

Affordability of the UK's Eatwell Guide

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Abstract

The UK Government's Eatwell Guide outlines a diet that meets population nutrient needs. However, there are several indicators that low income households in the UK may be struggling to follow the Eatwell Guide, including differential nutrient intakes and diets, increasing food bank usage, and higher childhood obesity statistics in deprived areas. This analysis assesses how affordable the Eatwell Guide is for households by income decile.

We compared the cost of following the Eatwell Guide, calculated from existing research, to household expenditure data from the 2015/16 Living Costs and Food Survey and to disposable income data from the 2015/16 Family Resources Survey. We found that 26.9% of households would need to spend more than a quarter of their disposable income after housing costs to meet the Eatwell Guide costs, and more than half of these households contain at least one child. For households with children in the bottom two deciles, earning less than £15,860, 42% of after-housing disposable income would have to be spent to meet the Eatwell Guide costs. The results point to the need to ensure the incomes and resources of low-income households are adequate for purchasing a healthy diet, and to take measures to support these households in affording the foods contained within the Eatwell Guide.

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Introduction

An affordable, healthy diet is essential to health. Yet the situation in the UK suggests that many families are struggling to put healthy food on the table. Most adults and children in the UK do not currently meet requirements for a nutritious diet, eating too much sugar, saturated fat and salt, and failing to meet recommendations for fruit and vegetable and oily fish consumption (Food Foundation, 2016). This is particularly true for lower income households, who consume significantly less fruit and vegetables than those on a higher income (Maguire and Monsivais, 2015).

Food bank usage in the UK is at unprecedented levels and UN data estimates that food insecurity in the UK may be as much as 17 times higher than measured levels of food bank use. However, food insecurity is not routinely measured in the UK, so it is difficult to know how many families are worried about or struggling to afford enough food or how this has changed over time (The Food Foundation, 2016). A one-time measure found that 21% of respondent households in England, Wales and Northern Ireland had 'marginally', 'low or very low' food security (Food Standards Agency, 2017).

At the same time, childhood obesity continues to rise beyond its already high level, particularly in deprived areas, and diabetes and other diet-related diseases present an increasing burden on the National Health Service (NHS). Among children age 10-11, 20% are obese and an additional 14% are overweight. Obesity alone costs the NHS in England more than £6bn per year, and this is expected to reach £10bn by 2050 (Public Health England, 2017). Diabetes adds on a further £10bn in costs per year to the NHS (Hex *et al.*, 2012).

These challenges and outcomes are all indicators of a population who are unable to meet their nutrient needs in one way or another. The co-existence of unhealthy diets and food insecurity is a logical consequence of the UK's food system, where healthy nutrient-rich foods are three times more expensive than unhealthy ones (Jones *et al.*, 2014). For families who are struggling to afford enough to eat, the nature of the UK's food system means they are dependent on inexpensive but less nutritious and more caloric food (Pechey and Monsivais, 2016). This is particularly true for fruit and vegetables, which form the cornerstone of a healthy diet. The combined consequence of these factors is that food insecurity and unhealthy diets are often interrelated, which can lead to diet-related disease and obesity (Dinour, Bergen and Yeh, 2007; Nackers and Appelhans, 2013; Benjamin Neelon *et al.*, 2017).

The Eatwell Guide is the Government's official guidance on a diet that meets nutrient needs (Public Health England, 2016). For a family or a household to be able to follow the Eatwell Guide, they need to be able to afford the foods recommended by the Eatwell Guide and have the resources and knowledge to be able to prepare them. Previous research has shown that diets which meet or exceed dietary recommendations as set out by the UK's Scientific Advisory Committee on Nutrition (SACN) were more expensive than diets which did not (Jones, Tong and Monsivais, 2018). Research has also shown 52% of households with children are unable to afford a "socially acceptable diet", as defined by the Minimum Income Standard (O'Connell *et al.*, 2018). However, it has not yet been investigated whether families can afford to follow the

Eatwell Guide. We conducted a secondary analysis of the Living Cost and Food Survey (LCFS) and the Family Resources Survey (FRS) in which we consider the estimated cost of an 'Eatwell' diet in relation to UK household expenditure on food and non-alcoholic drinks and to disposable household income.

Methods

The Eatwell Guide splits the diet into a five category pie chart: fruit and vegetables; potatoes, bread, rice, pasta and other starchy carbohydrates; beans, pulses, fish, eggs, meat and other proteins; dairy and alternatives; and oils and spreads. Each section of the pie chart is based on the proportion of the diet that should come from each category and were based on optimisation modelling commissioned by Public Health England and carried out at Oxford University (Scarborough *et al.*, 2016). The optimisation modelling was used to identify a diet that achieved the UK food-based dietary guidelines whilst minimising changes from current consumption in the UK. The cost of such a diet was estimated to be £5.99 per adult per day, or £41.93 per week. This cost was calculated on a per portion basis (e.g. cost of a single portion of bread), rather than how much a person would need to spend to buy the foods in question (e.g. a loaf of bread), and therefore it is likely to underestimate how much a person would need spend to buy a full weekly diet based on the Eatwell Guide. Subsequent research using a different method supports this assumption, as it found that the cost of a diet meeting 6-8 SACN dietary recommendations would be on average £6.54 per 2000 calories (Jones, Tong and Monsivais, 2018)

To better understand the affordability of healthy diets in the UK, we conducted a secondary analysis of the LCFS and the FRS, in which we consider our estimated cost of an 'Eatwell' diet in relation to UK household expenditure on food and non-alcoholic drinks, and to household disposable income. Weekly Eatwell cost per household was determined based on household composition. To consider different dietary intakes of children under 19 years, as well as economies of scale that would likely affect the overall Eatwell cost for a household, the McClement's equivalence scale was used to adjust the per-adult cost. Although a crude method, the McClement's scale was chosen over alternative equivalisation scales (e.g. OECD) because it better captures age group differences.¹ This approach was also chosen over adjusting the adult cost based on recommended energy requirements (EAR) by age group/sex because it considers economies of scale with increasing numbers of household members, which an EAR approach would not.

Eatwell guide cost in relation to household expenditure

The LCFS is a national cross-sectional survey of private households in the UK, collecting data on spending patterns and the cost of living of approximately 6,000 households. The LCFS collects information on purchasing at the household and individual level. Individuals aged 16 years and

¹ McClements weights: First adult – 0.61, Partner/spouse – 0.39, Other second adult – 0.46, Third adult – 0.42, Subsequent adult – 0.36, Children 0-1 – 0.09, Children 2-4 – 0.18, Children 5-7 – 0.21, Children 8-10 – 0.23, Children 11-12 – 0.25, Children 13-15 – 0.27, Children 16-18 – 0.36

over in the household visited are asked to keep a diary record of daily expenditure for two weeks and information about other regular and larger infrequent expenditures is obtained from a household interview. More information about the LCFS can be found elsewhere (Office for National Statistics, 2017).

Data from the 2015/16 LCFS was used to identify the proportion of UK households meeting the Eatwell guide cost using weekly household expenditure on food and non-alcoholic beverages consumed away from and at home, including paid school meals. It should be noted that FSM are not captured in LCFS expenditure data. An estimated 14% of pupils were eligible for free school meals in January 2017, excluding Universal Infant Free School Meals (Department for Education, 2017).

Relative household food expenditure compared to the Eatwell guide cost was analysed for UK households and for each of the four UK nations. Statistical comparisons of households meeting or not meeting the Eatwell cost were made in terms of characteristics such as household composition, number of children, household income, and working status, to the 95% significance level. The LCFS datasets were obtained from the UK Data Service (UK Data Service, 2018b). Weighting variables provided in the LCFS dataset were used to correct for non-response bias and to adjust the sample to reflect known population totals.

[Eatwell guide cost in relation to disposable income](#)

The FRS is an annual cross-sectional survey conducted on a representative sample of private households in the UK, capturing information on income of approximately 19,000 private UK households. Further details on the FRS survey design, sampling procedures and methods can be found elsewhere (Department for Work and Pensions, 2018a).

From the FRS, the Department for Work and Pensions produces an analysis of the UK income distribution in its annual Households Below Average Income (HBAI) publication (Department for Work and Pensions, 2018b). Data from the 2015/2016 HBAI was used to calculate the average proportion of unequivalised household disposable income that would be used up by the estimated household Eatwell cost, by income decile and nation. The HBAI datasets were obtained from the UK Data Service (UK Data Service, 2018a).

Disposable income was defined as the amount of money available for spending and saving after direct taxes (such as income tax, national insurance and council tax) and after housing costs (AHC) are removed. It includes income from earnings and employment, private pensions and investments, and cash benefits provided by the state. Unlike the LCFS, disposable income in the HBAI also includes the value of FSMs. Housing costs removed from disposable income included: rent; water rates, community water charges and council water charges; mortgage interest payments; structural insurance premiums; and ground rent and service charges.

The HBAI resets negative incomes before housing costs to zero but negative disposable incomes are still possible after housing costs are removed. Two percent of all households, comprising nearly 20 percent of households in income decile 1, had a negative disposable income AHC and

it was therefore not possible to calculate the proportion of disposable income that would be used up by the Eatwell cost. These households were set to 100%, meaning that 100% of their disposable income would have to be spent on food. All statistical analyses were conducted in Stata (version SE 14.2).

Findings

Data from the Living Costs and Food Survey (2015/16) indicate that, on average, UK households spent £36.37 per person per week on food and non-alcoholic drinks. Applying the McClements equivalence scale to Scarborough *et al.*'s figure of £41.93 per adult per week for the Eatwell Guide, we estimated the costs per subsequent household member (Table 1). For example, we estimate that a household of four (two adults and two children aged 10 and 15) would need to spend £103.17 per week to be able to follow the Eatwell Guide.

Table 1: Estimated cost of Eatwell guide per week for different family members

	Eatwell guide cost (£/week)
First adult	41.93*
Partner/spouse	26.81
Other second adult	31.62
Third adult	28.87
Subsequent adults	24.75
Child 0-1 years	6.19
Child 2-4 years	12.37
Child 5-7 years	14.43
Child 8-10 years	15.81
Child 11-12 years	17.18
Child 13-15 years	18.56
Child 16-18 years	24.75

*(Scarborough *et al.*, 2016)

Just over half of households (53%) are currently spending at least enough on food and non-alcoholic drink per week to meet the estimated Eatwell guide cost based on their household composition. Looking across the four nations, a higher proportion of households in Northern Ireland and a lower proportion of households in Wales are spending enough to be able to meet the Eatwell Guide costs; England and Scotland are at roughly the overall average (Table 2).

The proportion of households spending enough to meet the Eatwell Guide costs did not vary significantly between households with and without children. However, UK households with two or more adults, with or without children, were significantly more likely to meet or exceed the amount of expenditure of food needed to meet the Eatwell Guide cost than single adult

households. The working status of the household head had a significant impact on whether household expenditure met or exceeded the Eatwell cost. Households in which the household reference person (HRP) was in full or part-time employment were significantly more likely to meet the Eatwell cost than households in which the HRP was unemployed. Households with retired HRPS were also less likely to meet the Eatwell cost (Table 2).

Table 2: Percentage of UK households spending Eatwell guide cost or more on food and non-alcoholic drinks each week

	Proportion meeting Eatwell cost (%)	95% Confidence Interval
All households (n=4912)	52.8	51.4 – 54.3
England (n=4109)	53.1	51.5 – 54.8
Scotland (n=420)	52.5	47.4 – 57.6
Wales (n=227)	41.7	35.1 – 48.4
Northern Ireland (n=156)	65.1	57.4 – 72.8
By household composition		
Households with children meeting Eatwell cost	52.2	50.4 - 53.9
Households without children meeting Eatwell cost	54.5	51.8 - 57.2
Single adult (n=1342)	39.8	37.0 – 42.6
2 adults, no children (n=1728)	60.8	58.3 – 63.3
3+ adults, no children (n=369)	59.2	53.8 – 64.5
Single adult, 1+ children (n=260)	40.4	34.2 – 46.6
2 adults, 1+ children (n=1056)	58.1	54.9 – 61.2
3+ adults, 1+ children (n=157)	52.6	44.2 – 60.9
By working status of household reference person		
Self employed	55.6	50.2 - 61.0
Full time employee	60.9	58.7 - 63.2
Part time employee	50.2	45.7 - 54.7

Unemployed	19.7	11.7 - 27.7
Retired/unoccupied and of minimum NI pension age	48.1	45.2 - 50.9
Retired/unoccupied but under minimum NI pension age	40.2	35.8 - 44.6

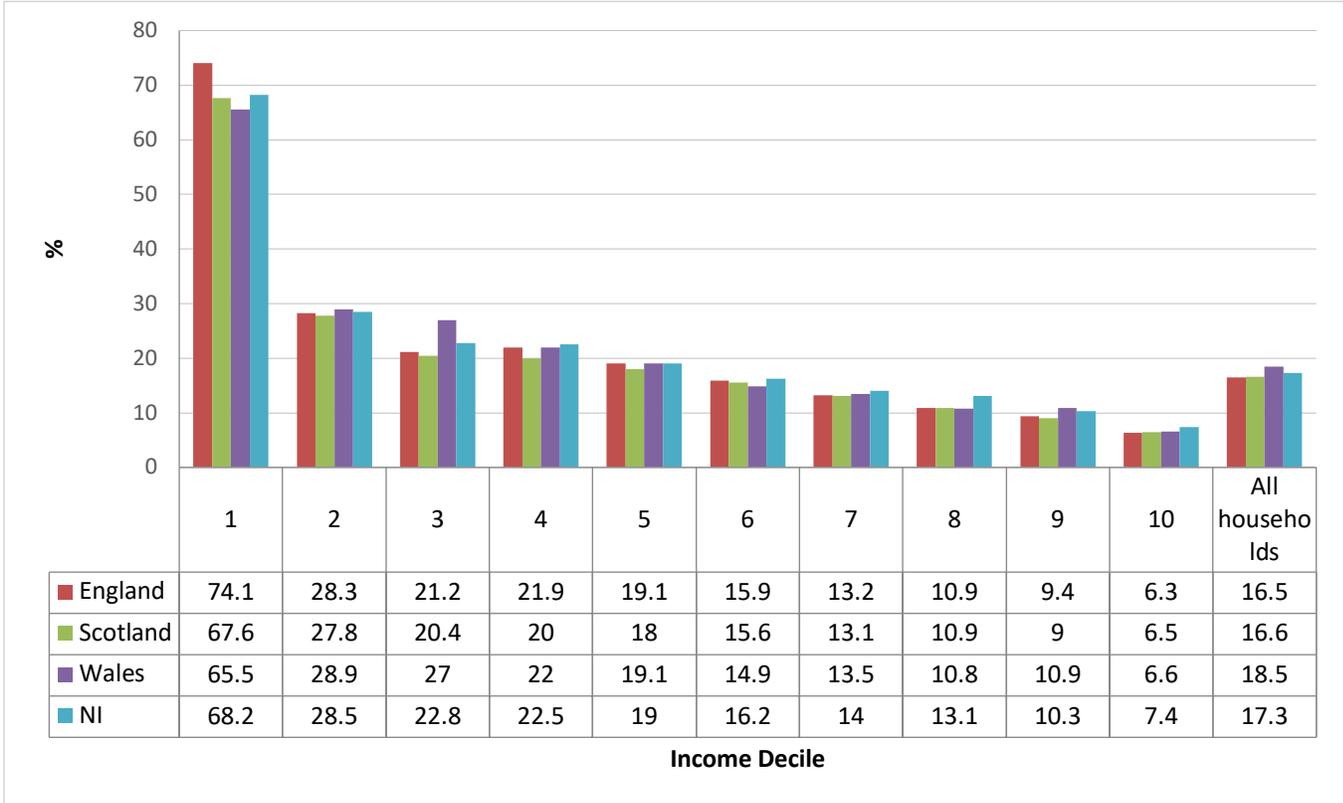
Across the board, households spending enough on food to meet or exceed the Eatwell Guide costs had higher average disposable income than those not meeting the Eatwell Guide costs (Table 3). For a household with two adults and two children under the age of 14, households spending enough to meet the cost of the Eatwell Guide earn on average £296 more per week than those not meeting the Eatwell Guide costs.

Table 3: Median household disposable income (£/week) of Eatwell and non-Eatwell households for different family types

	Household meeting Eatwell costs (£/week)	Households spending less than Eatwell costs (£/week)	All households (£/week)
1 adult	414.84	273.75	344.19
2 adults	622.26	410.63	516.29
2 adults, 2 children aged <14 and >14 years	954.13	629.63	791.64
2 adults, 2 children <14 years	871.16	574.88	722.80

For households in the lowest income decile, close to three-quarters (73.6%) of disposable income would need to be spent on food to meet the Eatwell Guide costs (Figure 1). This is compared to only 6% in the highest income decile. Looking across the nations, there is some variation but the income gradient is consistent. The majority of households in Decile 1 were single adult households with no children (66%) compared to households overall (29%) and they generally had fewer children compared to the average household (Technical Appendix, Table 2).

Figure 1: Median percentage of disposable income AHC used up if Eatwell guide cost was spent, by income decile and country



On average, the poorest half of households in the UK would need to spend close to 30% of their disposable income to meet the government’s dietary recommendations. The richest half of households would need to spend an average 12% of disposable income to do the same (Table 4).

Table 4: Median percentage of disposable income (after housing costs) that would be used up if Eatwell guide cost was spent, by households above and below median household income and nation

	Poorest 50% of households (%)	95% CI	Richest 50% of households (%)	95% CI
England	28.1	27.7 – 28.6	11.9	11.7 – 12.1
Scotland	26.0	24.9 – 27.1	11.7	11.2 – 12.2
Wales	29.5	28.2 – 30.8	12.5	11.8 – 13.3
Northern Ireland	26.4	25.3 – 27.4	13.6	13.2 – 14.1
UK	28.0	27.6 – 28.4	12.0	11.8 – 12.2

Looking across all income deciles, 26.9% of UK households would need to spend more than a quarter of their disposable income after housing costs to meet the Eatwell Guide costs. This is compared to 23% of households in Northern Ireland, 24.1% in Scotland, 27% in England and

31.6% in Wales. More than half (57%) of the households needing to spend more than 25% of their disposable income on the Eatwell Guide contain at least one child, equivalent to 4.2 million households. For households with children in the bottom two deciles, earning less than £15,860 per year, they would need to spend 42% of their after-housing disposable income to afford the Eatwell Guide. There are 3.7 million children in the UK living in households that fall in the bottom two deciles.

For households with food expenditure less than the level required to meet the Eatwell Guide costs, they typically spend 16.5% of their disposable income on housing, electricity and water, and 38.3% on other essentials, including furnishings/household equipment, health, childcare, transport and communication/education (Table 5).

Table 5: For households spending less than Eatwell cost, proportion of total disposable income spent on non-food essentials (housing, water, electricity, furnishings and household equipment, health, transport, communication and education)

	Proportion of disposable income spent on housing, water and electricity (%)	Proportion of disposable income spent on other non-food essentials (%)
England	16.6	38.1
Scotland	19.0	38.9
Wales	11.8	36.8
Northern Ireland	13.4	44.8
UK	16.5	38.3

Discussion

Principal Findings

Our analysis shows that households in the lowest income deciles would need to spend close to 30% of their disposable income after housing costs to meet the Eatwell Guide, compared to 12% percent in the top half of income deciles. 26.9% of UK households would need to spend more than a quarter of their disposable income after housing costs to meet the Eatwell Guide costs. More than half (57%) of the households needing to spend more than 25% of their disposable income on the Eatwell Guide would contain at least one child, equivalent to 4.2 million households. For households not meeting the Eatwell Guide costs this would be in addition to the more than 50% of disposable income that is required for housing and other essentials, making the Eatwell Guide diet increasingly unaffordable for many. These figures are a stark indication of the challenges low-income households face in affording the government’s recommendations for a healthy diet.

We also found that on average the current food budgets of more than half of households in the UK are likely insufficient to be able to meet the government’s recommendations for a healthy

diet as set out in the Eatwell Guide. In practice this means approximately 14.4 million households may be unable to afford the Eatwell recommended diet. Households with lone adults – with or without children – and those with three or more children are the least likely to have enough food budget to meet the Eatwell Guide costs.

Findings in Relation to Other Studies

According to the UK Department for Environment, Food and Rural Affairs (DEFRA), the share of household spending on food has been declining and is currently at 10.7% for all UK households and 16% for the lowest 20% of households by equivalised income (DEFRA, 2017). These figures are cited by the Government as evidence that food is affordable in the UK (Parliament.uk, 2017). However, they do not consider the healthfulness or sufficiency of the food purchased. Though not directly comparable to our analysis, which excluded housing costs and is based on non-equivalised income, our data suggests that a low-income household spending only 16% of their budget on food would be very unlikely to afford the Eatwell Guide.

In addition to the percent of disposable income that would have to be spent on the Eatwell Guide, in recent years low income households have also faced rising food costs and decreasing household income. For low income households, income after housing costs decreased 7.1% from 2002 and 2016. In this same time period, food prices in real terms increased by 7.7% (DEFRA, 2017). Previous analysis by the Food Foundation estimated that, as a result of rising food prices, fluctuations in the value of the pound and changing labour availability for horticulture following the UK's departure from the EU, a family of four would need to pay an additional £158 per year compared to current expenditure to meet the fruit and veg recommendations in the Eatwell Guide (The Food Foundation, 2017). For households in the lowest income deciles who are already struggling to afford a healthy diet, this level of price increase will move the Government's official dietary recommendations further out of reach.

The results of this research echo those from previous research in the UK and internationally. O'Connell et al (2018) looked at the affordability of a "socially acceptable diet" as defined by the Joseph Rowntree Foundation as part of establishing their Minimum Income Standard. They found that the proportion of families spending less than the amount needed to reach that diet has risen from 41% to 52% between 2005 and 2013. By looking both at household expenditure and disposable income, this analysis builds on previous research to put household food insecurity and poor diet quality in context. Research on household expenditure in Canada has shown that as food insecurity increases, the household will spend less overall but a higher proportion of their disposable income on essentials (Fafard St-Germain and Tarasuk, 2018). However, within the income spent on essentials, we know that the money set aside for food is often sacrificed if other essential expenditures increase or total household resources decrease. It is thus unsurprising that food insecurity is associated not only with uncertainty of food supply but a dependence on low cost, high energy foods which tend to be nutrient poor (Douglas *et al.*, 2015). The unaffordability of a healthy diet for low-income households in the UK is clearly evidenced in childhood obesity statistics. In England, childhood obesity in the most deprived areas is double compared to those in the least deprived areas. Furthermore, the gap between

the least and most deprived areas is increasing, rising 1.5% for reception-age children and 4.9% for children in year 6 between 2006 and 2017 (NHS Digital, 2017).

Strengths and Limitations

The primary strength of this research is the robustness of the underlying data sources. It compares government data on household expenditure with government data on disposable income, using a government commissioned costing of the government's dietary recommendations. It combines these data sources to provide further insights into the potential impacts of household resources on a household's ability to eat a healthy diet.

It is likely that our results are an underestimate of the cost of following the Eatwell Guide. The initial costing done by Scarborough *et al.* (2016) was likely an underestimate, and we may have further underestimated the costs by applying the McClement's scale, particularly for the second/third adults in a household. This is not the case for the large number of single adult households, which are particularly prominent in income decile 1 (Technical Appendix, Table 2).

This research is limited in that it assessed self-reported household expenditure on food, not whether those households were spending their food budget on the types of food required to meet the Eatwell Guide. However, we know from previous research that the majority of adults and children in typical households are not meeting dietary recommendations on sugar, salt and saturated fat (Food Foundation, 2016). The optimization study on which this research draws also found that compared to current mean intake, diets would need to change significantly to meet the Eatwell Guide (for example, on average a 75% reduction in red/processed meat and a 54% increase in fruit and vegetables) (Scarborough *et al.*, 2016). We also know that people in households that spend less on food are more likely to be eating less healthily (Morris *et al.*, 2014). The Eatwell Guide itself is limited in that it is based on a modelled or theoretically healthy diet, and there is a lack of outcome data on what health outcomes are associated with eating inside or outside of the Eatwell guide. A further limitation of our research is that it did not consider baseline price differences across the four nations, which may help to explain some of the nation-level differences found in the analysis.

Implications for Policy, Practice and Research

The findings of this research point to the need for a coherent cross-government policy that ensures low income households can afford to follow government's own recommendations for a healthy diet. Ensuring this affordability could be achieved through two overarching approaches: increasing the resources and incomes of low income households and ensuring that healthy foods are available and affordable to those on a low income. Focusing on the income of low income households is particularly important, as research from the Living Wage Foundation found that 37% of working parents who earn less than the living wage have regularly skipped meals due to a lack of resources.

Several government programmes currently seek to address poor nutrition in lower income families with children, including the Healthy Start programme and free school meals. However

the Healthy Start programme, which provides vouchers for healthy foods such as fruits and vegetables and milk for low income women with children, could be strengthened and modernised, including increasing the value of the vouchers. This is particularly important for improving the programme's uptake, which as of January 2018 was only at 64%, meaning 36% of eligible families are not benefiting from the programme (Department of Health, 2018). Access to healthy school meals could also be improved through the provision of universal free school meals, which would provide significant financial and nutritional benefit to households who fall above the current free school meal eligibility but nonetheless struggle to provide healthy food for their children. The Government is taking some steps to improve access to food access for children during the school holidays (Department for Education, 2018), however provision for 'holiday hunger' programmes could be significantly expanded.

Current government measures of the percent of spend going towards food do not capture the healthfulness or adequacy of that food. To gain a fuller picture of food affordability in the UK, the government would also monitor the relative costs of healthy and less healthy foods, and the percent of disposable income that would need to be spent to purchase a healthy diet. There is also a need for long-term and robust measurement of food insecurity in the UK to better understand how income and food costs interplay with intermittent or on-going household food insecurity to affect adequacy and healthfulness of the diet. Validated measurement tools for household food insecurity already exist, which capture a household's experience with food insecurity and serve as an important complement to quantitative metrics of food affordability (The Food Foundation, 2016). One of these validated tools could be inserted into an existing survey in the UK meaning that doing so would be relatively low (The Food Foundation, University of Oxford and Sustain, 2016). Doing so will ensure that the UK is able to report on household food insecurity as part of the Sustainable Development Goals (SDG2) and will significantly aid further research to better understand the link between incomes, food costs, food insecurity and the healthfulness of the diet.

About the Food Foundation

The Food Foundation is an independent think tank that tackles the growing challenges facing the UK's food system in the interests of the UK public.

References

- Benjamin Neelon, S. E., Burgoine, T., Gallis, J. A. and Monsivais, P. (2017) 'Spatial analysis of food insecurity and obesity by area-level deprivation in children in early years settings in England', *Spatial and Spatio-temporal Epidemiology*, 23, pp. 1–9. doi: <https://doi.org/10.1016/j.sste.2017.07.001>.
- DEFRA (2017) 'Food Statistics Pocketbook 2017'.
- Department for Education (2017) *Schools, pupils and their characteristics*.
- Department for Education (2018) *Boost to support disadvantaged families during the holidays, gov.uk*. Available at: <https://www.gov.uk/government/news/boost-to-support-disadvantaged-families-during-the-holidays> (Accessed: 23 August 2018).
- Department for Work and Pensions (2018a) *Family Resources Survey*.
- Department for Work and Pensions (2018b) *Households below average income statistics*.
- Department of Health (2018) *Cycle MI Pack - Cycle No. 191*.
- Dinour, L. M., Bergen, D. and Yeh, M.-C. (2007) 'The Food Insecurity–Obesity Paradox: A Review of the Literature and the Role Food Stamps May Play', *Journal of the American Dietetic Association*, 107(11), pp. 1952–1961. doi: <https://doi.org/10.1016/j.jada.2007.08.006>.
- Douglas, F., Ejebu, O.-Z., Garcia, A., MacKenzie, F., Whybrow, S., McKensie, L., Ludbrook, A. and Dowler, E. (2015) *The nature and extent of food poverty/Insecurity in Scotland*.
- Fafard St-Germain, A.-A. and Tarasuk, V. (2018) 'Prioritization of the essentials in the spending patterns of Canadian households experiencing food insecurity.', *Public health nutrition*. England, pp. 1–14. doi: 10.1017/S1368980018000472.
- Food Foundation (2016) 'FORCE-FED Does the food system constrict healthy choices for typical British families?'
- Food Standards Agency (2017) *The Food & You Survey Wave 4. Combined Report for England, Wales and Northern Ireland*.
- Hex, N., Bartlett, C., Wright, D., Taylor, M. and Varley, D. (2012) 'Estimating the current and future costs of Type 1 and Type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs.', *Diabetic medicine : a journal of the British Diabetic Association*. England, 29(7), pp. 855–862. doi: 10.1111/j.1464-5491.2012.03698.x.
- Jones, N. R., Tong, T. Y. and Monsivais, P. (2018) 'Meeting UK dietary recommendations is associated with higher estimated consumer food costs: an analysis using the National Diet and Nutrition Survey and consumer expenditure data, 2008–2012.', *Public health nutrition*. England, 21(5), pp. 948–956. doi: 10.1017/S1368980017003275.
- Jones, N. R. V., Conklin, A. I., Suhrcke, M. and Monsivais, P. (2014) 'The Growing Price Gap between More and Less Healthy Foods: Analysis of a Novel Longitudinal UK Dataset', *PLOS ONE*. Public Library of Science, 9(10), p. e109343.
- Maguire, E. R. and Monsivais, P. (2015) 'Socio-economic dietary inequalities in UK adults: an updated picture of key food groups and nutrients from national surveillance data', *The British Journal of Nutrition*. Cambridge, UK: Cambridge University Press, 113(1), pp. 181–189. doi: 10.1017/S0007114514002621.
- Morris, M. A., Hulme, C., Clarke, G. P., Edwards, K. L. and Cade, J. E. (2014) 'What is the cost of a healthy diet? Using diet data from the UK Women's Cohort Study', *Journal of Epidemiology and Community Health*.

Nackers, L. M. and Appelhans, B. M. (2013) 'Food Insecurity Is Linked to a Food Environment Promoting Obesity in Households With Children', *Journal of Nutrition Education and Behavior*, 45(6), pp. 780–784. doi: <https://doi.org/10.1016/j.jneb.2013.08.001>.

NHS Digital (2017) *National Child Measurement Programme England 2016/17*.

O'Connell, R., Owen, C., Padley, M., Simon, A. and Brannen, J. (2018) 'Which Types of Family are at Risk of Food Poverty in the UK? A Relative Deprivation Approach', *Social Policy and Society*. 2018/02/05. Cambridge University Press, pp. 1–18. doi: DOI: 10.1017/S1474746418000015.

Office for National Statistics (2017) *User guidance and technical information for the Living Costs and Food Survey*.

Parliament.uk (2017) *Food: Written question - 110923*. Available at: <https://www.parliament.uk/business/publications/written-questions-answers-statements/written-question/Commons/2017-11-01/110923/> (Accessed: 23 August 2018).

Pechey, R. and Monsivais, P. (2016) 'Socioeconomic inequalities in the healthiness of food choices: Exploring the contributions of food expenditures', *Preventive Medicine*, 88, pp. 203–209. doi: <https://doi.org/10.1016/j.ypmed.2016.04.012>.

Public Health England (2016) *Eatwell Guide*.

Public Health England (2017) *Health matters: obesity and the food environment*.

Scarborough, P., Kaur, A., Cobiac, L., Owens, P., Parlesak, A., Sweeney, K., Rayner, M., Nutrition, S. A. C. on, Organization, W. H., Agency, F. S., England, P. H., England, P. H., Department for Environment, F. and R. A., Rao, M., Afshin, A., Singh, G., Monsivais, P., Rehm, C., Drewnowski, A., Lasdon, L., Fox, R., Ratner, M., (COMA), C. on M. A. of F. P., Nutrition, S. A. C. on, Nutrition, S. A. C. on, Darmon, N., Ferguson, E., Briend, A., Darmon, N., Ferguson, E., Briend, A., Perignon, M., Masset, G., Ferrari, G., Ello-Martin, J., Ledikwe, J., Rolls, B., NatCen Social Research, M. H. N. R. U. C. L. M. S., England, P. H., Agency, F. S., Gatenby, S., Hunt, P., Rayner, M., Scarborough, P., Nnoaham, K., Clarke, D., Lennernas, M., Fjellstrom, C., Becker, W., Department of Environment, F. and R. A., NICE, Puska, P., Trust, T. C., Change, C. on C., González, A., Frostell, B., Carlsson-Kanyama, A., Tilman, D., Clark, M., Scarborough, P., Appleby, P., Mizdrak, A., Organization, F. and A., Bostock, J., McAndrew, B., Richards, R., Cornelsen, L., Green, R., Tuner, R., NHS, Maillot, M., Vieux, F., Amiot, M., Davis, G., You, W., Hurrell, R., Egli, I., Cogswell, M., Mugavero, K., Bowman, B., Lee, A., Kane, S., Ramsey, R., Masset, G., Monsivais, P., Maillot, M., Clerfeuille, E., Maillot, M., Verger, E., Macdiarmid, J., Kyle, J., Horgan, G., Wilson, N., Nghiem, N., Mhurchu, C. N., Foundation, B. N., Policy, C. on M. A. of F. and Nutrition, S. A. C. on (2016) 'Eatwell Guide: modelling the dietary and cost implications of incorporating new sugar and fibre guidelines.', *BMJ open*. British Medical Journal Publishing Group, 6(12), p. e013182. doi: 10.1136/bmjopen-2016-013182.

The Food Foundation (2016) *Household food insecurity: the missing data*.

The Food Foundation (2017) *Farming for 5-a-Day: Brexit Bounty or Dietary Disaster*.

The Food Foundation, University of Oxford and Sustain (2016) *Measuring household food insecurity in the UK and why we must do it: 4 facts you should know*.

UK Data Service (2018a) 'Households Below Average Income'.

UK Data Service (2018b) 'Living Costs and Food Survey'.

Technical Appendix

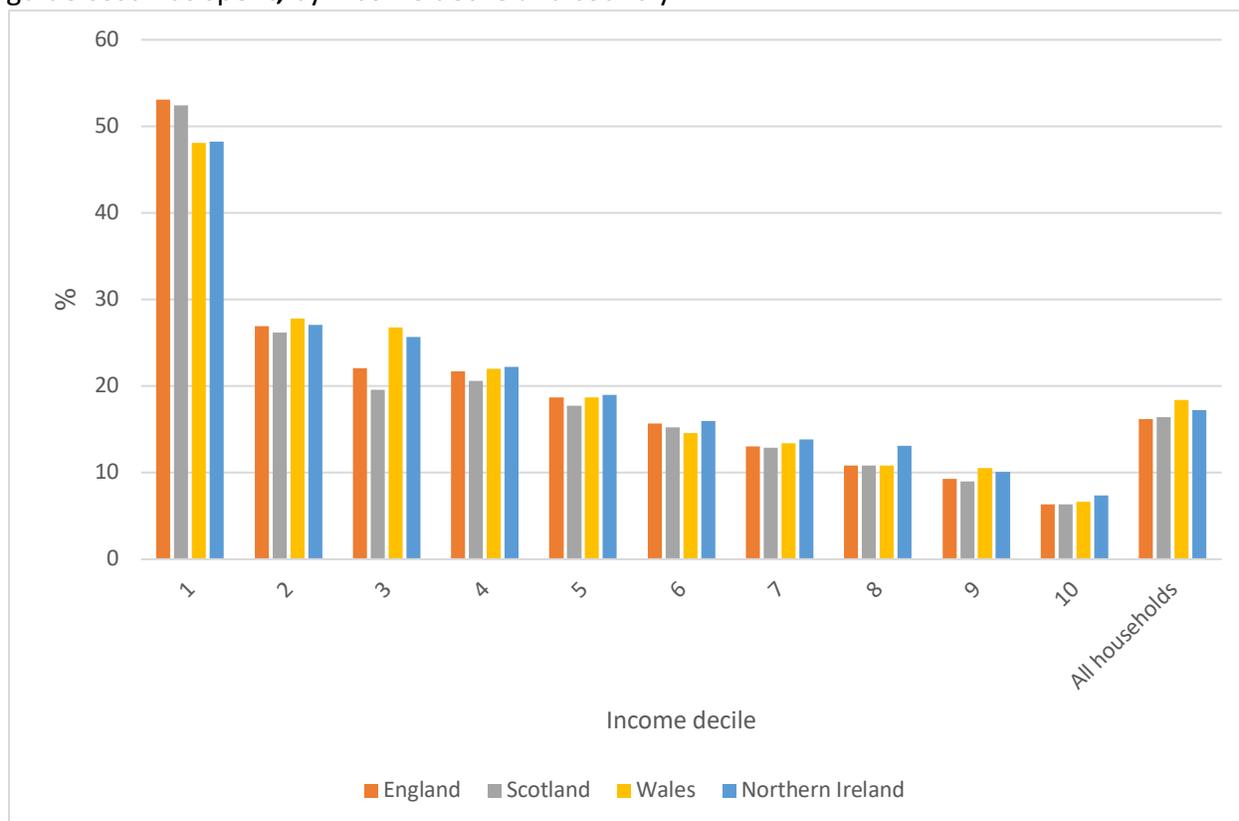
When comparing disposable income across income deciles, equivalised income values were used to account for household size and composition. For instance, a family of several members require a higher income than a single person to obtain a comparable standard of living. A couple with no children is taken as a reference point. Incomes of larger households are then adjusted downwards and the incomes of smaller households are adjusted upwards. The HBAI uses the OECD equivalence scale (Technical Appendix, Table 1) which adjusts household income to reflect different requirements for resources of single adults, any additional adults, and children according to their age group. Therefore, disposable income values relate to the 'cash' income for a couple with no children; the equivalisation process must be reversed for them to be converted to cash incomes for other family types.

Technical Appendix, Table 1: OECD Equivalisation scale

Type of Household Member	Equivalence value
First adult	0.67
Additional adult	0.33
Child aged 14 years and above	0.33
Child aged 0-13 years	0.2

When calculating the proportion of disposable income that the Eatwell cost comprises, two percent of all households in the FRS dataset, comprising nearly 20 percent of households in income decile 1, had a negative disposable income AHC. To enable us to calculate the proportion of disposable income that would be used up by the Eatwell cost, these households were set to 100%. An alternative approach would be to code these households as missing data values. The results of which are shown below (Technical Appendix, Figure 1). The median proportion of UK households in income decile 1 was slightly lower at 60.8% overall compared to 73.6% of households in the original analysis.

Technical Appendix Figure 1: Median proportion of disposable income AHC used up if Eatwell guide cost was spent, by income decile and country



Technical Appendix, Table 2: Household composition of income Decile 1 households vs all households

Household composition	Income Decile 1 households (%)	All households (%)
Single adult (n=6046)	66.1	28.9
2 adults, no children (n=6378)	15.3	33.6
3+ adults, no children (n=1130)	1.9	8.9
Single adult, 1+ children (n=1371)	7.5	5.6
2 adults, 1+ children (n=3810)	8.7	19.4
3+ adults, 1+ children (n=506)	0.6	3.7
All households (n=19241)	100	100