

Review Article

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The affordability of diets that align with the UK's dietary advice and the Eatwell Guide

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Abstract

Unhealthy diets are a leading cause of preventable ill health. Healthy diets tend to be more expensive than less healthy diets and as such are more likely to be consumed by individuals with a higher income. This review paper discusses the development of the Eatwell Guide, evaluates the affordability of a diet consistent with the Eatwell Guide ('the Eatwell Guide diet') and explores how food pricing can be leveraged to encourage and support healthier dietary choices. The Eatwell Guide is the UK's food-based dietary guidelines. It provides healthy eating advice that is intended to facilitate policy cohesion but is also used as a public-facing health promotion tool. The cost of food has increased and recent estimates suggest that the Eatwell Guide diet is now more expensive than the current average diet. There is strong evidence that subsidies would be effective at increasing the uptake of healthy diets. Monitoring the cost of a healthy diet is important for policy development; however, we should exercise caution when considering how to incorporate costs into food-based dietary guidelines and be mindful of the limitations of the data that could support this.

Unhealthy diets are a leading cause of preventable ill-health in the UK⁽¹⁾. Food-based dietary guidelines '... provide advice on foods, food groups and dietary patterns to provide the required nutrients to the general public to promote overall health and prevent chronic diseases'⁽²⁾. Food-based dietary guidelines are often tailored to the needs and cultural practices of the intended target population; as such, there are more than a hundred country-specific food-based dietary guidelines worldwide⁽²⁾. The UK's food-based dietary guidelines is the Eatwell Guide⁽³⁾.

This review paper examines the Eatwell Guide and its development, the affordability of a diet that aligns with the Eatwell Guide (henceforth referred to as 'the Eatwell Guide diet') and how food prices can be used to promote healthy diets.

Food insecurity in the UK

A commonly used definition of food security posits that food security is achieved when '... all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.'⁽⁴⁾ This definition goes beyond merely alleviating the physical sensations of hunger or meeting the minimum energy intake required and instead recognises the role of diet in a healthy life.

The UK's Family Resources Survey (FRS) is an annual survey examining households' income whilst also collecting information on other key indicators such as education, housing expenditure and food security⁽⁵⁾. In the most recent survey (2023–2024), 17 000 households were surveyed and their responses were weighted so that they are nationally representative of the UK. The majority of households (83 %) reported high levels of food security, meaning that the household had no issues or anxieties around consistently accessing the food required for an adequate diet. The remaining participants reported some degree of food insecurity, with 6 % reporting marginal food security, which refers to experiencing some occasions where they had concerns around access to an adequate diet, although their normal diet was not disrupted. Low food security was reported by 5 % of households, meaning that the household had to reduce the types of food they usually consume but the overall quantity was not disrupted. Very low food security was reported by 5 % of households, meaning that the amount consumed and/or the eating patterns were severely disrupted for at least one member of the household. The levels of food insecurity varied by region, with households in London and the North West of England more likely to be food insecure (13 % of households), whereas the South East and South West regions were least likely to be food insecure (8 % and 7 % of households, respectively). Levels of food insecurity also varied by income; 21 % of households with a gross weekly income of less than £200 per week were food insecure compared to 3 % of households with a gross weekly income of £1000 or more⁽⁵⁾.

Food prices and cost of living

In recent years food prices in the UK have increased, with rapid increases from mid-2022, reaching a peak Consumer Price Index (a measure of the average price change for a range of essential goods and services) of 18–19 % in February–March 2023⁽⁶⁾. Estimates from the Office of National Statistics show that price increases vary across different food groups and that price increases have been greater for lower-cost food items than for higher-cost foods^(6–8).

Alongside higher food prices, increases were also seen for other living costs such as energy, fuel and housing, meanwhile income has not risen at the same rate^{(e.g.(9,10))}. This cost of living crisis, where the costs of essentials (e.g. food, energy etc.) has risen at a faster rate than income, can impact health through different mechanisms. Broadbent et al.⁽¹¹⁾ mapped potential pathways for how the cost of living crisis may impact short- and longer-term health including effects on health behaviours (e.g. diet), material factors (e.g. food intake), psychosocial factors (e.g. stress) and through how policy responds to the crisis (e.g. cuts to services)⁽¹¹⁾. A rapid review conducted by Meadows et al.⁽¹²⁾ examined the impact of the cost of living crisis on population health in terms of immediate effects (between 1–2 months), intermediate effects (3–6 months) and longer-term effects (6 months plus) across a range of health outcomes. In terms of diet-related impacts, short-term impacts included malnutrition and intermediate impacts included decreases in healthy food consumption and increases in obesity. Meadows et al. conclude that the cost of living crisis exacerbates existing health inequalities that vulnerable populations face⁽¹²⁾.

High food prices are a significant source of concern for consumers. Data from the Opinions and Lifestyle Survey – a monthly survey of 2000 UK participants – reported that between October 2022 and March 2023 the cost of living was either the highest or second-highest important issue for 84–93 % of respondents (second only to concerns about the NHS). Since November 2021, the most commonly reported cause of increased living costs was the rise in food prices⁽¹³⁾.

Impact of price changes

Healthier diets are generally more expensive than less healthy diets. Rao et al.⁽¹⁴⁾ conducted a systematic review and meta-analyses of 27 studies and examined the price differences between healthier and less healthy options for different food groups, for example the average prices of skinless, boneless chicken breast relative to the price of chicken drumsticks. Rao et al. found that healthier meats and other proteins were more expensive than less healthy meats and other proteins. Smaller price differences were seen for other food groups such as grains, dairy and snack foods, and no significant differences were seen for soft drinks/juices. Rao et al. also examined the cost of healthier and less healthy dietary patterns and found that healthier dietary patterns cost more than less healthy dietary patterns⁽¹⁴⁾.

The higher costs of healthier diets may explain much of the existing dietary inequalities we see across different socioeconomic groups⁽¹⁵⁾. There is strong evidence that changes to food prices can improve diets. Afshin et al.⁽¹⁶⁾ conducted a systematic review and meta analyses of 30 studies to examine the impact of price increases and decreases on consumption. A meta-analysis of 22 studies found that a 10 % decrease in the price of healthy foods increased their consumption by 12 % (95 % confidence intervals (CI): 10 %, 15 %). Whereas, a meta-analysis of 15 studies found that a 10 % price increase on less healthy foods decreased their consumption

by 6 % (95 % CI: 4 %, 8 %). When examining differences by food groups, stronger effects were seen for price decreases on fruits and vegetables (increased consumption by 14 %, (95 % CI: 11 %, 17 %) and other healthy foods (16 %, 95 % CI: 10, 23). For price increases on less healthy foods, a 10 % price decreases had stronger effects on sugar-sweetened beverage intake (reduced consumption by 7 %, 95 % CI: 3 %, 10 %) and other unhealthy foods (reduced by 9 %, 95 % CI: 6 %, 12 %) than seen for fast foods (reduced by 3 %, 95 % CI: 1 %, 5 %)⁽¹⁶⁾.

The Eatwell Guide

The Eatwell Guide is the UK's food-based dietary guidelines⁽³⁾. The Eatwell Guide is a pie chart that represents the amounts and types of food that people should aim to consume each day to achieve a healthy diet. It is intended to promote policy cohesion through providing a definition of a healthy diet that can be used across different government departments and agencies. The Eatwell Guide can also be used as a health promotion tool through providing healthy eating advice on public-facing materials, such as the NHS website – an online resource intended for the general public⁽¹⁷⁾. However, educating people about a healthy diet is not enough to improve the population's health and may even risk exacerbating existing diet-related inequalities⁽¹⁸⁾.

The Eatwell Guide incorporates both nutrient recommendations (e.g. to consume less than 6 grams of salt per day) and food-based recommendations (e.g. to consume 5 or more portions of fruit and vegetables per day) and translates this into advice on how much of each food group we should aim to consume. In total there are 11 dietary recommendations that were incorporated into the Eatwell Guide. The nutrient-based recommendations considered were energy intake, carbohydrates, free sugars, fat, saturated fat, protein, salt and fibre. The food-based recommendations were fruits and vegetables, fish, red and processed meat.

Previous research has found that adherence to specific dietary recommendations is higher for some diet components than for others. For example, it was estimated that 80 % of the UK population meet their corresponding age- and gender-specific total fat recommendation whereas just 7 % of the population meet the fibre recommendations⁽¹⁹⁾.

The food groups depicted in the Eatwell Guide pie chart are fruit and vegetables; potatoes, bread, rice, pasta or other starchy carbohydrates; beans, pulses, fish, eggs, meat and other protein foods; dairy or dairy alternatives; and oils and spreads. Other dietary advice is also provided outside of the pie chart, such as advice on fluid intake and consumption of foods high in fat, salt and sugar.

The sizes of the segments in the Eatwell Guide were derived through a method called diet optimisation. This is a method used to find the optimal diet that meets a set of rules (or 'constraints') with a defined purpose or aim (the 'objective function'). The output of this model is the optimised diet. The aim of the model underpinning the Eatwell Guide was to identify a diet that meets the dietary recommendations with the least divergence from the current, average diet. This was achieved through an objective function which minimised the sum of the differences between the current average diet and the optimised diet.

The data used to estimate the current average diet was the UK's National Diet and Nutrition Survey (NDNS), a nationally representative annual survey comprising approximately 1000 participants each year⁽²⁰⁾. Participants are asked to record all of their food intake over three to four days and these entries are linked

to food compositional data allowing for the nutritional quality of diets to be assessed. NDNS food items are grouped into 140 'subfood' groups, which are grouped into 58 'main food' groups. The diet optimisation was conducted using average intakes for 125 subfood groups (15 subfood groups such as vitamins and minerals, alcoholic drinks, baby food etc. were removed for analyses). The diet optimisation model operates by systematically varying the intake of the 125 subfood groups until the model finds the optimal diet that meets the dietary constraints with the smallest deviation from the current average diet.

Diet and health impacts of achieving the Eatwell Guide diet

In 2016, Scarborough et al.⁽²¹⁾ estimated the diet and cost implications of achieving the dietary recommendations and found that large changes are required to the average diet to meet the dietary recommendations. The largest changes required were a 69 % increase in the consumption of potatoes, bread, rice, pasta and other starchy carbohydrates and a 54 % increase in the consumption of fruit and vegetables. Substantial reductions in the consumption of other food groups would also be required, for example a 21 % reduction in the consumption of dairy and dairy alternatives and a 53 % reduction in the consumption of foods high in fat and sugar. A 24 % reduction in the consumption of beans, pulses, fish, eggs, meat and other proteins was also required. When looking at this category in more detail, there was considerable variation in the changes in the types of foods; for example, the diet optimisation model resulted in a 90 % increase in the modelled consumption of beans and pulses, combined with a 78 % reduction in the modelled consumption of red meat⁽²¹⁾.

Cobiac et al.⁽²²⁾ then estimated the changes to population health that could be achieved if the dietary recommendations were met by the entire population. These outcomes are measured as changes to life expectancy and disability-adjusted life years (DALYs). DALYs are a measure of years of life lost due to ill-health where a single DALY refers to a loss of a year of perfect health. The modelled health outcomes included a range of non-communicable diseases such as CVD, stroke, diabetes and multiple cancers such as breast cancer, colorectal cancer and lung cancer. Meeting the dietary recommendations whilst maintaining current energy intake was estimated to increase life expectancy by 5.4 months for men (95 % Uncertainty Intervals (UI): 4.7–6.2 months) and 4.0 months for women (95 % UI: 3.4–4.6 months). In terms of improvements to DALYs, it was estimated that 19.9 million DALYs (95 % UI: 17.6–18.2 DALYs) would be averted over the lifetime of the population. The largest health improvements were related to changes in the expected number of new cases of diabetes over the next ten years. There would be a reduction of 44 000 new cases of diabetes in men (95 % UI: 400 000–480 000 cases) and a reduction of 340 000 new cases of diabetes in women (95 % UI: 310 000–370 000 cases). The modelled results also included reductions in the expected new cases of CVD and colorectal cancer and smaller reductions in the number of new cases of stomach, lung and breast cancer⁽²²⁾.

Cost impacts of the Eatwell Guide diet

In their 2016 paper Scarborough et al.⁽²¹⁾ also reported the cost impacts of achieving the dietary recommendations. This was estimated by scraping price data for 7575 food items listed on a supermarket price comparison website in March 2016. In total, 14 638 prices were collected. The 7575 were matched to one of the

125 NDNS subfood groups used in the diet optimisation model. The prices were converted from the price per unit to the price per kilogram (kg). This was then multiplied by the amount consumed in the current average diet and the optimised diet and then summed across the 125 food groups to obtain the cost of the current average diet and optimised diet respectively. To account for changes to weight due to cooking and/or preparation conversion factors from McCance and Widdowson Food Composition tables were applied to the relevant subfood groups⁽²³⁾. To account for unavoidable waste such as the inedible parts of food (e.g. bones, stones etc.) estimates were taken from the Waste and Resources Action Programme (WRAP) 2012 report on household food and drink waste in the UK⁽²⁴⁾, and applied to the relevant subfood groups.

Scarborough et al.⁽²¹⁾ found that there was no significant difference between the cost of the current diet and the optimised diet (i.e. the diet underpinning the Eatwell Guide). The estimated cost of the current, average diet was £6.02 (95 % CI: £5.96, £6.08) per person, per day and the estimated cost of the optimised diet was £5.99 (95 % CI: £5.93, £6.05) per person, per day⁽²¹⁾.

More recently, these cost estimates were updated to inform the Food Foundation's annual report *The Broken Plate*⁽²⁵⁾. Data on foods and drinks available to purchase in November 2019 was sourced from foodDB - a timestamped, weekly updated database of foods and drinks available to purchase from the UK's leading online supermarkets⁽²⁶⁾. In total, prices for 13 912 products were matched to the 125 foods NDNS subfood groups⁽²⁷⁾. Where subfood groups were matched to multiple products the median value was used. Following the same steps as described for the 2016 analyses⁽²¹⁾, prices were converted to £ per kg and adjusted for changes to cooking and unavoidable food waste. The estimated cost of the current, average diet was £6.44 and the cost of the Eatwell Guide diet was £6.82 per person, per day⁽²⁷⁾. The following year these estimates were updated using foodDB food price data from May 2022. Based on data for 18 441 foods the estimated cost for the current, average diet was £6.82 and the cost of achieving the Eatwell Guide diet was £7.48⁽²⁸⁾. These findings suggest that the cost of a healthier diet has increased by a greater degree than that of the current average diet. However, these point estimates should be used cautiously as further work is needed to capture the uncertainty around these estimates. Further limitations of these estimates will also be discussed in the subsequent section.

The 2019 and 2022 cost estimates were used in the Food Foundation's *Broken Plate* reports in 2022⁽²⁹⁾ and 2023⁽³⁰⁾ (respectively). Further analyses examined the percentage of disposable income that would be required to purchase the Eatwell Guide diet for each income quintile. The Food Foundation reported that in 2020–2021 the most deprived households would need to spend 43 % of their disposable income compared to just 10 % for the least deprived income groups⁽³⁰⁾. In 2021–2022, the most deprived households would need to spend 50 % of their disposable income, whereas the least deprived would spend 11 %⁽³⁰⁾.

Challenges of estimating the cost of the Eatwell Guide diet

These findings suggest that the cost of a healthier diet has increased by a greater degree than that of the current average diet. However, all three of the Eatwell Guide diet cost estimates face similar limitations due to the data sources (online supermarkets) and methodologies used. Firstly, the food prices are not weighted by

brand or by sales nor by retailer market share; instead, where multiple data points were present for a single subfood group, the median price for each subfood group was used. Weighting by sales may impact results if the most commonly purchased products are higher or lower than the average subfood group price. Similarly, weighting by retailer market share may impact results as pricing strategies may differ between retailers and also across different types of retailers (e.g. smaller stores). Another limitation is that only price data from online supermarkets was used. Bhatnagar et al.⁽³¹⁾ found that online supermarkets and their corresponding bricks-and-mortar stores tend to be similar in terms of the availability of products and prices; however, price promotions were more common in physical stores than in their online counterparts⁽³¹⁾. Finally, the estimates assume that all foods and meals will be purchased commercially and do not account for preparation through home cooking. For example, the price data for pre-packaged ready-made fruit pies were used to represent the cost of homemade fruit pies.

Research and policy implications

Examining the cost of a healthy diet is important as we know that price is a key factor when making dietary choices. Discussions around the affordability of healthy diets, particularly in political contexts, can be unnecessarily contentious. A common, but unhelpful, practice is to compare lower-cost, healthier foods to higher-cost, less healthy foods. For example, comparing the price of a single apple to the cost of a store-bought cupcake. However, diets consist of multiple foods that may be consumed more or less frequently and in larger or smaller amounts. Instead dietary patterns are a more useful way to assess affordability^(32,33). Another approach is to compare the costs of a home-prepared meal to the cost of purchasing a similar meal from the food service sector. However, these discussions typically only consider the financial cost of purchasing ingredients and often only consider the amount of ingredients required for the recipe, rather than the amount that must be purchased (e.g. the cost of two slices of bread rather than the cost of a loaf of bread). In doing so the wider costs or resources needed for food consumption are ignored. Similarly, some individuals may not have the resources (e.g. time, access to/funds for suitable transport etc.) to shop around and find the lowest retail price for their preferred foods. Once food has been acquired there may be costs associated with storing the food (e.g. physical space required, refrigeration costs etc.). There may be additional resources required for food preparation (e.g. equipment and/or energy/fuel costs). And, finally, how the individual consumes foods may be shaped by the individual's time resources.

There have been some suggestions that perhaps food-based dietary guidelines should aim to incorporate the cost of foods into their design. Arguments for this include that food-based dietary guidelines should be tailored to their intended population(s) and that it may be considered unethical to promote a diet that is inaccessible to many. Doing this may even reinforce or worsen existing dietary inequalities.

Costs could be incorporated into the Eatwell Guide through including a constraint or rule into the diet optimisation model that prohibits the optimised diet exceeding the cost of the current diet or requires that the optimised diet is proportionally cheaper than the current diet. However, doing this may not yield a realistic diet as the current average diet underpinning the Eatwell Guide already reflects consumer's purchasing/spending habits which they may have already adapted in response to higher food prices⁽³⁴⁾. We

should also be mindful of the limitations of our food price data – firstly with how representative they are of how people purchase food, and secondly whether they incorporate the other costs associated with food consumption as described above. Furthermore, as we have seen over the past few years, food prices are extremely volatile so their use in food-based dietary guidelines should be considered carefully. However, monitoring the affordability of a healthy diet should be considered a priority for governments so that fiscal policies can be responsive to the population's needs.

Conclusions

There is good evidence that healthier diets cost more than unhealthy diets. Policy should aim to improve uptake of healthy diets and there is evidence that changes to food prices, such as through price increases and decreases, are effective in promoting healthier diets. Whilst tracking the cost of food-based dietary guidelines is important, the incorporation of costs into dietary guidelines should be exercised with caution. Data on the cost of healthy diets can be incomplete, therefore their use in policy settings should be mindful of the limitations of the data.

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