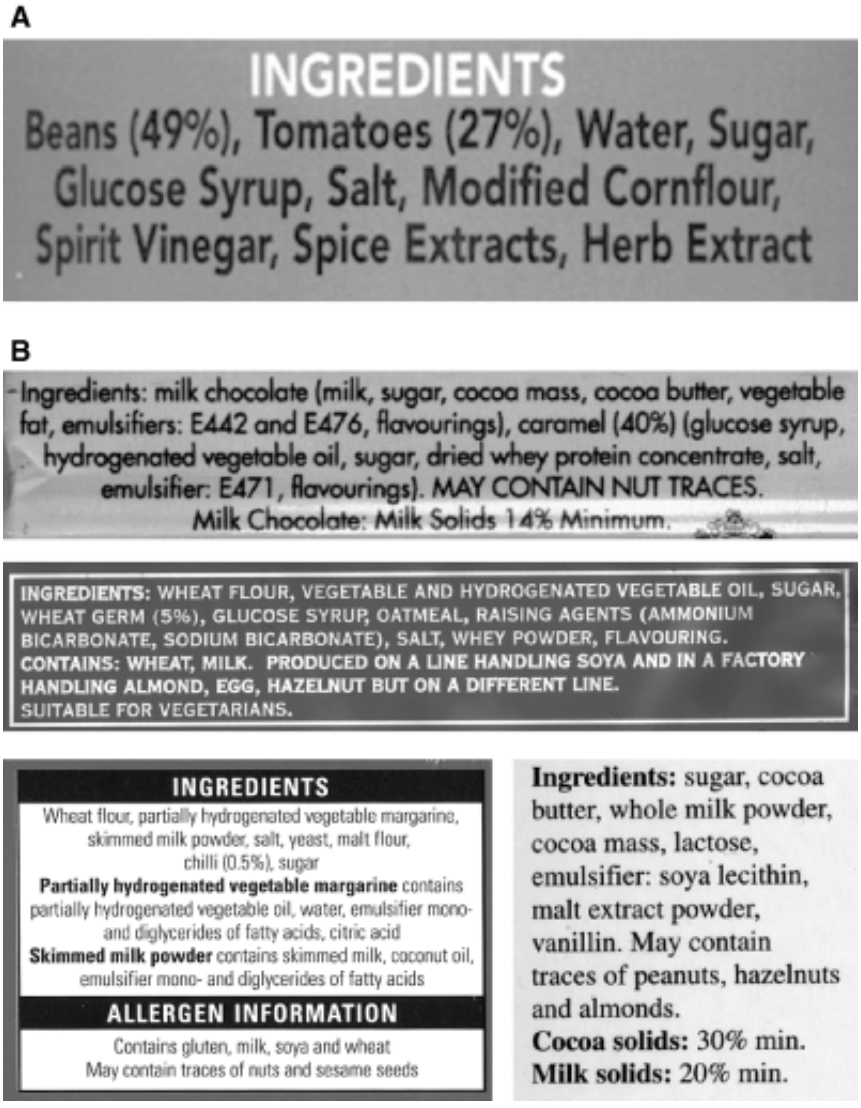


Figure 5. Examples of labels with different explicit claims regarding allergens.

Many of the studies available examine the impact of different types of labels containing information for food-allergic consumers, and converge on the same conclusions. The studies use a variety of techniques including surveys, interviews and ethnographic techniques where consumers are observed while in shopping environments. Food-

allergen consumers report problems [145] [146] [163] [164] [165] [166] [167] [168] [169] . These include issues with: 1) the readability of labelling (often the text is too small, and not well contrasted), 2) the placement of the labels (for example there was no pattern to where the critical information was presented on packages), 3) confusing and contradictory information, and 4) lack of harmonisation of labelling across countries (where food imports are concerned).

Across studies there is also convergence around best practices [145] [150] [151] [170]. Symbols indicating the presence of food allergens were judged helpful in making quick determinations of selection, but there is a stronger preference to have this accompanied with detailed text. Also, examples of food allergen labelling which is effective is often found in baby foods, and confectionaries. Specific details that ought to be contained regarding allergens are: 1) proportion of allergen content,(or a precautionary allergen label) 2) allergen management in the factory, 3) standardised allergen information format, 4) an allergen symbol on the front and back of packaging. Moreover, there is a willingness to use barcoding scanning systems either available at food stores or mobile phone applications[171] where critical information is easily available to food-allergen consumers[154] [172] . Though it is clear that while there might be interest in these kinds of technologies, particularly smart phone scanners which could be personalised to the consumer, as yet no work has been conducted to examine the extent of improvement of personalised technologies on: a) reducing exposure to negative health related incidents from food allergen consumption, b) the accuracy and efficiency of personalised applications on smart phone for food allergen consumers.

Lifestyle reasons: The most popular trending diets are gluten-free veganism, and vegetarianism[173]. In the latter two, personal dietary choices not only reflect health reasons but also values concerning ethical practices and environmental factors.

For those that do not have health conditions, the motivation for adopting a healthier life style is the primary reason for moving to a gluten-free diet[174] [175], where the other reason is having a family member or partner that has Coeliac disease, or other gluten sensitivity, and so by practical necessity, or solidarity, adopts a gluten-free diet. In addition, the gluten-free diet has received celebrity endorsement by athletes promoting health benefits. However, one concerning aspect of adopting this diet, for both coeliac and non-coeliac consumers, is that products specifically marketed as gluten-free (for example biscuits, cakes, pasta) often contain higher concentrations of salt and sugar to enhance the taste, thus making them unhealthy as a result. Thus, coeliac and non-coeliac consumers of gluten-free products are likely to attend to labels that indicate the products are gluten-free, but attend less to the nutritional contents[176] that indicate greater levels of sugar/ salt or less protein compared to non-gluten free counterparts[177] [178] [179].

Consistent with concerns highlighted elsewhere regarding food labelling, to date the most prevailing issues with vegan food labelling are that there is no uniform definition of vegan, and no standardised labelling format (see Figure 6), and a lack of consistent transparency and prominence of labelling of vegan products[180] [181] [182].

Figure 6. Examples of vegan food labels (taken from Gerke & Janssen, 2016). N.B. The labels vary according to four types: simple lettering, highlighted lettering, as part of the product name, as part of the brand name.[165]

In addition, of particular relevance to vegans and vegetarians is the fact that meat-based substitutes for meals that are typically meat-based presents a problem for how they are labelled and marketed. Consumers have a strong preference for retaining critical information that is indicative of the product for example 'vegan/vegetarian meatballs' rather than moving to new food product labels for example 'protein balls'[183]. A key reason for this preference is that referring to products by their traditional names accompanied by "vegan" or "meat-free" is enough to indicate the likely taste, texture, and cooking methods of the product, compared with an entirely new label[167]. Moreover, attracting meat-eaters towards plant-based equivalent meals (either ready-meals sold in food stores, or cooked meals in restaurants) requires efforts to carefully consider labelling[184], where labels indicating meat-free are preferred to those explicitly indicating that they are for vegans/vegetarians[185].

Take home message – Specific consumer groups

As highlighted at the start of this section, specific consumer groups, either motivated by medical reasons or lifestyle, are attentive to labels that are related to their dietary choices. Therefore, the literature that was surveyed highlighted aspects of the labels that are problematic, and where labelling could be improved. In the main, the issues are consistent with some of those highlighted in other sections, which is that labels need to be presented in ways that carry information clearly and accurately, which according to consumers, is still not the case. Definitions behind the concepts that the labels relate to need to be clarified in order to make the labels and what they mean consistent, as well as standardised across countries. There are also issues regarding nutritional content claims, particularly for products marketed at specific groups that are health conscious, where substitution of proteins or gluten often entail higher concentrations of fats, sugars and salts, which undermine or contradict the promotional front of pack health claims. Given that there may not be sufficient space to present critical information, especially for special consumer groups that have health conditions, alternative ways of sourcing information or else personalising information can be achieved via mobile phone applications, or barcode scanners in food stores.

Front of Pack Labelling

Some of the literature has already been covered with respect to details about information that is summarised at the front of packagaing concerning the details of the nutritional content of food (for example traffic light labelling [TLL] indicating levels of sugar – according to the ways academic literature has examined traffic light labelling not FSA traffic light labellings systems)[186] [187], and sustainable consumption (for example carbon footprint trust). Therefore, the focus here is to consider two other aspects of front of pack labelling: 1) salient informational sources (for example nutritional content claims, promotional offers, and celebrity endorsement, and 2) typically who attends to this kind of information (for example demographics). It is worth noting here that what is being reported is the way the academic literature refers to nutritional labelling and health claims, not what the specific terms mean with respect to "nutritional claims". Therefore, it is worth clarifying what the distinction is between the two. A nutrition claim is 'any claim that states, suggests or implies that a food has particular beneficial nutritional properties due to the energy, nutrients or other substances it contains, contains in reduced or increased proportions or does not contain' for example 'sugar free' or 'high in fibre'. Health claims are 'any claim which states, suggests or implies that a relationship exists between a food category, a food or one of its constituents and health'.

Much of the work looking at front of pack labelling examines the impact of health claims on consumer behaviour, primarily because many of the claims are used as part of several other marketing strategies (for example promotional offers, celebrity endorsements). Direct comparisons made between the impact of front of pack nutritional labelling and health claims is limited[188] [189] [190] [191] [192] [193], but of the work that has been conducted, there are a few key consistent findings. Consumers will attend more to health claims than nutritional labelling, where the health claims focus on positive aspects (for example Calcium may help improve bone density) compared with negative aspects (for example Diet rich in whole grain foods may reduce the risk of heart disease and some cancers). Consumers also find health claims more persuasive than nutritional labelling, and this does lead to behavioural change. In addition, consumers who are more health conscious (especially if they have developed particular illness, or because they want to improve their diet,) are biased towards attending to positive health claims over and above nutritional labelling. One reason offered for this is that simple statements regarding positive health claims are easier to interpret, and are generally used as as indicator of nutritional content[194] [195]. More specifically, regardless of the healthiness of the product's specific nutrient profile (for example sugar content, salt content), a general health claim is prioritised over inspecting the specific nutritional profile of the food product. This is also consistent with work examining the effects of allergen labelling on consumer choices, which shows that where it does influence consumers, labels such as "gluten free" are treated as indicating the healthfulness of the product, ignoring the fact that the same product may in fact be high in sugar and salt to increase its taste, making it less, rather than more healthy. This section examines evidence that concerns the different types of labels that appear on the front of packaging of food, in order to determine which types of labels have the most impact on consumer behaviour.

Salient front of pack information: A well regarded and cited empirical study by Dixon et al. (2014)[196] examined different types of front of pack marketing information and the potential influence on pre-adolescent children's choices. They looked at three common forms of front-of-pack promotions: health and nutritional claims (for example "high fibre" or "rich in omega 3"), health claims (for example "calcium helps improve bone density"), premium offers (for example buy one get one free), and celebrity endorsements (for example containing pictures of celebrities either picture holding or consuming the product). Children were asked to indicate their preferred choice from two comparable child-orientated food products; one of which had a healthier nutritional profile than the equivalent promoted alternative. Dixon found that, compared to the control condition (no promotion), children were significantly more likely to prefer the unhealthier food option containing energy-dense and nutrient-poor qualities which were found in the nutrient content claims condition and the celebrity endorsement condition. However, children who viewed the products with the Nutrition Information Panel (NIP) had more realistic perceptions of the healthfulness of the products, but viewing the NIP was not sufficient to weaken preferences for on-pack promotions. The same findings have been replicated in adult consumer samples[2 197], and through analysis of a variety of different food categories assessing disparities between nutritional content claims, promotional offers, and endorsements to actual nutritional scoring of the products[181 198 199 200 186].

For example, bread and breakfast cereals are two food product categories that have received considerable attention when examining front of pack content claims (for example 'no artificial colours or flavouring', 'preservative free', 'nutritious', 'Good source of fibre')[201 202 203 204 205 206 207]. Of particular interest are health claims as well as nutritional labelling on breakfast cereals targeted at children[208]. Much of the work examining bread and breakfast cereals converges on the conclusion that health claims and nutritional content claims overstate the actual healthfulness of products, such as breakfast cereals, though at least one study conflicts with this[174]; the reason for this inconsistency might be country specific, where manufacturers are more compliant with regulations in some countries, though empirical work is needed to support this speculation. In addition, products such as breakfast cereals and drinks that are not permitted to be sold to children because of their nutritional scores[209], are nonetheless targeted at children because they contain attractive messaging of interest to children (for example the contents include toys/stickers, or are celebrity endorsed). Combined with empirical evidence showing the strong persuasive impact of promotional offers, nutritional content claims and celebrity endorsements on front of packing, researchers investigating deviations of claims from actual nutritional facts indicate their concerns[210 211 212 213], especially since these labels appear to be the most reliable in influencing consumer choice behaviour when compared to official nutritional labelling. The key point here, as highlighted at the start of this section is that certain types of labels that appear on the front of packaging can be highly influential on consumer behaviour, but not necessarily in ways that benefit consumers. This is because the types of salient information that is used to influence consumer purchases (for example health claims, promotional offers, celebrity endorsement) often results in increases in purchasing of unhealthy food products.

Eye-tracking studies: One line of research worth mentioning here is the use of eye-tracking methods to determine which aspects of the front of packaging consumers orientate their attention towards. These types of studies have been conducted in the laboratory[214] [215] as well as in the field (i.e in shopping stores where customers wear eye tracking head gear while shopping)[216] [217], or simulated shopping environments[218]. Three general conclusions can be drawn from this work. First, as mentioned earlier in this report, the habitual nature of food shopping means that people spend very brief amounts of time attending to labels (for example average referred to by Machin et al., 2020 – 6.9 seconds)[189]. Second, consumers tend to prioritise what they attend to (for example price, brand), which reflects their need to introduce efficiencies into their shopping behaviours. The third is, even if attention is directed towards labels that contain information regarding nutritional content, this is no guarantee that the product will be selected. However, in general, the longer people attend to labels on a food package, the more likely they will end up selecting the product, so long as it is also within a particular price range.

Demographic characteristics: There is a substantial amount of work reporting that gender, marital status, socio-economic background, education level and general nutritional knowledge predict attention paid to front of pack and back of pack food labels [219] [220] [221] [222] [223] [224] [225] [226] [227] [228].

To address some of the sampling issues of previous studies, a recent survey by Bryla (2020)[229] based on a robust representative sampling (n= 1051) method examined the demographics of those that attend to front of pack and back of pack food labels. The survey was carried out online, where participants were invited to report on food items they purchase with questions referring to information that is either present on the front of pack or back of pack of food packaging[230]. None of the typical demographic characteristics were found to predict attention for front of pack and back of pack labels, but rather knowledge about a healthy diet, the level of importance attached to health claims, and fat content of food items did.

These findings are aligned with ethnographic work which suggests that the highest level of consensus is towards attending to price and quality of food items, with no clear characteristics of shoppers predicting attendance to labels related to health or sustainability[115]. The findings also align with earlier cross comparison work of preferences towards different types of front of pack nutritional labels conducted on European citizens[231]. Moreover, consistent with previous work reviewed here, food labelling alone, even when attended to, was not shown to be sufficient to determine the adoption of healthy diets.

FOP labelling targeting demographics: While it is worth understanding who typically attends to FOP and BOP labelling (particularly nutritional labelling), it is also worth considering some of the literature that has examined the way in which FOP labelling is designed to target specific groups[176] [232] [233] [234] [235] (for example age groups, ethnic groups). In the latter case, targeting of ethnic groups is often achieved through endorsement of celebrities of ethnic backgrounds that are the same of the target group. As with findings presented earlier in this section regarding front of pack labelling that

target children, the work presented here suggests that there are concerns about targeting specific ethnic groups. In the main, this is because the use of celebrity endorsements that are from the same ethnic group that is being targeted promote food products that are not necessarily healthy. Moreover, there is special concern that FOP labelling (for example celebrity endorsements, nutrient content claims, promotional offers) combined with digital marketing targeted at children[236] is contributing to a rise in childhood obesity[237]. Finally, there is work showing that when looking at the interpretability of FOP labels of food products in the UK, older adults (over 65-year old), people with lower levels of education, and those from lower social classes are less likely to be able to accurately interpret the labels. Minority ethnic groups also have difficulty in interpreting them[238] [239].

Take home message – Front of pack labelling

Concerns are raised in work examining the saliency of promotional offers, nutritional claims and health claims, and celebrity endorsements because of their highly persuasive nature. The reason is that where many of these mechanisms are combined, the negative impact on consumer choices is greater because these mechanisms are applied to products overstating healthfulness. Concerning still is the use of salient front of pack information that targets children, where again, the products themselves are not especially nutritional, but nonetheless are attractive to children, adolescents, and adults that are making purchases on behalf of their family.

The most robust work to date suggests that there are no clear demographic factors that predict attention directed towards either front of pack or back of pack food labels. The most reliable predictors are based on general interest towards and knowledge of health and nutrition. In general, work looking at front of pack labelling that targets specific groups suggests that there is sufficient attentional capture to motivate consumers (children, adolescents, adults) to purchase food products targeted at them. Often several factors combine to achieve this, including promotional offers, brand names, along with celebrity endorsement. In other words, the effectiveness of these types of labelling methods is because they match precisely with the factors that consumers prioritise the most when making their purchases – price, quality and value for money.

Country of Origin Labelling

Figure 7. Examples of country of origin labels.

When considering the effect of country of origin labels (CoOL), it is first important to define what exactly is meant by the term. Whilst straightforwardly defined for single, unprocessed products such as chicken, for processed or composite products, the term can either refer to the origin of the product (for instance, country of birth, rearing or slaughter), or the country where the 'last substantial change' occurred[240]. Notably, research has shown relatively low levels of consumer understanding for the term[241], which should be borne in mind when considering the extent to which CoO labelling influences consumer behaviour – even if effects are found, these may be based on misunderstandings of the label.

Balcombe et al. (2016) [242] selected a range of 12 meat products (for example, chicken breast fillets, bacon, beef lasagne), which differed on five attributes: price, CoO (UK, specific EU country, generic EU option or specific non-EU country, either presented in text, or with text plus flag), product quality (basic, choice or premium), farming system (organic or conventional) and quality assurance (no label, Freedom Food or International Quality label). Using a discrete choice experiment, UK participants were asked to choose between two product options, which varied on the five attributes. Results indicated a strong home country bias, with the UK CoO products always the most preferred, followed by the specific EU country. Participants were willing to pay more for UK products and required significant price discounts to consider non-UK products. However, the CoO was not the most valued attribute for the majority of the products, indicating the effects of CoOL may be limited to particular types of products, such as fresh/frozen meat rather than processed products. Whilst participants preferred the text and flag CoO format, this did not appear to influence choice, with similar levels of willingness to pay (WTP) seen for both formats.

More generally, results of research investigating the effects of CoO labelling are mixed[243], likely due to the diverse set of products and participants featured, as well as the variation in outcome variables measured – such as attitudes, evaluations, perceptions, preferences, WTP, purchasing intentions/behaviour[244]. Greater effects are observed when 'perceived quality' is measured versus attitudes or purchase intentions[245]. Generally, studies find that domestic food is perceived more positively than foreign food[246], which may be due to the belief that the former is safer and of higher quality[247] [248]. These beliefs are reflected in studies of consumer preferences – consumers prefer food products from their home country[249] and are willing to pay more for such products[250]. Its effects also vary according to product type and complexity = stronger effects are seen for high involvement, high risk products versus less 'everyday' than low involvement products such as coffee and bread[251]. There is however, limited research on the effects of CoOL on purchase intentions and behaviour – that which has been conducted has typically concluded CoO evaluations have "little or no direct influence on purchase intentions"[252] (p.39).

Moreover, the effects that are observed may not even be directly attributable to the information contained on the label per se, but rather what it represents to consumers conceptually. CoO information is suggested to be used as a proxy for other information

important to consumers, most typically product quality[253], but also other factors such as food safety and traceability[254,255].

Take home message – Country of origin

Research considering CoO effects conclude it is not a particularly important extrinsic cue for decision making[256], findings which are echoed in studies concerning food CoOL. The relative impact of CoOL appears to depend on the presence of other attribute information and quality cues, such as price and brand name[257]. For instance, effects of CoOL are (inevitably) greater when CoO is the only attribute presented for a product[258,259,260], which of course is not reminiscent of real life. Although over half of consumers (62%) reported looking at the information when making a purchasing decision, only 3.5% cited it as a reason for their choice[261]. Instead, price and quality are perceived by consumers to be more important[262].

Additives Labelling

Figure 8. Examples of additive labelling.

Additives can be defined as ingredients which are added to food in order to fulfil a particular function and are typically grouped according to this function, for instance ‘preservatives’ refer to additives that are used to keep food safer for longer[263]. The majority of research on additives has focused on consumer understanding and perceptions, rather than behaviour change following information provision via labelling. Often studies find that food additive labels are perceived as informationally inadequate or difficult to comprehend[264 265]. Studies have also found relatively low levels of knowledge regarding the differences between various flavourings[266] (as defined by regulators), which indicates that the presence of a label does not necessarily mean the label will be understood in the correct way, and thus have the desired or intended effect.

Food additives are typically perceived as unnatural, unhealthy, frequently met with scepticism and distrust[267 268] and as such, consumers often seek to avoid them[269]. If foods without additives are not available, consumers choose those with natural additives over artificial additives[270]. Research specifically investigating ‘additive free’ labels and their effects have focused on consumer perceptions, with products labelled as ‘additive free’ typically perceived positively and associated with lower safety concerns[271]. The format of the label (whether the additive is presented as an e-number or description) has been found to influence consumer perceptions. The same product was perceived as less

natural when it was labelled with a food additive listed as an e-number (for example E330) versus one described with its chemical name (for example citric acid)[272]. However, there might be a tipping point following the complexity of the chemical name, with greater risk perceptions for additives which were harder to pronounce[273].

Research considering decision-making in relation to additives has typically featured more general labels such as 'free-from', 'X free', 'no X added', 'natural' or 'clean labels'. Findings from these studies are mixed and have demonstrated the influence of additional factors (other than label) on decision-making, such as knowledge and product type. Consumers who showed an awareness of food additives were willing to pay more for a wine which was labelled as 'antioxidant free' though the opposite pattern occurred for those who were knowledgeable about wine [274]. The presence of 'all natural' labels increased purchase likelihood, but this effect differed across food categories, with increased purchase intentions for products such as cheese and milk, and lower purchase intentions for products such as pork[275]. For those who believed the 'all natural' label was associated with no preservatives, the products were also perceived to be better tasting, more nutritious and safer, which increased intended likelihood of purchase.

Findings from research on clean labels can also indirectly inform our understanding of the effect of additive labels. The term 'clean label' is not well defined, but is typically understood as referring to product labels which do not have negatively perceived ingredients in the list, such as artificial or chemical sounding additives[276]. Again, however, this research is mixed – although clean label products (described as 'All natural, organic, GMO, free from artificial preservatives and colours') are perceived as more nutritious, healthier and safer, these perceptions do not always translate into increased WTP for such a product[277]. Whilst some studies have indicated participants would pay a premium for such clean labelled products, this preference differed across different demographic groups[278] [279] and thus cannot be said to be consistent. For instance, those with lower incomes are less WTP for such products.

Take home message – additives

Much of the psychological research on additive labelling has focused on consumer perceptions, acceptance and risk perceptions. That which has examined decision-making has primarily used laboratory WTP tasks, which do not provide strong support for the notion that additive labelling induces behaviour change in the real world. Indeed, despite the fact that food additives have been present, scientifically tested and regulated for a long time (relative to more novel technologies), there still exists the belief that they do not belong in food – the 'paradox of e-numbers'[280]. The fact that such distrust regarding additives still remains despite such prolonged regulation suggest that labelling does not always lead to habituation[281]. The proliferation of 'clean labelling' means that the issue of trust is likely to become even more prominent for consumers in the future, given the labelling of such products is currently not regulated.

Labelling of Organic Food Products

Figure 9. Examples of organic labels from the a) Soil Association b) Organic Farmers & Growers CIC and c) European Union.

The majority of research focusing on the effects of organic labels has focused on two questions – how are food products labelled as organic perceived by consumers and how much are consumers willing to pay for such products? Generally, organic labelled food products are perceived positively – the 'organic halo effect'. They are perceived as healthier, more nutritious and more environmentally friendly, with such benefits extending to improved taste perceptions and perceived safety of consumption[282]. It is therefore unsurprising that such positive perceptions translate into increased WTP for organically labelled products, consistently found in a range of samples[283] [284]. However, the effect of the label does appear to depend on contextual factors, such as: the type of product (how processed it is, whether it is a vice or virtue product)[285], brand equity[286] and the format of the label/its description. More positive perceptions are observed for certification logos versus a generic organic logo[287], with increased WTP for certified organic labels [288, 289], attributed to increased levels of trust. Higher preferences for organic food were observed when a jam was described as '100% organic' versus '95% organic' or 'with organic blueberry'[290]. However, the presence of an organic label does not always equate to increased purchase intentions[291]. Studies in the US comparing USDA organic labelled products versus one where this label was absent revealed no difference in the likelihood of purchase and crucially, an expectation that organic products cost more[292].

Whilst useful, results from such experiments on perceptions and WTP cannot be said to demonstrate substantive evidence of behaviour change, for a number of reasons. The first reason relates to the methodology of such studies – typically, studies pick one or two products, simplify their packaging and vary the presence or absence of an organic label. In reality, consumers will have further attributes to base their decision on, including brand, packaging and price promotions. Secondly, the majority of studies have taken place within the laboratory, where likelihood of purchase decisions are far removed from real-world contexts in which factors such as price are far more important for organic purchase intentions[293]. They also ignore consumer reliance on other information sources such as the internet and word of mouth when making purchasing decisions[294].

Perhaps the biggest limitation for the claim that organic labels substantially influence behaviour is the literature examining understanding of such labels. Studies consistently find that knowledge about organic labelling and certification standards is low, with little awareness of monitoring/inspection systems or of how labels differ from each other in terms of the standards required[295] [296]. For instance, although the USDA organic logo

requires 95% of ingredients to be organic, perceived average content was far lower[297]. A common finding in the literature is that the terms ‘natural’ and ‘organic’ are confused and assumed to be equivalent, with overestimation of standards perceived for the natural label [298] [299] [300], with such confusion influencing food purchasing behaviour[301], increasing purchases of ‘natural’ products. Studies featuring UK participants have consistently found low levels of recognition for European Union and Organic Farmers & Growers organic labels, with the highest levels of recognition were found for the Soil Association logo [302] [303]. Many of the sustainability labels such as the Red Tractor and Fairtrade are mistakenly perceived as organic[304]. Given the diversity in understanding of such labels, it becomes near impossible to claim that any effects on behaviour change are specifically due to these labels.

Take home message - Labelling of organic food products

Even if one overlooks the fact that organic labels are commonly misunderstood, there is little evidence that consumers pay much attention to them, or actually use them when choosing products. An eye-tracking study of nine different products with organic and regional labels found that the label was not the most attended to zone for any of the products. For the majority of products, the brand received the most amount of attention[305]. In addition, a lack of trust in the label and government regulations[306] often means that consumers use other proxies, such as taste, texture and freshness when making purchasing decisions[307]. Given that organic products are **credence** goods, whereby customers cannot verify the attribute even after purchase or the consumption of the food [308], the issue of trust in the label is paramount [309] [310]. Even if the label is present, there is no guarantee it will be trusted and thus used in decision-making. Coupled with the fact that over half of consumers buy no, or proportionally very little organic food[311] and show generally low levels of interest in and low use of organic labels[312] [313], it does not seem that organic labelling is an overly effective technique for inducing behaviour change.

Labelling of Meat Alternatives

Figure 10. Examples of meat alternative labels.

Psychological research on meat alternatives has grown over the last five years, though remains considerably less researched than the other topics considered in this review (for

example nutrition, ecolabelling). The majority of studies have focused on consumer acceptance and perceptions of such products, primarily focusing on differences between terminology such as ‘meat-free’, ‘synthetic meat’, ‘clean meat’, ‘lab-grown meat’, rather than focusing on choices for specifically labelled products[314 315 316]. Research consistently finds that meat-alternatives are perceived negatively[317], with terms such as ‘cultured meat’ or ‘in-vitro meat’ met with disgust and perceived as unnatural[318 319]. When studies have compared more traditional labels, such as ‘vegan’, ‘plant based’ and ‘meatless’, ‘plant-based’ is typically more positively perceived than ‘vegan’[320].

Some studies have explored WTP for meat alternatives. One (non-peer reviewed) study compared WTP for cell-based products described either as ‘clean meat’, ‘meat 2.0’, ‘pure meat’, ‘safe meat’ and ‘cultured meat’, and found the highest WTP for ‘clean meat’ [321]. Positive associations for the term ‘clean meat’ have been replicated[322], with the term also associated with increased behavioural intentions, such as willingness to try, or buy the product regularly, as well as eating it instead of conventional or soy-based meat[323]. However, in experiments comparing meat alternatives with conventionally produced meat, meat alternatives still remain unpopular choices[324 325]. Terminology such as ‘meat-free’ has consistently been noted to discourage consumers from choosing vegetarian products[326]. Notably, choices for such products were highly sensitive to price and brand information[327 328]. Indeed, attributes such as affordability remain a strong influence of purchase intentions for meat-alternatives.[329]

Take home message – labelling of meat alternatives

Despite the lack of research measuring consumer choice, it seems reasonable to suggest that, as has been identified in previous sections, that labelling of meat alternatives is unlikely to induce substantial behaviour change, with factors such as price, brand and quality far more important to consumers. The former factor is likely to be a particular limitation for the success of meat alternative labelling, given that such products are typically more expensive[330]. Furthermore, given that vegetarians and vegans represent a significant proportion of consumers of meat alternatives, and deliberately do not eat meat often for ethical reasons[331], trust in the label and associated regulation is likely to be central to decision-making regarding meat alternatives.

Conclusions and Recommendations

This section is divided into three sections. First, the general conclusions are presented in context of the four target questions this review set out to address. Second, gaps in the literature and emerging trends for future exploration are presented. Third, recommendations are outlined, drawn from the theoretical and empirical base on which this rapid review has been conducted.

1. Answering the Four Target Questions

(1) What impact (if any) does food labelling have on consumer decision-making?

The limited time (approximately six to ten seconds on average) consumers spend attending to food products means that there is a restricted slot for any of the multitude of food labels to have a chance of impacting choice behaviour. Of the many types of food labels that appear on pre-packaged food products, the labels that consumers are likely to attend to most, and that will have a direct impact on their purchasing decisions are those that carry information regarding price, quality and value for money. Specific consumer groups that have particular motivations to attend to labels (for example for medical or lifestyle reasons) will make purchasing decisions based on food labels that contain information other than price, brand, and value for money.

In the main, a vast body of meta-analytic work and systematic reviews, as well as many recent individual empirical studies, suggest that food labels such as those containing information about nutrition, food safety information, organic status or sustainability consumption do not reliably change consumer behaviour towards healthier, safer, or environmentally friendly food choices.

(2) What are the most persuasive aspects of food labelling that impact consumer decision-making? (2a) What are the reasons behind the persuasiveness of some food labelling to change behaviour? (2b) What factors limit the persuasiveness of food labelling on behaviour change?

In the main, front of pack (FOP) labelling that contains nutritional content claims, celebrity endorsements and promotional offers are the most persuasive labels on pre-packaged food. The reason that these labels in combination are so persuasive is that they complement the common interests of consumers which are price and value for money that are targeted by promotional offers, and quality often targeted by celebrity endorsement. Nutritional content claims on FOP labels are an effective marketing strategy, but require scrutiny given that claims may not precisely align with the actual nutritional value of the food product.

To understand what the limitations are on the persuasiveness of food labelling, it is worth considering the work conducted on special consumer groups, because they are in effect the most reliable captive audience for food labels. Work examining these groups (either

motivated for medical or lifestyle reasons) suggest that style of labelling (for example too small), content of labelling (for example information is contradictory or ambiguous), and inconsistency in the labels used across countries (for example there is no harmonisation or standardisation of food labels) are common issues. Thus, even for groups that are significantly motivated to attend to food labels, there appear to be problems with the labels such that they do not yet communicate the essential information in an accurate, easy to process format.

While it is the case that consumer prioritise price, quality and value for money above most other factors, some consumers are motivated by issues concerning health and sustainable consumption. However, consumers also scrutinise the information that they can rely on, because it can be trusted and is easy to process. Bold nutritional claims, paired with promotional offers, branding, and price are effective because there is most consensus on what they mean, which make them less ambiguous and more easily trusted. This also explains why labelling of this kind is most effective, because price and information about the product are often combined. This provides vital clues as to how labels concerning health, safety and sustainability need to be improved and paired with pricing systems in order to generate effective behavioural change.

2. Gaps in the Literature and Emerging Trends

Electronic-labelling (alternatively referred to as smart labelling, e-labelling) and AI-Automated support systems It is worth highlighting that the technologies, the type of labelling, and the function of the labelling differ hugely, and only indicate one small part of a bigger emerging set of disruptive technologies which will change the way in which food is sold, and how shoppers make their choices[332]. The literature in these areas is still nascent, and so more work needs to be done to track which labelling methods and technologies are currently in use, or will be in use in the next 5 to 10 years. In addition, it would be important to also assess which technologies will be adopted in the near future, what attitudes consumers have towards them, and their likely adoption into their food shopping habits.

- **Labelling systems to support retail:** Stores are now adopting electronic shelf labelling. This is where the displays of the price can be updated daily (which otherwise has to be done by hand), and can also display the barcode, descriptions of the product itself, and country of origin[333]. The function of this system is to increase the efficiencies in price adjustments that are made frequently. Also, there have been developments in the direction of smart packaging. This is where packaging contains chemical and biosensors to monitor the quality and safety of food (for example sensing freshness, presence of pathogents, CO_2, O_2, pH, temperature, and other relevant indicators)[334] [335]. Finally, in the context of food safety, block chain[336] technologies are being used to develop a framework for digitising food production, so that retailers (and regulators) can track food production, along with tracing back the origin of an outbreak[337].

- **Automated systems to support retail:** The next level up are AI systems that utilise in store (as well as online) shopping behaviour to anticipate customer demand, automation of store operations, as well as price optimization[338].
- **Labelling systems to support consumers:** Several bricks and motor stores already have price scanners that enable shoppers to scan the barcodes of food items, which are an efficient way for consumers to track the cost of the shopping basket/trolley of goods. For instance, barcodes can be used to communicate details regarding the nutritional value of foods (for example changeforlife- a barcode scheme developed by PHE[339]); the findings suggest some limited uptake, and in turn limited success in achieving behavioural change in improving nutritional consumptive habits [340] [341] [342] [343]. Electronic coupons, as well as QR-codes which are a matrix barcode, can contain more information about the product aside from price. Combined with a smart phone, a variety of labelling methods can be used to inform consumers of promotional offers; though uptake of these different modes of communicating promotional offers is still mixed[344] [345]. Nonetheless, this is of particular interest to consumers, because they expect that their shopping experiences in actual stores need to match their online experiences, for which they have easy access to information regarding in-store promotional offers. Also, for specific consumer groups, such as those with food allergies, there is certainly interest in having scannable food products to make better informed food choices[346].
- **Automated systems to support consumers:** There are two forms of decision-support systems where the methodology is currently being trialled. These decision-support tools, while early in development, are likely to signal a pattern of consumer behaviour of the future. The first is assisted decision-support systems, where an application on a smart phone or on laptop can be activated to help make recommendations for a shopping list (to be used online or in bricks and mortar stores). It is based on past preferences, so that it can tailor recommend promotional offers, as well food options such as nutritional meals[347]. The future of shopping may also be in the form of automated assisted decision-support systems[348]. These systems entail a move away from active choice that recommender systems still ofter, but instead fully automate choices. In sum this would mean the selection of weekly food shops is entirely automated, once consumers enter their budget and other key preferences.

3. Conclusions and Recommendations

Conclusions

(1) Food labelling that contains information other than price, brand, quality, value for money, or promotional offers, has had limited persuasive power to change consumer behaviour (for example in the direction of sustainable, healthy, safer choices). This is largely for two reasons: consumers spend a matter of seconds on each food item

they select, and because of this, consumers prioritise, price, brand, and value for money above all else.

(2) The food labelling landscape is made all the more complex given that the concepts behind the labels are unclear because they are themselves multi-faceted (for example sustainable can mean low CO_2 emissions, ethically grown/sourced/ produced, organic), the scoring of the concepts varies by country (for example traffic light labelling of nutrition), and there is inconsistency in how stringently the conditions are applied (for example mixed levels of stringency for warnings of the presence of food allergens by country and label type).

(3) A vast number of studies, and meta-analyses indicate that food labelling alone is not a sufficient method to support positive behavioural change (for example towards sustainable, healthy, safer choices) unless other types of methods are used. These can include combinations of taxes and subsidies (for example a redistributive pricing mechanism) or other behavioural change methods (for example schemes like **Fresh Street (UK, 2020)** [349] - a community based intervention combined with a voucher scheme to increase uptake of fresh fruit and vegetables; a **Thursday Veggie Day (Belgium, 2009)** community and school intervention involving NGOs and government support [350] [351]). They also involve matching the different **types of consumers** to interventions to target different lifestyles and thus avoiding a one-size-fits-all strategy[352]; as well as developing methods for disrupting habitual habits at the point of choice[353] [based on eye tracking work] and counter-advertising methods that encourage scepticism around the front of package promotional claims of health[354]).

Recommendations

(1) Efforts to improve the quality and accuracy of information that food labels contain, and represent is necessary for two reasons: 1) thinking currently – a) due to their role in communicating statutory food safety information and b) special consumer groups depend on food labels (for example food allergens) and so efforts to coordinate food labels across countries to improve the accuracy and consistency of the information labels contain/refer to is still necessary; 2) thinking ahead – there will still be a demand for accurate food labels because smart/AI technologies such as assisted and automated decision-support systems will either base their recommendations or even make choices on behalf of the consumer from the details contained on food labels.

(2) Efforts to achieve behavioural change in the direction of sustainable, healthy and safer food choices requires a considerable co-ordination of multiple methods: choice incentivizing (for example subsidies, taxes, vouchers) and choice preserving (for example community schemes, school schemes), which require trialling before launching on a population-wide scale. While these methods in combination require efforts to ensure trialling them before implementation on a wide scale, it is worth noting that the impact on behaviour is unlikely to be detected within a short time scale (for example weeks, months). The evidence based thus far suggests that this type of approach leads to sustainable and generalisable behavioural change, but in the long term (for example 6 months, 12 months).

(3) In support of the emerging technological innovations in retail, and given the vast knowledge gaps that persist, this project presents some insights from a recent behavioural survey that examines the beliefs, attitudes and expectations of the efficacy of three types of interventions: smart applications (e.g assisted/automated smart systems), financial (for example taxes, subsidies), behavioural (for example labelling, campaigns).

Appendix 1. Investigating Attitudes and Willingness to Adopt Different Behavioural and Technological Interventions to Increase Healthier and More Environmentally Sustainable Food Choices – A Survey

Study Rationale

The rapid review has identified a vast amount of work examining the efficacy of different food labels on changing behaviour towards healthier, safer, and more sustainable food choices. However, there is a considerable gap in current understanding of peoples' views on different behavioural measures, such as labelling, and other technological innovations to promoting behavioural change relative to each other. In other words, when presented with a range of different types of interventions, which do people judge to be most influential and most ethical? Which interventions are people most likely to adopt to achieve potential positive behavioural change?

Aims of the Study

To date, there has been no comprehensive examination of the attitudes towards, and willingness to adopt a variety of behavioural interventions (labelling, public campaigns) and new technological innovations that utilise food labelling to assist in consumer choices (for example recommender systems, autonomous shopping systems). In light of this, the current empirical study aimed to reduce this gap.

Research Questions

1. Which behavioural interventions currently in operation, and forecasted technological innovations are:

a) consumers most willing to adopt?

b) perceived as most ethical?

c) perceived as most influential in achieving behavioural change?

2. To what extent do motivations to change behaviour influence likely adoption of the different types of interventions?

3. To what extent do demographic factors play a role in the adoption of particular interventions?

4. What do consumers understand by the notion of 'environmentally sustainable' food choices?

Method

Participants

A total of 400 participants were recruited via the survey platform Prolific Academic[1] , comprising of 119 participants worldwide who took part in the pilot, and the final sample of 281 who were UK nationals, currently living in the UK and aged between 18-75 years. For final sample characteristics, see Table 1. The study took approximately 10-12 minutes to complete and participants received £1.10 for taking part. Ethical approval was granted from the Queen Mary University Ethics Board - QMREC1948.

Table 1: Characteristics of sample.

Gender

Categories	**Percentage in Study**	**n**
Male	21.7	61
Female	76.5	215
Other	1.4	4
Prefer not to say	0.35	1

Age

Categories	**Percentage in Study**	**n**
18 – 24	42.0	118
25 - 34	28.1	79
35 - 44	17.1	48
45 - 54	5.7	16
55 +	7.1	20
Prefer not to say	0	0

Education

Categories	**Percentage in Study**	**n**

[1] Prolific Academic survey platform

Primary	7.1	20
Secondary (GCSEs)	41.3	116
Higher or further education (A-Levels)	35.6	100
Undergraduate	14.2	40
Postgraduate	1.1	3
Doctoral	0.7	2

Income

Categories	Percentage in Study	n
< £10,0000	9.6	27
£10,0000 to £19,999	12.8	36
£20,000 to £29,999	17.1	48
£30,000 to £39,999	10.7	30
£40,000 to £49,999	15.3	43
£50,000 to £49,999	7.1	20
£60,000 to £49,999	5.3	15
£70,000 to £49,999	3.2	9
£80,000 to £49,999	1.8	5
£90,000 to £49,999	2.1	6
£100,000 to £149,999	1.8	5
£150,000 +	2.8	8
Prefer not to say	10.3	29

Children under 18

Categories	Percentage in Study	n
Yes	23.1	65
No	76.5	215
Prefer not to say	0.4	1

Dietary preferences

Categories	Percentage in Study	n
None	76.5	215
Pescatarian	5.0	14
Vegetarian	8.2	23

Vegan	3.2	9
Other	6.8	19
Prefer not to say	0.4	1

Frequency of meat eating

Categories	Percentage in Study	n
Seven days a week	15.8	34
At least five days a week	40.0	86
At least three days a week	29.8	64
At least one day a week	12.1	26
At least once a fortnight	2.3	5

Questionnaire and Procedure

The study was run using Qualtrics. Participants were first asked to respond to a number of demographic questions, including age, gender, education, income and if they had children under 18 years (see Table 1). Participants were also asked to indicate if they had any specific dietary preferences and if applicable, they were asked how frequently they ate meat.

Firstly, participants were asked to indicated their general motivation to change their shopping habits in line with a) more environmentally sustainable food choices and b) more nutritional food choices, on a slider scale from 0 (No motivation to change) to 100 (Completely motivated to change). On the next screen, they were asked to write what they understood by the term ‘environmentally sustainable food choices’ in a free text response box. Then, participants were presented with a list of 18 behaviours/food choices (see Table 2) and asked to select those they would classify as ‘environmentally sustainable’. They were then asked to indicate which of those behaviours/food choices they selected they engaged in on a regular basis.

Table 2: Understanding of ‘environmentally sustainable’ behaviours/food choices.

Food choices/behaviour	Percentage classifying as environmentally sustainable	Percentage indicating they engaged in on regular basis
Reduce meat consumption	25.3	14.4
Reduce dairy consumption	19.0	8.4
Buy organic food	19.2	5.9
Buy Fairtrade food	18.3	7.2

Food choices/behaviour	Percentage classifying as environmentally sustainable	Percentage indicating they engaged in on regular basis
Reduce alcohol consumption	5.0	2.5
Buy less processed food	22.2	12.0
Buy locally grown food	30.2	12.3
Buy seasonal food	25.1	12.8
Buy low carbon food	25.4	1.9
Buy less pre-packaged food	28.2	15.9
Buy food only in the place of origin	19.2	1.1
Eat fewer foods high in fat, salt and sugar	4.5	2.0
Eat more plants	18.9	11.9
Reduce food waste	30.0	23.8
Eat more healthily	9.1	7.0
Adopt a vegetarian/vegan diet	19.5	5.9
Eat more variety	5.2	3.3
Grow own food	28.5	7.4

For the main part of the study, we identified three types of interventions which could be used to elicit behaviour change: smart applications (technological), financial and behavioural, each of which consisted of six specific interventions (see Table 3).

Table 3: Interventions referred to in the study.

Intervention Type	Specific Intervention
Smart Applications	An application on a smart phone/online that RECOMMENDS options based on the most NUTRITIONAL food options for you for your weekly shop.
Smart Applications	An application on a smart phone/online that AUTOMATICALLY SELECTS ALL YOUR options based on the most NUTRITIONAL food options for you for your weekly shop.

Intervention Type	Specific Intervention
Smart Applications	An application on a smart phone/online that RECOMMENDS options based on the most ENVIRONMENTALLY SUSTAINABLE food options for you for your weekly shop.
Smart Applications	An application on a smart phone/online that AUTOMATICALLY SELECTS ALL YOUR options based on the most ENVIRONMENTALLY SUSTAINABLE food options for you for your weekly shop.
Smart Applications	An application on a smart phone/online that gives you an OVERALL NUTRITIONAL SCORE of your weekly shop according to latest recommended health guidelines.
Smart Applications	An application on a smart phone/online that gives you an OVERALL CARBON FOOTPRINT SCORE of your weekly shop according to latest recommendations for environmentally sustainability.
Financial	A system where low nutritional food options are taxed (for example sugar tax, salt tax, fat tax) and the money from the taxes is used to subsidize (i.e. reduce costs) the most nutritional food options in your weekly shop.
Financial	A system where low environmentally sustainable food options are taxed (for example carbon tax on red meat) and the money from the taxes is used to subsidize (i.e. reduce costs) the most sustainable food options in your weekly shop.
Financial	A system where low nutritional food options are taxed (for example sugar tax, salt tax, fat tax) to discourage the choices of low nutritional food options.
Financial	A system where low environmentally sustainable food options are taxed (for example carbon tax on red meat) to discourage the choices of low environmentally sustainable food options.
Financial	A scheme where you can apply for a discount voucher of £10 off your fruit and vegetables weekly shop, if you scan your shopping receipts every time you shop.
Financial	A scheme where you can apply for a discount voucher of £10 off your weekly shop when you buy low carbon footprint meals, if you scan your shopping receipts every time you shop.

Intervention Type	Specific Intervention
Behavioural	Local events in schools [for pupils and parents] arranged to encourage nutritional food choice through taste-testing of vegetarian/vegan/meat substitute foods, on-stage cooking courses, goodie bags with, products, a recipe booklet.
Behavioural	Local events in schools [for pupils and parents] arranged to encourage environmentally sustainable food choice through taste-testing of ethically sourced/organic/local foods, on-stage cooking courses, goodie bags with, products, a recipe booklet.
Behavioural	Public campaigns explaining the reasons behind how adopting specific food options would make a direct positive impact on healthy eating.
Behavioural	Public campaigns explaining the reasons behind how adopting specific food options would make a direct positive impact on the environment.
Behavioural	Improvements to food labelling on food products to help decide which food options are the most nutritious.
Behavioural	Improvements to food labelling on food products to help decide which food options are the most environmentally sustainable.

For each type of intervention, participants were asked to rank the six specific interventions (presented randomly) in the order that they would be willing to adopt them, from most to least likely to adopt. After ranking, participants were presented with the specific intervention they were most willing to adopt, and asked a) to what extent they thought it would encourage them to positively change their shopping habits and b) to what extent they thought it was ethical (where ethical meant that even if the method was implemented, they would still be able to overrule it and choose what they wanted freely). Finally, participants were asked to indicate whether they would want each method of influence to be used to influence their food choices, answering ‘Yes’ or ‘No’ for the three types of intervention. Then participants were thanked, debriefed and re-directed to claim their reward.

Results

General motivation to change

Participants were significantly more motivated to change their shopping habits in line with more nutritional food choices (M= 70.49 SD= 19.50) than more environmentally sustainable food choices ((M= 62.14 SD= 24.09), $t(280) = 5.86$, $p < .001$).

Smart applications

The recommender system for sustainable food choices was generally the most highly rated intervention across all three dependent variables (willingness to adopt, likely change in behaviour and ethicality). The application which generated an overall environmental score (carbon footprint) was also rated similarly highly in terms of ethicality versus the recommender system for sustainable food choices (see Table 4).

Table 4: Ratings for smart applications.

Intervention	Percentage selected as top ranked option (willingness to adopt)	Ratings of likely change in behaviour (0 to 100)	Ratings of ethicality (0 to 100)
Recommender system-nutrition	23.13	66.42	74.77
Automatic selector-nutrition	9.61	68.74	69.22
Recommender system-sustainable	35.59	82.17	80.46
Automatic selector-sustainable	6.05	71.41	72.06
Nutritional score	16.01	68.6	69.27
Environmental score	9.61	74.67	80.70

Note: Highlighted cells indicate highest ratings.

82.21% would want smart applications to be used to influence choices.

M = 70.11 (*SD* = 18.74) Average rating of likely change in behaviour.

M = 75.79 (*SD* = 21.74) Average ratings of ethicality.

Financial interventions

The discount voucher scheme for buying fruit and vegetables was generally the most highly rated intervention across all three dependent variables (willingness to adopt, likely change in behaviour and ethicality). The discount voucher scheme for buying low carbon footprint meals, as well as a tax on low nutritional value foods was also rated similarly highly in terms of likelihood of inducing behaviour change (see Table 5).

Table 5: Ratings for financial interventions.

Intervention	Percentage selected as top ranked option (willingness to adopt)	Ratings of likely change in behaviour (0 to 100)	Ratings of ethicality (0 to 100)
Tax + subsidies - nutrition	10.32	69.79	70.69
Tax + subsidies - environmental	13.17	75.30	71.03
Tax nutrition	2.14	79.17	66.33
Tax environmental	2.14	62.83	65.17
£10 voucher - nutrition	45.20	79.61	82.35
£10 voucher - environmental	27.05	79.23	79.30

Note: Highlighted cells indicate highest ratings.

90.39% would want financial interventions to be used to influence choices.

M = 77.56 (*SD* = 20.28) Average ratings of likely change of behaviour

M = 78.12 (*SD* = 20.46) Average ratings of ethicality

Behavioural interventions

Improvements to food labelling regarding environmental sustainability was the most popular behavioural intervention in terms of willingness to adopt and was perceived as the most ethical, though improvements to food labelling regarding nutrition also received high ratings of ethicality. The latter intervention received the highest ratings in terms of likelihood of inducing behaviour change (see Table 6).

Table 6: Ratings for behavioural interventions.

Intervention	Percentage selected as top ranked option (willingness to adopt)	Ratings of likely change in behaviour (0 to 100)	Ratings of ethicality (0 to 100)
Taste testing in schools - nutrition	13.52	61.87	79.21
Taste testing in schools - environmental	11.03	67.10	76.65
Public campaigns nutrition -	6.41	70.11	70.39
Public campaigns - environmental	6.76	64.74	79.95
Labelling - nutrition	30.60	72.38	81.34
Labelling - environmental	31.67	69.88	83.11

Note: Highlighted cells indicate highest ratings.

72.95% would want behavioural interventions to be used to influence choices.

M = 69.06 (*SD* = 21.43) Average ratings of likely change of behaviour

M = 80.28 (*SD* = 20.86) Average ratings of ethicality

General type of intervention

Popularity

Looking at the range of specific interventions for each of the types of intervention for achieving behavioural change (smart applications, financial, behavioural), and only focusing on the most popular rated option.

The most popular rated option (across all interventions) was introducing a discount voucher scheme for money off more nutritious food options. However, the recommender system for environmentally sustainable options was rated as the most likely to lead to personal changes in behaviour, and the labelling of environmentally sustainable options was judged to be the most ethical overall (see Table 7).

Table 7: Most popular intervention for each type.

Intervention	Percentage selected as top ranked option (willingness to adopt)	Ratings of likely change in behaviour (0 to 100)	Ratings of ethicality (0 to 100)
Smart Application: Recommender system - sustainable	35.59	82.17	80.46
Financial: £10 voucher - nutrition	45.20	79.61	82.35
Behavioural: Labelling - environmental	31.67	69.88	83.11

Implementation preference

Here we look at the percentage of respondents that would want the three types of interventions (smart applications, financial, behavioural) to be used to influence food choices (with the response yes/no). Significantly more participants responded yes to the financial interventions (90.39%) compared to smart functionalities (82.21%) or behavioural interventions (72.95%), (χ^2 = 28.80, p = < .001).

Likelihood of change in behaviour

Here we look at the average overall ratings (scale from 0 to 100) estimating the likelihood of the three general methods (smart applications, financial, behavioural interventions) to lead to personal behavioural change. Financial interventions were perceived as the most likely to lead to personal behavioural change (M= 77.56, *SD* = 20.28) versus behavioural interventions (M= 69.06, *SD* = 21.43) or smart applications (M= 70.11, *SD* = 18.74). The differences here are significant (one-way ANOVA, *F* (2,840) = 14.80, p < .001). A post-hoc Tukey test showed that financial interventions were significantly different from the two others, with no significant differences between behavioural interventions and smart applications.

Perceived ethicality

Here we look at the average overall ratings (scale from 0 to 100) estimating the ethicality of the three general methods (smart applications, financial, behavioural interventions). The most ethically rated general method were the behavioural interventions (*M* = 80.28, *SD* = 20.86) compared to financial interventions (*M* = 78.12; *SD* = 20.46) and smart applications (*M* = 75.79; *SD* = 21.74). The differences here are (marginally) significant – one-way ANOVA, *F*(2,840) = 3.27, p = .04. A post-hoc Tukey test showed that smart applications were perceived as significantly less ethical than behavioural interventions, with no other significant differences.

Take home summary

There are slight differences in ratings of perceived ethicality of the three general methods (smart applications, financial, behavioural interventions), with smart applications perceived as less ethical than behavioural interventions. People tend to estimate that they will likely change their behaviour more when financial incentives are introduced and would like to see these implemented. Judging that financial methods are more likely to lead to personal behavioural change more than the other methods, corresponds to the consistent finding that the cost of food items is one of, if not the, key contributing factor that influences food choices. So, this estimate corresponds with considerable evidence and reflects an accurate estimate of reality.

Role of demographic factors

In all but one instance, there were no significant associations between any of the demographic variables (age, gender, education, income, having children under the age of 18) and whether one wanted to see smart applications, financial or behavioural interventions used to influence choices. The only exception was the significant association (p = .011) between income and whether one wanted financial interventions to be used, though this should be interpreted with caution, given the exceedingly small numbers of participants indicating the highest income levels.

References and Endnotes

[1] https://www.food.gov.uk/business-guidance/packaging-and-labelling

[2] This is only a legislative requirement in certain circumstances – i.e. where the ingredient is in name of food, commonly associated or emphasised.

[3] Where required, it's not always mandatory.

[4] Durability date marking is mandatory on most prepacked foods.

[5] Only required in certain circumstances.

[6] For instance, font size requirement is a requirement of Retained EU Law (REUL) Regulation (EU) No. 1169/2011

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[14]https://onlinelibrary.wiley.com/doi/abs/10.1002/cb.1812?casa_token=h5F1OzZO1Y4AAAAA%3Afnvtrp7Dt7xqMKJQg9wtcoS6CXnSKIvhZRbuAEVAEEgE6SVJBIJV38hk8eHFjk4IvE5Y2vLQ0KfTtVtE

[15] https://www.finder.com/uk/supermarket-statistics-uk-2021

[16] https://www.statista.com/statistics/412514/shopping-time-spent-by-location-great-britain-uk/

[17] https://www.fivestarhomefoods.com/blog/grocery-shopping-facts

[18] The values will be extremely inaccurate, because people shop for food that they consumer at home from places other than supermarkets (for example online – for which the data is 8 years old), the estimates of average times spent shopping are only for supermarkets, and based only on an estimate of 33 staple items in a food basket, when in fact there will likely be more food items in a food basket for an average week, and other non-food products will also be bought, and depending on demographic factors, shoppers may shop multiple times in the week and so this increases the average shopping time.

[19]https://onlinelibrary.wiley.com/doi/pdf/10.1002/cb.1812?casa_token=h5F1OzZO1Y4AAAAA:fnvtrp7Dt7xqMKJQg9wtcoS6CXnSKIvhZRbuAEVAEEgE6SVJBIJV38hk8eHFjk4IvE5Y2vLQ0KfTtVtE

[20] There is on average 11 aisles in a supermarket, with an average length 16 meters,

[21]

https://onlinelibrary.wiley.com/doi/pdf/10.1002/cb.1566?casa_token=4IB7BmCqD98AAAAA:nyK9XHCbixfbGuOQUuJGnCA2AKyo2S6ogp6epcSpRrRI2i1XoSbcEPyfiQjMOSsL1pD3LstLVzM9vHr

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