

How hungry were the poor in late 1930s Britain?[†]

By IAN GAZELEY , ANDREW NEWELL, KEVIN REYNOLDS,
and HECTOR RUFRANCOS*

This article re-examines energy and nutrition available to British working-class households in the late 1930s using individual household expenditure and consumption data. We use these data to address a number of questions. First, what was the extent of malnutrition in late 1930s Britain? Second, how did the incidence change over time? Third, what were the nutritional consequences of the school meals and school milk schemes? We conclude that, for working households, energy and nutritional availability improved significantly compared with current estimates of availability before the First World War. These improvements were not equally shared, however. In the late 1930s, homes with an unemployed head of household had diets that provided around 20 per cent less energy than their working counterparts and female-headed households had diets that provided around 10 per cent fewer kcal per capita than the average male-headed household. The availability of most macro- and micronutrients showed similar relative reductions. State interventions designed to improve diet and nutrition, such as school meals and school milk, made children's diets significantly healthier, even if they did not eliminate macro- and micronutrient deficiencies completely. Not surprisingly, they made the greatest difference to children in households where the head of household was unemployed.

The course of working-class living standards in Britain during the 1930s has been the subject of intense controversy, both at the time and at various points since, with the periodicity of debate seemingly related to the behaviour of the economy over time.¹ Central to this debate is the extent of malnutrition and hunger experienced by the working class. Indeed, as Lawrence points out, the dominant concern of interwar social commentators was 'directed towards publicizing the plight of working people still scourged by unemployment and poverty',² and cataloguing and exposing the extent of malnutrition formed

*Authors' Affiliations: Ian Gazeley, London School of Economics; Andrew Newell, University of Sussex; Kevin Reynolds, University of Brighton; Hector Rufrancos, University of Stirling.

[†] We would like to thank seminar participants at the University of Sussex and the University of Warwick, Sir Roderick Floud, Pat Thane, Claire Langhamer, and Hester Barron for comments on an earlier version. Research support for this work was provided by Economic and Social Research Council grants RES-062-23-2054 and ES/L002523/1. We gratefully acknowledge the research assistance of Samantha Shave, who photographed the original Rowett Institute records; Natacha Chevalier, who extracted the data; and the Rowett Institute, Aberdeen for their assistance. Comments from anonymous referees are also gratefully acknowledged.

¹ For example, the 1980s was a period of fervent argument at a time when Britain was experiencing the worst depression since the 1930s, with high unemployment and a similar regional pattern of deprivation. Mitchell argues that the experience of unemployment in the 1980s made it important to understand its impact in the 1930s, since the interwar years were the most relevant comparator at the time of writing; Mitchell, 'Effects of unemployment', p. 106.

² Lawrence, 'Everyday life in Britain', p. 276.

an important component of this mission. Typical of pessimistic contemporary commentary is Fenner Brockway's *Hungry England*.³ Examples were highlighted in the national press during the depression and the *Daily Mirror* ran a number of reports on poverty and malnutrition. One, under the title 'Mother's life for her 7 children', highlighted the case of Minnie Weaving, who died aged 37. Minnie was married to an unemployed general labourer and the family had an income of 48s. per week. According to the *Mirror*, she sacrificed her life for the sake of her children, and although pneumonia was the immediate cause of death, the pathologist noted, 'Had she had sufficient food in the past, the attack would not have proved fatal'.⁴

Crucially, however, for Boyd Orr in *Food health and income*, malnutrition was not confined to those who were out of work, sick, or old, but was pervasive among working households too. His conclusions were based upon the comparison of household food consumption evidence from budget studies with contemporary dietary recommended intakes.⁵ Such descriptions of malnutrition helped shape the way that historians writing in the immediate post-Second World War period viewed the interwar years. The 1930s attracted the sobriquet 'the hungry 1930s', which pithily depicted the lived experience of millions and promoted the concerns of a substantial body of contemporary opinion to a canonical description of a time and place. In an oft-quoted passage Mowat demonized this appellation as 'myth, sedulously propagated later',⁶ but as the 'Golden Age' of unprecedented affluence drew to a close in the 1970s, a more measured reassessment of living standards in the 1930s rapidly established a new orthodoxy. This interpretation portrayed the period in a more optimistic light, though did not necessarily deny the validity of the descriptions of hardship that characterized the traditional view. One of the key protagonists was Aldcroft, who wrote: 'not only was there a significant increase in real incomes and real wages but, partly as a result of this improvement and together with the extension of community services, the nation generally was better fed and clothed, and was housed in better conditions than those prevailing before the war'.⁷ A similar conclusion was reached by Winter. In a review of the behaviour of mortality statistics in Britain in the years 1870–1950, he claimed: 'the sustained decline in mortality rates such as Britain experienced before the 1930s was impossible without major improvements in the quantity and quality of per capita food intakes'.⁸

During the mid-1980s, as unemployment reached a new postwar peak in Britain, a number of historians questioned this optimistic reassessment of the 1930s, particularly with respect to the supposed improvements in health associated with advances in material living standards and increased food consumption. On the basis of a detailed analysis of mortality data and a deconstruction of contemporary morbidity assessments, Webster concluded that, 'For those substantial sections of the population in a position of disadvantage it is difficult to maintain that the interwar period was marked by any meaningful improvement in health'.⁹

³ Fenner Brockway, *Hungry England*.

⁴ *Daily Mirror*, 28 Jan. 1933, p. 1.

⁵ Boyd Orr, *Food health and income*, p. 55.

⁶ Mowat, *Britain between the wars*, p. 432, quoted in Webster, 'Healthy or hungry thirties?', p. 126.

⁷ Aldcroft, *Interwar economy*, p. 375.

⁸ Winter, 'Decline of mortality in Britain', p. 115.

⁹ Webster, 'Healthy or hungry thirties?', p. 125.

Support for Webster's view was provided by Mitchell's analysis of the effects of unemployment on infant and maternal mortality rates. Her inference that unemployment had a negative impact on infant mortality is drawn largely from the inspection of aggregate data, but her conclusions on the role played by malnutrition on maternal mortality are more convincing. These were based on William's detailed investigation into maternal health in the Rhondda during the 1930s, where the introduction of food aid to women in maternity clinics resulted in a significant fall in the puerperal death rate in 1935.¹⁰ Vernon points to the resurrection of the 'hungry 1930s' as being a direct consequence of the unravelling of the social democratic project and the re-assertion of free-market economics that was occurring at this time under the Conservative governments led by Prime Minister Thatcher.¹¹ Indeed, as Mason demonstrates, the answer to the question as to whether Britain in the 1930s was healthy or hungry can be seen as providing a judgement on capitalism itself.¹²

More recently, Lawrence has argued for the recognition of a plurality among interwar Britons' experience, based largely upon the economic geography of the depression.¹³ The recognition of the co-existence of a largely prosperous south and a relatively depressed north is not a new idea and can be found in Priestley's description of his travels around England in 1933 published in *English journey*,¹⁴ and in any number of accounts since. However, it does help to make sense of the persistence of diametrically opposed interpretations of the period. In this article we take an empirical approach to investigate an alternative, if related, taxonomy, based upon employment status and household structure, rather than economic geography *per se*, to describe the plurality of interwar Britons' experiences, though, of course, employment status had a strong geographical component.

To this end, this article uses individual household level data from the Ministry of Labour 1937/8 household expenditure enquiry and those collected by the Rowett Research Institute in 1938/9 for the Carnegie Trust to construct new estimates of food consumption and nutrition. It is set out as follows: in section I, we analyse changes to material indicators of living standards in the first 40 years of the twentieth century. In section II, we further explore contemporary concerns over malnutrition in Britain during the 1930s, review the findings of the major food surveys of the period, identify their shortcomings, and examine the standards used to judge nutritional adequacy. In section III, we review the 1937/8 Ministry of Labour working-class household expenditure survey, discuss how the individual household data can be utilized for nutritional analysis, and compare our estimates with the published results of 1930s food enquiries. Almost all the households taking part in this survey were headed by working men. In section IV we move on to consider the nutritional position of unemployed male-headed households and female-headed households in employment, derived from the analysis of the

¹⁰ Scheme described in Williams, 'Malnutrition as a cause of maternal mortality', *Public Health*, 50 (1936), p. 11, cited in Mitchell, 'Effects of unemployment', pp. 115–16.

¹¹ Vernon, *Hunger*, p. 270.

¹² *Ibid.*, pp. 257–8; Mason, 'Hunger', p. 24.

¹³ Lawrence, 'Everyday life in Britain', p. 274.

¹⁴ Priestley, *English journey*.

individual household data for the Carnegie Trust's *Dietary and clinical survey*.¹⁵ We also use these data to explore the impact of 1930s state interventions; namely free school meals, school milk schemes, and food provided in clinics, as recorded by households taking part in the Carnegie survey. Section V places our results in a longer time frame and makes comparison with estimates of nutritional status at the beginning of the twentieth century, and section VI concludes.

Our study suggests that both the traditional and ameliorist viewpoints of the 1930s are plausible descriptions that can coexist. Among working households there was a significant improvement in average food consumption per capita, which translated into improvements in average energy and macronutrient availability. These nutritional gains permeated through most of the household income distribution among those households where the head of household was in work. In those households where the head of household was unemployed, however, levels of energy and macronutrient availability per capita were in many cases similar to those households that contemporaries described as 'destitute' before the First World War. Household structure also played an important role here, as we go on to show. We also examine the role of the state in improving energy and nutrition levels available to children through free school meals, school milk schemes, and assistance to working-class mothers in clinics, and conclude that collectively these state interventions made a considerable difference, especially with respect to calcium and protein intakes among children, but were not sufficient individually to ensure adequate standards of nutrition generally. For the children in receipt of school meals from low-income households, however, it was probably transformative in terms of the proportion of the day spent hungry.

I. Improvement in living standards, 1900–40

Gazeley and Newell used household expenditure survey evidence to examine changes in material living standards in the first half of the twentieth century.¹⁶ In table 1, we take our analysis further using data from the 1904 Board of Trade survey and the 1937/8 Ministry of Labour survey, in conjunction with Feinstein's retail price index.¹⁷ Most of the households present in these surveys had two parents, at least one of whom was in work. It can be seen that by 1937/8, average weekly total household expenditure in 1937/8 prices was 228 per cent higher than weekly mean household income in 1904, at 1904 prices.¹⁸ Between these dates, however, the retail price index (RPI) had risen by 69 per cent, so real weekly mean household expenditure increased by about 34 per cent.¹⁹ However, average household size also fell by about 24 per cent between these two surveys, from about 5.1 in 1904, to about 3.9 in 1937/8.²⁰ In per capita terms, therefore, the rise in average real

¹⁵ The results of this survey, though not the individual level household data, were subsequently published in Report to the Carnegie United Kingdom Trust from the Rowett Research Institute, *Family diet and health in pre-war Britain*.

¹⁶ Gazeley and Newell, 'British Living Standards Project'.

¹⁷ Feinstein, *National income*, tab. 65 T140 (col. 3).

¹⁸ Calculated from tab. 1 (1007.9/442.6).

¹⁹ Calculated from tab. 1 (595/442.6).

²⁰ In comparison with household size estimates derived from the population census returns, these household survey data indicate slightly larger households. Average household size from the population census data for 1911 is 4.36, falling to 4.14 in 1921 and 3.72 in 1931. See Engineers' Study Group, *Design of a family budget*, p. 6.

Table 1. *Household characteristics, 1904 and 1937/8*

<i>Nutrient</i>	<i>Mean</i>	<i>Median</i>	<i>90th percentile</i>	<i>10th percentile</i>	<i>Std. dev.</i>
Board of Trade 1904					
Weekly food expenditure (d.)	265.6	249	435	153.5	115.7
Weekly family income (d.)	442.6	408	666	264	185.6
Food share of income	0.63	0.60	0.85	0.40	0.22
Household size	5.1	5	8	2	2.2
Ministry of Labour 1937/8					
Weekly food expenditure (d.)	407.6	370	631	232	169.4
Weekly total expenditure (d.)	1,007.9	880.5	1,642.5	504.5	542.6
Food share of expenditure	0.43	0.43	0.58	0.29	0.12
Household size	3.9	4	6	2	1.7
Weekly total expenditure (1904 d.)	595.0	519.8	969.6	197.8	320.3

Sources: Calculated by authors from the surviving returns of the 1904 Board of Trade and 1937/8 Ministry of Labour surveys; data available at UK Data Archive, *Living standards of working households in Britain, 1904–1954*, <http://doi.org/10.5255/UKDA-SN-7916-1>. Weekly total expenditure in 1904 d. calculated from the retail price series given in Feinstein, *National income*, tab. 65 T140, col. 3.

incomes between 1904 and 1937/8 was around 75 per cent.²¹ This rise in real incomes per capita is reflected in a substantial fall in the mean food share, from 0.63 to 0.43, but only a minor part of this is due to lower food prices, which, according to Feinstein, rose only a little less than the rise in the overall RPI between 1904 and 1937/8.²² Notice in table 1 that the fall in the food shares for the poorest households is much greater than at average income levels. At the 90th percentile, the food share falls by about 32 per cent from 0.85 to 0.58, compared to a fall of about 20 per cent at the mean and about 10 per cent at the 10th percentile. This is consistent with a shift in consumption of a basket of goods composed mainly of essential items in 1904 to one in 1937/8 that better reflected the inclusion of consumer goods produced by an advanced industrial economy. Other price changes also benefited poorer households. Housing was a little cheaper relative to food in 1937/8, though not by much, and as a consequence of interwar house-building the available housing stock had probably improved in quality.²³ The scourge of the interwar years was the high incidence of unemployment, though in aggregate terms, by the end of the 1930s, the comparison with 1904 is more favourable. Feinstein gives an unemployment rate of 6 per cent in 1904, compared with an average rate of about 8.5 per cent for the years 1937 and 1938.²⁴ We also know, however, that the duration of unemployment was probably longer in 1938, where on average about

²¹ Calculated from tab. 1 $(595/3.9)/(442.6/5.1)$.

²² Feinstein, *National income*, food price index, tab. 62 T138 (col. 1). Feinstein's food price index gives a 5% lower rise than his retail price index 1904–38.

²³ Feinstein, *National income*, housing price index, tab. 62 T138 (col. 3). Rent expenditure was the next most important category of expenditure, estimated to vary between about 12% and 16% of total household expenditure depending on income and household size (not that different from expenditure share on rent in 1904). See Nicholson, 'Variations', p. 365, tab. 6.

²⁴ Feinstein, *National income*, tab. 57 T125. The 1904 figure is based upon adjusted trades union records, whereas those for 1937 are estimates of the percentage of the civilian working population unemployed (7.8% in 1937, 9.3% in 1938), and thus are not strictly comparable. Boyer and Hatton's ('New estimates', p. 662, tab. 4) reworking of the pre-1914 unemployment data suggest levels of unemployment in 1904 similar to those that Feinstein gives for 1937 and 1938.

one-fifth of claimants had been unemployed for over one year, largely reflecting the weak position of staple export trades.²⁵

The optimism conveyed by the aggregate data reported in table 1 for those in work is borne out by recent research on European male heights by Hatton and Bray, who find that for northern European countries the increase in heights was greatest during the trans-war period. For the UK, during the period from the middle of the nineteenth century until the end of the twentieth century, the largest decadal increase in heights was among the birth cohorts born before the First World War, who would have reached maturity during the interwar period; and this occurred before the advent of universal health care and sustained economic growth of the golden age.²⁶ According to Hatton, the single most important explanation for the increase in heights during the trans-war period is improvements in the net disease environment.²⁷ So in short, there are good reasons to believe that, for those households in work, average levels of food consumption and nutrition would be considerably higher than corresponding families at the turn of the century.

II. Food consumption and nutritional standards in the 1930s

Investigations of (minimum needs based) poverty in Britain during the interwar period incorporated major advancements in nutrition science into their prescribed dietary requirements. In 1933 the British Medical Association (BMA) set out their own nutritional recommendation, which they translated into a cash sum representing the minimum cost of a diet that would maintain health and working capacity.²⁸ There were two other important dietary standards developed in the 1930s: the US dietary standard designed by Stiebelling (1933),²⁹ which specified minimum per capita intakes for protein, calcium, phosphorus, iron, and vitamins A and C, and the standard developed by the League of Nations Technical Commission (1937).³⁰ These three standards differ from each other in detail, as we shall see shortly, especially with respect to vitamin and mineral recommendations, and differ significantly from modern nutritional intake recommendations with respect to energy, protein, and vitamin and mineral recommendations. So the choice of comparator standard can clearly affect judgements on the extent of nutritional adequacy, and each of the major contemporary investigations of food poverty in the 1930s used a different standard.

In *Poverty and public health*, M'Gonigle and Kirby utilized the 1933 BMA recommendations in their landmark study of working-class living conditions in Stockton-on-Tees in 1935. They compared the budget available for food in 141 families, once the cost of other necessities had been deducted, with the BMA recommended cost per capita of a minimum diet required to maintain health, re-priced at 1935 Stockton-on-Tees prices. They found that sufficient income was

²⁵ Crafts, 'Long-term unemployment', p. 421, tab. 2.

²⁶ Hatton and Bray, 'Long run trends', p. 407, tab. 1.

²⁷ Hatton, 'How have Europeans grown so tall?', p. 366.

²⁸ Mayhew, '1930s nutrition controversy', p. 450.

²⁹ Stiebelling, *Food Budgets*.

³⁰ League of Nations (Health Committee of the Technical Commission on Nutrition), *Bulletin of the Health Organisation*, vol. VII, no. 3.

only available in the highest household income class of 70–80s. per week.³¹ The nutritional analysis of these households' food purchases revealed that, while energy availability rose with income, for groups with an income of less than 55s. per week, energy values were below the 1933 BMA standard of 3,400 kcal per capita per day. A similar pattern was found in the analysis of the availability of first-class animal protein in the diet.³² They analyse in detail the essential living costs facing working-class households at different income levels and while, at the margin, a lack of knowledge or ignorance of the nutritional value of particular foods had an impact on nutrition, malnutrition was overwhelmingly the consequence of low income per capita, whether by virtue of low wages or large household size.³³ Clearly, any event that drastically reduced income, such as a lack of employment, chronic ill health, or death of the principal wage earner, was liable to have a strong negative impact on household nutrition. M'Gonigle and Kirby were circumspect concerning the extent to which their findings for Stockton-on-Tees could be generalized to other areas, but ultimately they concluded that 'it appears not improbable that nearly one half of the population of England and Wales subsist, to a greater or lesser extent, below the safety line of nutrition'.³⁴

In *Food health and income* (1937), Boyd Orr reached a more emphatic conclusion. Based upon the application of Stiebeling's US standard, he claimed that the poorest group of the population—some 4.5 million people, or about 10 per cent of the population of the UK—had diets deficient in every nutritional constituent he examined, and another nine million people had a diet deficient in all nutritional constituents other than protein. He argued for a direct causal link between nutrition and the incidence of disease and physical stature: 'as income increases, disease and death-rate decrease, children grow more quickly, adult stature is greater and general health and physiques improve'.³⁵ The empirical basis of Boyd Orr's conclusions was the analysis of the nutritional content of foods recorded in 1,152 family budgets from six household and dietary surveys carried out between 1932 and 1935. The largest single group (538) were for England and Wales, carried out by the Women's Co-operative Guild in 1935; the next largest were from Merseyside (243) in 1932, followed by Great Britain Middle Class (138) in 1932, Newcastle (102) in 1933–4, Stockton-on-Tees (82) in 1932, and finally Manchester and District (49) in 1933.³⁶ According to Boyd Orr, these surveys included a wide range of income classes from 'very poor families spending less than 2s per head weekly on food, up to families with an income of £2,000 per annum spending 15s or more per head on food'.³⁷

³¹ M'Gonigle and Kirby, *Poverty and public health*, pp. 243–7.

³² *Ibid.*, p. 253, tab. 46.

³³ *Ibid.*, pp. 194–6.

³⁴ *Ibid.*, p. 263.

³⁵ Boyd Orr, *Food health and income*, p. 55. A recent analysis of adult male heights during the late nineteenth and the early part of the twentieth century suggests that average final heights of men who reached maturity in the third quarter of the nineteenth century was 167.2 cm, increasing to 168.2 cm by the first quarter of the twentieth century and 170 cm in the second quarter of the twentieth century. Surprisingly, perhaps, it was not until the third quarter of the twentieth century that average male heights in Great Britain exceeded the estimate for the second quarter of the nineteenth century (175 cm and 171.2 cm respectively). Floud, Fogel, Harris, and Hong, *Changing body*, p. 69, tab. 2.5.

³⁶ Boyd Orr, *Food health and income*, p. 59, app. II. These represented a sub-set suitable for nutritional analysis from the total of budgets collected. The total numbers were Women's Co-operative Guild 700, Newcastle 105, Manchester and District 50, Stockton-on-Tees 85, Merseyside 300, and Great Britain Middle Classes 200.

³⁷ *Ibid.*, p. 59, app. II.

From the analysis of these budgets, in conjunction with unpublished data derived from the 1931 population census, Boyd Orr estimated food and nutrient availability per head by income class for all of England and Wales.³⁸

Crawford doubted the general validity of Boyd Orr's findings and commissioned his own Food Enquiry, which informed *The people's food*. Crawford justified his new survey on the basis that Boyd Orr's *Food Health and Income* was the outcome of the analysis of fewer than 1,200 budgets, none of which were bespoke to the study, and a high proportion of which were from large, low-income households in the industrial north of England. Thus, clerical workers and middle-class households were under-represented and the very rich were completely excluded.³⁹ Crawford's Food Enquiry collected budgets from nearly 5,000 urban households between October 1936 and March 1937 in seven centres (London, Birmingham, Leeds, Glasgow, Newcastle, Liverpool, and Cardiff), which Crawford claimed were representative of two-thirds of the population of Great Britain.⁴⁰ Details of the method of sampling are unfortunately scant, but Crawford indicates that households in his study were randomly selected from five income groups, after a preliminary survey of each centre had identified particular areas that 'comprised the bulk of the respective members of those classes in each selected town'.⁴¹ Helpfully, Crawford compared his findings with the recommendations of all three interwar nutritional standards (BMA, Steibeling, and the League of Nations). Unpublished postwar analysis by the Ministry of Food regarded the Crawford survey as superior to Boyd Orr's, though expressed doubts over the extent to which it could claim to be representative of Britain as a whole.⁴²

Rowntree had also updated the dietary component of the minimum needs poverty line that he utilized in *Poverty: a study of town life* (1901) and set out this new dietary standard in *Human needs of labour* (1937), which combined the BMA recommendations for energy and protein with the League of Nations Technical Commission (1937) recommendations for minerals and vitamins. This composite standard formed the basis of the food component of the poverty line he employed in his second social survey of York, *Poverty and progress* (1941).⁴³

The recommendations Boyd Orr utilized for 'moderately active' adult males are set out in table 2, along with those adopted by Rowntree in *Poverty and progress* (1941), and the 1991 UK standard produced by the Department of Health's Committee on Medical Aspects of Food and Nutrition Policy (COMA).⁴⁴ Vitamin and minerals in Boyd Orr's and Rowntree's standards have been converted into milligrams and micrograms to make them comparable with COMA 1991 (see the notes to table 2 for an explanation). These standards are recommendations for adult males, with a physical activity level (PAL) of 1.4. The desired intakes for adult women and children are generally less, but the most apparent difference between the minimum nutritional standard used by Boyd Orr's and Rowntree and the

³⁸ *Ibid.*, pp. 62–4, app. V.

³⁹ Crawford and Broadley, *People's food*, pp. 25–6.

⁴⁰ *Ibid.*, pp. 27–31.

⁴¹ *Ibid.*, p. 310, app. I.

⁴² TNA, MAF 300/1, Crawford Broadley Comparisons, notes on the comparability of pre-war budgetary samples, p. 3.

⁴³ Rowntree, *Poverty: a study of town life*; *idem*, *Human needs of labour*, pp. 48–76; *idem*, *Poverty and progress*.

⁴⁴ The more recent 2011 UK Scientific Advisory Committee on Nutrition (SACN) recommendations are identical to COMA except for a reduction in energy requirements for adult males of 50 kcal per day.

Table 2. *Daily minimum dietary intakes for a moderately active adult male (standardized units)*

Nutrient	Rowntree (1901)	Boyd Orr (Stiebeling, 1933)	Rowntree (composite BMA/ League of Nations, 1941)	Department of Health (COMA 1991)
Energy (kcal)	3,500	3,000	3,400	2,550
Protein (g)	125	67	100	55.5
Calcium (g)		0.68	0.5	0.7
Phosphate (g)		1.32	1.0	0.55
Iron (mg)		15	10	8.7
Vitamin A (μ g)		857	600	700
Vitamin B1 (mg)		-	0.9	1.0 ^a
Vitamin C (mg)		50–60	30	40

Notes and sources: a 0.4 mg per 1,000 kcal.

Calculated from Boyd Orr, *Food, health and income*, p. 38, tab. VI, values for moderately active man. These recommendations were compiled by Stiebeling, *Food Budgets*. Boyd Orr provides values for vitamin A and vitamin C in Sherman Units (SUs). One SU of vitamin C translates into about 0.5–0.6 mg. One SU of vitamin A translates into 1.4 International Units (IUs) (Sherman Units to International Unit conversion based on E. Fullerton-Cox, 'New US pharmacopoeial for cod liver oil', *Analyst*, 701 (1934), pp. 545–6). These have been converted to micrograms using the equivalence given below. Rowntree, *Poverty and progress*, p. 183, values for adult male. Rowntree based his recommendations on the 1933 BMA recommendations for energy and protein, but because these did not include recommendations for minerals and vitamins, Rowntree used those provided by the League of Nations (Health Committee of the Technical Commission on Nutrition), *Bulletin of the Health Organisation*, vol. VII, no. 3. Rowntree provides vitamin values in International Units. These have been converted to micrograms (μ g) and milligrams (mg) on the following basis: vitamin A, 1 IU equal to 0.3 μ g of retinol; vitamin C, 1 IU equal to 0.05mg; vitamin B1, 1 IU = 0.003mg. COMA, *Dietary Reference Values*, energy (EAR), tab. 1.1, p. xix; protein, tab. 1.3, p. xxi; vitamins, tab. 1.4, p. xxii; minerals, tab. 1.5, p. xxviii. All based on RNI values for an adult male aged 19–50 years.

modern (COMA 1991) standard is the lower estimated average requirement (EAR) for energy, reflecting the lower energy requirements of more sedentary modern life styles. Note that although Boyd Orr's standard for energy and protein requirements are significantly lower than Rowntree in *Poverty and progress*, it is higher for every mineral and vitamin. As a consequence, the use of Boyd Orr's standard would give more evidence of malnutrition than would be the case if Rowntree's standard were used instead and is a part explanation of Boyd Orr's conclusions with respect to the pervasiveness of malnutrition in 1930s Britain.

III. The 1937/8 Ministry of Labour household expenditure survey

None of these contemporary investigators had available to them the food consumption records collected by the Ministry of Labour as part of their survey of working-class household expenditure, carried out in four quarters during 1937–8. This was the largest interwar survey of its type, which used two-stage stratified random sampling techniques. The Ministry of Food's postwar assessment of the relative worth of this survey was that it is 'without doubt as representative a sample as can humanly be made of its universe, defined as industrial households of which the head is employed and not earning more than £250 per year, i.e. manual workers and lower black-coated workers'.⁴⁵ Using the surviving returns from this survey, we are able to report new estimates of energy and nutritional availability and make direct comparison with Boyd Orr's and Crawford's findings.

⁴⁵ TNA, MAF 300/1, Crawford Broadley Comparisons, notes on the comparability of pre-war budgetary samples, p. 2.

In 1937–8, the Ministry of Labour carried out a large-scale household expenditure enquiry, so as to be able to update the official cost of living index. For the week beginning 17 October 1937, 12,967 working-class household expenditure records were collected. These were from a stratified random sample of about 22,000 households headed by manual and non-manual workers from the unemployment insurance register, earning less than £250 per annum, and currently employed.⁴⁶ These were supplemented by data recorded by households where the head of household was not currently insured against unemployment (particularly railway workers, local authority, and public utilities employees and those employed by government departments).⁴⁷ The Ministry designed the survey so that it would produce national coverage.⁴⁸

The full survey was repeated for the weeks beginning 23 January 1938, 24 April 1938, and 17 July 1938. The subsequent quarterly investigations for the three weeks in 1938 produced 11,518, 11,126, and 10,920 useable household budgets. The total number of households supplying expenditure records for all four weeks of the enquiry was 10,762.⁴⁹ Of these, 623 are extant for all four quarters (about 2,500 budgets, around 5.8 per cent of the total) and have been analysed.⁵⁰ As Gazeley and Newell show, the relatively small number of surviving returns appears to be an extremely good sample of the entire enquiry with respect to regional coverage, the size distribution of households, the distribution of children, and numbers of secondary workers.⁵¹ They also compared the distributions of total household expenditure in the surviving sample with that given for the random sample of 2,225 that was analysed by the Ministry of Labour. The surviving sample has a slightly greater proportion of low-expenditure working households than the random sample, and other things being equal we would expect this modest over-representation of poorer households to increase the extent of measured malnutrition in these data. It must be remembered, however, that the target group was working households, most of whom would have been male-headed in regular employment. Excluded from the survey were the long-term unemployed, the irregularly employed, important categories of single-person households (such as residential domestic servants), and those living in workhouses.⁵²

The 1937/8 survey reports household expenditure, and the quantity purchased, for 57 items of food, but in table 3 these have been aggregated into major food types, which have been reported by Boyd Orr income groups to facilitate comparison. As might be predicted from the analysis carried out in section I, these show significantly greater levels of consumption of quality food types than Gazeley and

⁴⁶ Approximately 31,000 households were identified and visited, but about 9,000 were found by the enquiry investigators to fall outside the scope of the enquiry; TNA, LAB 17/7 99338, 'Weekly expenditure of working class households', p. 7.

⁴⁷ *Ibid.*, p. 5.

⁴⁸ For example, to ensure that all regions were adequately covered the Ministry required that it received responses from households amounting to at least two-fifths of the total number of households in random sample from any district. If less than this were received, further questionnaires were sent to households on a reserve list in the under-represented district. *Ibid.*, p. 5.

⁴⁹ *Ibid.*, p. 8.

⁵⁰ 524 of these are extant at the University of Bangor and 99 at TNA, LAB 17. The extracted data are available from Gazeley and Newell, 'British Living Standards Project'.

⁵¹ Gazeley and Newell, 'Poverty in Edwardian Britain'.

⁵² In common with all expenditure surveys, there is a bias towards literate and numerate households. The extent of this bias is unknown.

Table 3. *Consumption of foods per capita day, Ministry of Labour 1937/8 household survey (Boyd Orr income groups)*

	<i>All</i>	<i>Income group 1</i>	<i>Income group 2</i>	<i>Income group 3</i>	<i>Income group 4</i>	<i>Income group 5</i>	<i>Income group 6</i>
Bread/flour	0.77 (0.007)	0.67 (0.017)	0.72 (0.015)	0.75 (0.013)	0.79 (0.013)	0.82 (0.016)	0.87 (0.028)
Milk	0.44 (0.005)	0.22 (0.012)	0.31 (0.011)	0.41 (0.009)	0.49 (0.008)	0.56 (0.012)	0.60 (0.017)
Cheese	0.03 (0.001)	0.02 (0.001)	0.02 (0.001)	0.03 (0.001)	0.04 (0.001)	0.04 (0.002)	0.05 (0.003)
Butter/marg	0.13 (0.001)	0.09 (0.003)	0.11 (0.002)	0.12 (0.002)	0.13 (0.002)	0.15 (0.004)	0.16 (0.007)
Meat	0.28 (0.004)	0.14 (0.006)	0.21 (0.006)	0.27 (0.007)	0.32 (0.007)	0.36 (0.013)	0.39 (0.023)
Eggs	0.52 (0.008)	0.19 (0.014)	0.33 (0.013)	0.45 (0.013)	0.58 (0.015)	0.69 (0.020)	0.87 (0.051)
Fruit	0.34 (0.007)	0.11 (0.011)	0.17 (0.010)	0.27 (0.012)	0.40 (0.013)	0.51 (0.023)	0.65 (0.036)
Vegetables	0.19 (0.004)	0.06 (0.005)	0.09 (0.005)	0.15 (0.006)	0.21 (0.006)	0.30 (0.012)	0.39 (0.023)
Potatoes	0.50 (0.010)	0.32 (0.027)	0.42 (0.024)	0.47 (0.020)	0.54 (0.021)	0.57 (0.023)	0.58 (0.036)
Fish	0.07 (0.002)	0.04 (0.003)	0.05 (0.003)	0.06 (0.003)	0.08 (0.003)	0.10 (0.005)	0.14 (0.011)
Cereals	0.03 (0.001)	0.03 (0.003)	0.02 (0.002)	0.02 (0.018)	0.03 (0.002)	0.03 (0.002)	0.03 (0.003)
Sugar	0.20 (0.002)	0.15 (0.005)	0.17 (0.004)	0.19 (0.004)	0.21 (0.004)	0.24 (0.009)	0.24 (0.011)

Notes and sources: All items are measured in lbs, except eggs which are recorded as the no. consumed, estimated by authors from the surviving returns of the Ministry of Labour 1937/8 survey; data available at UK Data Archive, *Living standards of working households in Britain, 1904–1954*, <http://doi.org/10.5255/UKDA-SN-7916-1>. Income groups are as Boyd Orr, *Food, health and income*. Standard errors of the mean are in parentheses. Some items were purchased in ambiguous units of quantity or volume (tins, packets, bottles, numbers bought, and so on) and a small number of others routinely do not have quantities assigned. We attended to this missing quantity data in two ways. First, where some quantity data are recorded across the 623 households in any of the four quarters (2,492 observations), we calculated the average unit price from the expenditure and quantity data. This was then used to derive the implied quantity purchased, in cases where only expenditure was recorded. Second, average unit prices are recorded in Stone and Rowe, *Measurement of consumers' expenditure*, for most items of food and these were used to derive implied quantities in cases where only expenditure data are recorded in the surviving 1937/8 survey returns. The Stone and Rowe average unit price was also used to evaluate the within-survey derived prices in cases where quantity was rarely recorded. For the small number of items where the recorded quantity is in ambiguous weight units (such as packets, bottles, or tins), we invariably relied upon the prices quoted in Stone and Rowe to derive quantities in unambiguous units from the expenditure data. Full details are provided in online app. S1. The table is based on some aggregation of the consumption data. This is as follows: bread includes white and brown bread, flour, and fancy bread and cakes; milk includes whole and skimmed milk (but excludes condensed milk); meat includes bacon, home and imported beef, home and imported mutton, pork, tinned meat, sausage, and other meat; eggs include those purchased and from self-provisioning; fruit includes apples, oranges, bananas, tinned fruit, dried fruit, and other fresh fruit (not including fruit from the garden); vegetables include legumes, green vegetables, root vegetables (other than potatoes), onions, and tinned vegetables (not including vegetables from the garden); fish is fresh fish, shellfish, dried fish, and 0.5 fish and chips; cereals are cereals, oatmeal, and rice; potato does not include those produced in the garden but includes 0.5 fish and chips; sugar does not include sugar consumed as jam or confectionery, but does include treacle/syrup; and butter/marg is butter and margarine, but also includes lard and suet recorded in the survey).

Newell document from data extracted from the Board of Trade's 1904 survey.⁵³ The 1904 Board of Trade survey was a non-random survey of mainly working-class households, which Gazeley and Newell analysed on the basis of skill groups of head of household. Comparing unskilled households in 1904 with Boyd Orr's income per capita group 2 or 3 shows significant increases in the weekly per capita consumption of milk, cheese, meat, eggs, fruit, and fish by 1937/8, and decreases

⁵³ Gazeley and Newell, 'Poverty in Edwardian Britain', tab. 3, p. 109.

in the consumption of bread and flour, and cereals. Changes in the consumption of potatoes and other vegetables in the 1937/8 Ministry of Labour survey depend upon the Boyd Orr income per capita group used as a comparator: households in income per capita group 2 in 1937/8 show similar levels of consumption as unskilled households in 1904, while households in income per capita group 3 were consuming significantly more per capita than their 1904 unskilled household forbears. Even those households in Boyd Orr's income per capita group 1 were consuming more milk, fats, eggs, and fruit than the average unskilled household in 1904. Overall, it is clear that by 1937/8, households were consuming significantly more foods rich in minerals and micronutrients than had been the case at the beginning of the century. The one exception to this trend is the increased per capita consumption of sugar: in 1937/8 across all income groups this was 1.42 lbs per capita, compared with about 1.0 lb per capita across all households in 1904.

McCance and Widdowson's food composition tables have been used to translate the food consumption data recorded in this survey into available nutrients, adjusted so as to remove the impact of fortification on the values for bread, flour, and margarine.⁵⁴ There are reasons to treat these estimates of available nutrients with caution. First, the estimates of micronutrient availability derived from this survey are subject to larger errors than are the estimates of macronutrient availability, as we have no knowledge relating to the methods of storage, preparation, and cooking used by the households in the 1937/8 enquiry, but these are known to affect the micronutrient composition of foods. Second, the 1937/8 survey was not a bespoke nutritional or food survey, and as a consequence the estimates of household nutritional intake that can be obtained from these household food consumption records are subject to a number of other potential errors. For example, there is no information relating to the existing stock of food or any food purchased during the week of the survey that remained unconsumed. Because this survey is a fixed-format design, some of the records of expenditure lack precision from a nutritional perspective.⁵⁵ Third, there is also the problem of how to treat meals consumed away from the home. The 1937/8 survey includes expenditure on meals out, but it is obviously impossible to gauge the nutritional content of these meals. In consequence, where we report nutritional availability inclusive of meals out, the nutritional content of meals away from home have been assumed to be the average of the weekly diet.⁵⁶ This is probably an upper-bound assumption, but a better one than ignoring what had become an important component of food expenditure in the late 1930s, especially for better-off households. Finally, we have adopted McCance and Widdowson's assumptions concerning the amount of waste associated with each food consumed. These are often generous and may imply significantly more food waste than would have been the case in the 1930s.

Making a smooth comparison between the nutritional information derived from the food consumption data in the surviving returns of the Ministry of Labour 1937/8 enquiry and either Boyd Orr's or Crawford's published results is not

⁵⁴ Paul and Southgate, *Composition of foods*.

⁵⁵ For example, although it is known that the household purchased a quantity of meat, it is not known what cut of meat was purchased and whether it was on or off the bone. We take an average nutritional value of a variety of different cuts for each type, including both on-the-bone and off-the-bone cuts, to try and mitigate this problem.

⁵⁶ For example, if 10% of food expenditure is recorded on meals away from home, we have inflated the estimates of nutritional availability by this amount.

Table 4. *Weighted mean energy and macronutrient availability per capita per day*

	Energy (kcal)	Protein (g)	Calcium (g)	Phosphate (g)	Iron (mg)	Vitamin A (μ g)	Vitamin B1 (mg)	Vitamin C (mg)
Boyd Orr	2,984	84.9	0.67	1.22	11.29	535	n.a.	74.4
Crawford	2,711	74.7	0.64	1.17	11.76	780	1.32	62.8
MoL 1937/8	2,922	77.2	0.68	1.23	11.28	598	1.08	58.3

Notes and sources: Boyd Orr: calculated from the nutrients available by income per capita group given in *Food, health and income*, p. 40, tab. VII, weighted by estimates of income per capita group size in the population given in *ibid.*, p. 27, tab. IV. Crawford: calculated from the nutrients available by Boyd Orr's income per capita group in *People's food*, p. 159, weighted by Boyd Orr's estimates of income per capita group size in the population given in *Food, health and income*, p. 27, tab. IV. In both cases, vitamin availability is reported in International Units and these have been converted to micrograms and milligrams using the equivalence reported in the notes to tab. 1 of this article. MoL (Ministry of Labour) 1937/8 figures are the Boyd Orr per capita group estimates reported in tab. 1 of this article, weighted by Boyd Orr's estimates of the income per capita group size in the population; authors' estimates from the surviving returns of the 1937/8 Ministry of Labour survey; data available at UK Data Archive, *Living standards of working households in Britain, 1904–1954*, <http://doi.org/10.5255/UKDA-SN-7916-1>.

straightforward. The target group, sampling method, food inclusion list, and waste assumptions all vary between the three surveys.⁵⁷ Neither Crawford nor Boyd Orr reports estimates of the mean energy and nutrient availability from the diets recorded in their surveys. However, Boyd Orr does provide details of the assumed population proportions of each income per capita class,⁵⁸ and we have used these in conjunction with Boyd Orr's energy availability data by income per capita class to generate an estimate of mean energy and macro- and micronutrient availability. We have also used these weights to generate a set of comparable estimates from Crawford's *Food survey*, using Crawford's own estimates of energy and nutrient availability by Boyd Orr income per capita group and from the Ministry of Labour's survey. These calculations are reported in table 4.

The outcome of this comparison is that on average macronutrient availability is similar in the data recorded in all three enquiries, despite differences in target

⁵⁷ Crawford made no allowance for edible waste, though he recognized that some energy and nutrients would be lost (Crawford, *Food survey*, p. 123), and while Boyd Orr similarly acknowledges the potential loss, it is not clear how his reported figures adjust for edible waste in the food preparation and cooking processes, as they are not based solely on the analysis of budgetary data. Instead they are adjusted in various ways to take account of discrepancies between estimates derived from budgetary data and estimates of average quantities consumed derived from production data (Boyd Orr, *Food, health and income*, pp. 71–5). It is uncertain whether Crawford or Boyd Orr includes energy and nutrients available from all foods purchased. In particular, their treatment of sweets and confectionery remains unclear. In the case of Crawford, he does not report expenditure on or quantities consumed of these items and notes that consumption of sweets and confectionery forms part of the discrepancy between his estimates of sugar (and jam, marmalade, and honey) consumption and the estimate produced by the Advisory Committee on Nutrition, with the clear implication that sweets and confectionery consumption is not included in his *Food survey* calculations (p. 270). Similarly, Boyd Orr reports the quantity of sugar (purchased as such) and jams, jellies, and syrups, but not sweets and confectionery, so it seems he also excluded them from his analysis. There is also a list of exclusions to Boyd Orr's estimates provided in these notes to this table, including chipped potatoes, fried and tinned fish, and biscuits and cakes (Boyd Orr, *Food, health and income*, tab. 1 (app. VI), p. 72). Neither Boyd Orr nor Crawford includes meals out in their calculations for lower-income households, though Boyd Orr does make adjustments for meals out consumed by the two highest income per capita classes. Crawford was interested in food consumed within the home, and although he records the average expenditure and quantity of beer consumed in the home by social class, and expenditure for home consumption on wines and spirits by social class, it seems unlikely that his estimates of energy and nutrient availability includes those derived from alcohol, as according to Crawford, the home consumption of beer in working-class homes was 'negligible'. Similarly, he claims that it was only the wealthiest social class that had expenditure on wines and spirits 'of any significance' (*Food survey*, p. 284). In contrast, the Ministry of Labour survey records expenditure on alcohol (whether consumed in or away from the home).

⁵⁸ Boyd Orr, *Food, health and income*, p. 66.

group and method. Variations in average nutrient levels between these surveys are generally relatively minor. With respect to energy availability, the average per capita estimates derived from Crawford are around 200–270 kcal per capita below the Ministry of Labour's and Boyd Orr's figures, probably because Crawford was focused on home consumption only. The estimates of protein availability derived from Boyd Orr's survey are around 10g per capita per day higher than the other two surveys, while vitamin C availability is lower in the Ministry of Labour survey estimates and vitamin A availability is highest in estimates derived from Crawford's survey. The reasons for these differences are probably due to a combination of factors, including differing waste assumptions and the treatment of meals out, alcohol, and sweets, as well as sampling differences.⁵⁹

A full analysis of the 1937/8 data facilitates a detailed investigation of levels of energy and nutrient availability by income per capita class and the pattern of likely deficiencies, which is not possible using published Boyd Orr and Crawford material. Energy availability per capita per day among the lowest income group (less than 10s. per week per capita) is a little over 2,000 per day, rising to just under 4,000 per day for those households with an income of more than 45s. per week per capita. The variation in nutrient availability roughly mirrors this pattern for protein, iron, and vitamin B1, with the highest income per capita group having a diet that provides roughly twice the available nutrients of the diet consumed by the lowest income per capita group. In the case of calcium and vitamin A, the multiple is roughly 3, and in the case of vitamin C, the multiple between the highest and lowest income group is roughly 4. There is also a strong negative correlation between household income per capita and household size, with significant variation around the mean (coefficient of variation of 0.42). The variation in the number of household members by income per capita class is mainly due to the number of children under 14 years old in each household, with a few of the richest households having no children, and the poorest households having nearly three times more than the average number among all households taking part in the survey. The average total household size of 3.88 is significantly lower than at the time of the 1904 Board of Trade survey (which varied between 5.75 and 6.28, depending upon skill class), reflecting the progress of the demographic transition across the First World War and interwar period.⁶⁰

In the 1937/8 survey, the poorest households by income per capita class also have the highest average number of working age children aged 14 to 17 years. The existence of older children of working age might be expected to mitigate the impact on the household economy of a larger-than-average household size, but in fact the number of wage earners in the household was identical to the number in the richest households.⁶¹ Across the sample as a whole, the number of wage earners per household displays an inverted U-shape pattern (increasing before decreasing) with respect to household average income per capita, with the highest average number of wage earners in the 15–20s. per week income per capita group (just fewer than two wage earners per household). However, since neither the precise occupation of the head of household nor the head of household's wage is recorded in the 1937/8

⁵⁹ Excluding recorded alcohol, sweets, and meals out accounts for about 140 kcal and 10g of protein per capita per day for the average household in the Ministry of Labour survey.

⁶⁰ Gazeley and Newell, 'Urban working class food consumption', p. 106, tab. 1.

⁶¹ Unfortunately, this figure is not broken down between spouses' and children's employment.

Table 5. *Within-group proportion of households with likely energy and LRNI nutrient deficiencies in the Ministry of Labour 1937/8 survey, by Boyd Orr income group (within-group number in parentheses)*

Income per capita group per week	N	Energy (kcal)	Protein (g)	Calcium (g)	Iron (mg)	Vitamin A (µg)	Vitamin B1 (mg)	Vitamin C (mg)
<10s.	212	0.48 (101)	0.03 (6)	0.49 (103)	0.18 (37)	0.40 (84)	0.01 (3)	0.17 (36)
10–15s.	398	0.29 (115)	0.01 (4)	0.25 (98)	0.10 (40)	0.15 (58)	0.01 (4)	0.07 (28)
15–20s.	524	0.16 (82)	0.01 (5)	0.08 (44)	0.05 (28)	0.05 (25)	<0.01 (1)	0.05 (28)
20–30s.	750	0.08 (58)	<0.01 (1)	0.03 (20)	0.03 (20)	0.03 (21)	0	0.02 (14)
30–45s.	425	0.05 (20)	<0.01 (2)	0.02 (7)	0.02 (7)	0.02 (64)	0	0.03 (12)
>45s.	188	0.02 (3)	0 (3)	0.02 (3)	<0.01 (1)	0.01 (2)	0	0.02 (4)
All households	2,492	0.15 (379)	0.01 (18)	0.11 (275)	0.05 (133)	0.08 (196)	<0.01 (8)	0.05 (121)

Notes and sources: Authors' estimates from the surviving returns of the 1937/8 Ministry of Labour survey; data available at UK Data Archive, *Living standards of working households in Britain, 1904–1954*, <http://doi.org/10.5255/UKDA-SN-7916-1>. Energy and nutritional availability include meals away from home and alcohol consumption. This table reports household energy availability relative to COMA 1991 EARs and nutrient availability relative to COMA 1991 LRNI by age and sex (COMA, *Dietary Reference Values*); namely, energy (EAR), tab. 1.1, p. xix; protein, tab. 1.3, p. xxi; vitamins, tab. 1.4, p. xxii; minerals, tab. 1.5, p. xxviii. COMA, *Dietary Reference Values*, does not report LRNI for protein and these have been calculated by the authors as EAR minus 2 standard deviations. There is also some inconsistency with the reporting of LRNI in COMA for four- to six-year-olds for vitamin A and vitamin B1 between tab. 1.4 and the summary tab. 8.1. The former has been used for these calculations. For children less than one year old, the mean requirements of all the reported monthly age ranges have been used.

survey, it is not possible to investigate the extent to which households in this group were composed of lower-paid household heads, where the household budget was augmented by the earnings of other household members.

Table 5 shows the extent of likely energy and nutrient shortfalls among the Ministry of Labour households relative to the 1991 COMA requirements. Note that these calculations move away from the simple per capita estimates of food consumption and nutrient availability previously discussed. The estimates of household malnutrition that follow are based upon the complex equivalence scales embodied in the 1991 COMA recommendations, which vary for each nutrient by sex and age (see the notes to tables 5 and 6 for sources). Our calculations are based upon the aggregate for the household of the requirements of each individual, relative to household nutrient availability derived from the household food consumption data recorded in the survey. The figure for energy is the EAR for the household (with an average physical activity level (PAL) of 1.4), while those for macro- and micronutrients are expressed relative to the household reference nutrient intakes (RNIs).⁶² The extent of the shortfalls recorded in this table suggests that low income per capita group households were typically not meeting the modern EAR for energy and none of the RNIs for macro- and micronutrients.

⁶² COMA, *Dietary Reference Values*, energy, tab. 1.1, p. xix; protein LRNI derived from tab. 7.1, p. 79; calcium, tab. 22.3, p. 141; iron, tab. 28.2, p. 163; vitamin A, tab. 8.1, p. 88; vitamin B1, tab. 9.1, p. 91; vitamin C, tab. 17.1, p. 120. Requirements for children under one year old have been calculated as the average of the requirements of all those age groups given for children under one year old.

Table 6. *Within-group proportion of households with likely energy and RNI nutrient deficiencies in the Ministry of Labour 1937/8 survey, by Boyd Orr income group (within-group number in parentheses)*

Income per capita group per week	N	Energy (kcal)	Protein (g)	Calcium (g)	Iron (mg)	Vitamin A (µg)	Vitamin B1 (mg)	Vitamin C (mg)
<10s.	212	0.48 (101)	0.14 (29)	0.93 (197)	0.85 (181)	0.91 (192)	0.61 (129)	0.79 (168)
10–15s.	398	0.29 (115)	0.06 (24)	0.85 (336)	0.81 (320)	0.83 (329)	0.51 (201)	0.63 (248)
15–20s.	524	0.16 (82)	0.05 (29)	0.68 (354)	0.68 (355)	0.69 (362)	0.30 (156)	0.46 (241)
20–30s.	750	0.08 (58)	0.02 (15)	0.48 (363)	0.54 (407)	0.57 (430)	0.18 (138)	0.29 (220)
30–45s.	425	0.05 (20)	0.01 (5)	0.31 (131)	0.34 (145)	0.37 (155)	0.12 (49)	0.19 (82)
>45s.	188	0.02 (3)	0.01 (2)	0.17 (31)	0.21 (39)	0.18 (34)	0.07 (14)	0.13 (24)
All households	2,492	0.15 (379)	0.04 (104)	0.57 (1,410)	0.58 (1,445)	0.60 (1,497)	0.28 (685)	0.39 (980)

Notes and sources: Authors' estimates from the surviving returns of the 1937/8 Ministry of Labour survey; data available at UK Data Archive, *Living standards of working households in Britain, 1904–1954*, <http://doi.org/10.5255/UKDA-SN-7916-1>. Energy and nutritional availability include meals away from home and alcohol consumption. This table reports household energy availability relative to COMA 1991 EARs and nutrient availability relative to COMA 1991 LRNI by age and sex (COMA, *Dietary Reference Values*); namely, energy (EAR), tab. 1.1, p. xix; protein, tab. 1.3, p. xxi; vitamins, tab. 1.4, p. xxii; minerals, tab. 1.5, p. xxviii. For children less than one year old, the mean requirements of all the reported monthly age ranges have been used.

Overall, taking the 2,492 weekly budgets, around 15 per cent record a diet deficient in energy at a 1.4 PAL level. At an income of 20–30s. per capita and above, energy and protein intakes largely conform to modern standards, but there are still significant shortfalls among macronutrients, with only roughly half of households consuming a diet that could generate sufficient iron and calcium for all members.

Note, however, that RNI levels are set to ensure that 97.5 per cent of the population meet the requirements, and this undoubtedly exaggerates the extent of nutritional deficiency in the 1937/8 sample.⁶³ Gazeley and Newell's analysis of the 1904 Board of Trade survey diets used 0.5 RNI as the benchmark for adequacy for macro- and micronutrients,⁶⁴ and this is a roughly comparable alternative to lower reference nutrient intakes (LRNIs), which represent 'the lowest intakes which will meet the needs of some individuals in the group. Intakes below this level are almost certainly inadequate for most individuals'.⁶⁵

Nutritional deficiencies measured using LRNI are concentrated in the lowest two income per capita groups and particularly in the lowest group, as table 6 reveals. The extent of the deficiency of any macro- or micronutrient at an income level of 20–30s. per capita or above is minimal and even at an income level of 10–15s.

⁶³ RNIs provide an estimate of the average daily nutritional intakes that meet the needs of 97.5% of the population. It therefore exceeds the requirements of nearly all the group, and intakes at the RNI level would have a low probability of inadequacy. Conversely, LRNIs provide an estimate of daily nutritional intakes that meet the needs of 2.5% of the population and intakes at this level would have a high probability of inadequacy. Both assume a normal distribution of needs, with each +/- 2 standard deviations from the EAR.

⁶⁴ Gazeley and Newell, 'Urban working-class food consumption'.

⁶⁵ COMA, *Dietary Reference Values*, p. 3. Using 0.5 RNI for the analysis of the 1937/8 households would affect the detail, but not the overall conclusion that we present here.

per capita, the levels are generally quite low, other than for calcium and vitamin A. Using LRNI as a reference, 11 per cent of all households in the survey have a diet with insufficient calcium and just under 8 per cent record food expenditures that yield insufficient vitamin A. Protein and vitamin B1 availability are generally sufficient across the sample.

IV. The Carnegie Trust survey and state intervention: moving away from working, nuclear households

In the previous section, we presented evidence that macronutrient and key micronutrient availability among two-parent working households suggests a pattern of significant deficiency concentrated in the lowest income per capita groups and probably largely restricted to a sub-set of macro- and micronutrients. However, much of the contemporary concern for malnutrition related to households that did not conform to this description; either because they were not working or were not nuclear households. Indeed, the case of Minnie Weaving highlighted in the introduction is an example of a household where the extent of hardship intensified when the principal wage earner became unemployed.

We have available the records of another large household survey carried out at the end of the 1930s that was not focused exclusively on working households. The Carnegie United Kingdom Trust commissioned the Rowett Research Institute to undertake a dietary and clinical survey of around 1,350 households from 16 areas in Scotland and England in 1938/9. We have extracted the data from the original Carnegie household records and analysed the nutritional content of the diets, using the same methods as employed for the analysis of the Ministry of Labour 1937/8 survey. The survey returns provide details of the occupation of the head of household in nearly all cases; the demographic structure of the household, including the age and sex of all the children; along with full details of the incidence of school meals and the nutritional value of food provided to children in schools and to mothers themselves and their children in clinics and canteens.⁶⁶ The average size of households taking part in the Carnegie survey was just fewer than six persons (5.93), which is just over two persons more than the average taking part in the Ministry of Labour 1937/8 survey and only a little different from the average size of households in the 1904 Board of Trade survey. This was no accident, as households 'were deliberately chosen as having children since the aims of the Survey included an examination of the child population'.⁶⁷

There are important methodological differences between the Carnegie and Ministry of Labour surveys. The Carnegie survey was a bespoke nutritional survey (rather than an expenditure survey). The dietary analysis carried out in

⁶⁶ The regions were Aberdeen, Seaton, Kintore, Hopeman, Barthol Chapel, Tarves, Methlick, West Wemyss, Dundee, Edinburgh, Barrow-in-Furness, Liverpool, Yorkshire West Riding, Wisbech, Fulham, and Bethnal Green.

⁶⁷ Rowett Institute, *Family diet and health*, p. 24. Households with a head that was unemployed during the Carnegie survey are on average about 0.75 persons larger than those with a working head (6.48 and 5.73 respectively), and had the highest number of children less than 18 years of age of any household type. Female-headed households were still relatively large due to a large number of children (5.13). Professional-headed households were the smallest (4.76), with the fewest number of children, as would be expected. Agricultural-headed households (including farmers) were also relatively small (5.49), with fewer children than the average for all working-headed households.

the Carnegie survey is based upon net consumption in the survey week (including allowance for stocks in hand before and after the survey, household members being absent for meals, additional visitors, and so on). For each household the original record cards provide the amount of foods purchased for consumption at home, plus food obtained from gardens, allotments, and as a perquisite from employers. What is unique about the dietary component of this survey is the inclusion of school meals, school milk, and food provided by clinics to children and mothers deemed in need.⁶⁸ This allowed the Carnegie survey to report food/nutrition at home, food consumed at school, and food provided by clinics. The incidence of school meals is much higher in the Carnegie enquiry than in the Ministry of Labour 1937/8 survey, possibly reflecting the greater proportion of poorer households in the former and/or the design of the enquiry. In the Carnegie enquiry 672 households (roughly half the sample) were in receipt of some sort of meal at school (including milk), and an overlapping set of 514 households received some food from clinics.⁶⁹

Many of the households included in the Carnegie survey were unemployed-and/or single-headed. Of the 1,352 households in the survey, 363 had a head of household who described themselves as unemployed or in receipt of public assistance at the time of the survey. There are also 40 households that were female-headed, where no male over 18 years old was present. These include households where the female head described herself as 'deserted by husband', or 'widow'. The 989 households who were working at the time of the survey include heads of households employed in occupations across the primary, secondary, and tertiary sectors. There are 169 households where the head of household is working in agriculture, or the occupation is recorded as farmer,⁷⁰ 104 miners' households, and 92 households where the head of household is described as a labourer of some kind. The remainder are a diverse cross-section of the social fabric of interwar Britain, from police chief constable to dustman. Most wage earners in female-headed households worked in typically low-paid adult female occupations of the period (washerwoman, charwoman, cleaner, and so on).

Despite the many virtues of this enquiry, however, it is not clear how households were selected, as the published Carnegie survey report provides few details, simply stating that 'rule-of-thumb selection procedures rather than elaborate statistical sampling methods' were used.⁷¹ Moreover, household income was not recorded in the vast number of cases, as the response was 'very poor'.⁷² The lack of detail on head of household income and total household income makes it difficult to assess any biases in the data. Food expenditure and food expenditure per capita is known (but not food as a share of total expenditure) and the Carnegie survey allocated households into six groups according to food expenditure per capita, ranging from the poorest class with food expenditure of less than 36d. per capita per week to the

⁶⁸ *Ibid.*, p. 18. See, in addition, Gilbert, *Evolution of National Insurance*, pp. 102–58, for the history of the creation and evolution of schemes designed to feed children at school.

⁶⁹ Although the incidence of school meals was recorded in the Ministry of Labour survey, the food provided was not. Moreover, of the surviving 2,492 household budgets (for the 623 households), there are only 44 households for which school meals are recorded. By 1938, 176,767 children were in receipt of school meals in 273 local education authorities; Harris, *Health of the schoolchild*, p. 122, tab. 7.1.

⁷⁰ Including occupations described as 'farmer', 'crofter', 'grieve', 'small holder', 'farm labourer', 'land labourer', 'farm servant', 'horseman', 'cattleman', or 'dairyman'.

⁷¹ Rowett Institute, *Family diet and health*, pp. 24–5.

⁷² *Ibid.*, p. 18.

Table 7. *Consumption of foods per capita day, Carnegie 1938/9 household survey*

Household type	Working male head (<i>n</i> = 989)	Unemployed head (<i>n</i> = 363)	Female head (<i>n</i> = 40)
Bread	0.53 (0.0063)	0.53 (0.0103)	0.51 (0.0303)
Milk	0.44 (0.0131)	0.14 (0.0090)	0.38 (0.0662)
Cheese	0.02 (0.0005)	0.01 (0.0005)	0.01 (0.0022)
Butter	0.04 (0.0011)	0.01 (0.0011)	0.03 (0.0054)
Meat	0.21 (0.0034)	0.19 (0.0050)	0.18 (0.0173)
Eggs	0.43 (0.0095)	0.28 (0.0112)	0.28 (0.0424)
Fruit	0.13 (0.0047)	0.06 (0.0037)	0.08 (0.0165)
Vegetables	0.11 (0.0035)	0.09 (0.0040)	0.11 (0.0156)
Potatoes	0.52 (0.0078)	0.46 (0.0106)	0.43 (0.0300)
Fish	0.05 (0.0017)	0.04 (0.0023)	0.05 (0.0077)
Cereals	0.09 (0.0044)	0.03 (0.0025)	0.07 (0.0142)
Sugar	0.15 (0.0022)	0.11 (0.0024)	0.13 (0.0123)

Notes: All items are measured in lbs per day, except eggs which are recorded as the no. consumed. The table is based on some aggregation of consumption data. This is as follows: milk is whole and skimmed milk; meat is 'meat' (as described by the Carnegie Trust) and smoked pig; vegetables is fresh green and root vegetables; cereals is 'cereals' (as described by the Carnegie Trust) and oatmeal. All other categories are as described by the Carnegie Trust in their report. Standard error of mean is in parentheses.

Source: Calculated by authors from the Carnegie Trust nutritional data from the surviving returns held at the Rowett Institute, Aberdeen.

richest with expenditure of over 132d. per capita per week. The Rowett Institute carried out analysis by food expenditure per capita group, but such a procedure sorts larger families with greater numbers of children into lower food expenditure per capita groups, in which the children often consume less than their per capita share.⁷³ We have chosen to analyse these data by occupation type as, whatever the shortcomings of the survey, it is unique in providing detailed evidence on the food consumption patterns of those households where the head was in employment, along with a large number of households where the head was unemployed. In addition, the information on the take-up and nutritional benefits of school meals, school milk, and food provided in clinics also allow us to address the impact of the nascent welfare state on the health of school-aged children in the late 1930s.

Table 7 provides estimates of food consumption per capita per day, using the Carnegie survey's own estimates of food consumption, which we have aggregated for the purpose of comparability with the Ministry of Labour survey, and expressed in terms of amounts per capita per day, notwithstanding the sorting issue noted above. The food consumption estimates for working households derived from the Carnegie data show most similarity with those of income groups 2 or 3 (10–15s. and 15–20s. per capita per week) in the Ministry of Labour 1937/8 survey (see table 3). This gives an indication that the average income per capita of those households taking part in the Carnegie survey was a little lower on average than those households taking part in the Ministry of Labour survey.

Not surprisingly, nutrient availability estimates per capita are also lower on average in the Carnegie survey than the near-contemporaneous Crawford survey or the estimates we have made from the Ministry of Labour 1937/8 survey (either because of their focus on larger households with children, or the inclusion of a large number of heads of household in low-income occupations or unemployed). These differences in household structure and employment status have a direct impact

⁷³ *Ibid.*, p. 25.

upon nutritional availability. On average, including school food, the Carnegie households had 2,400 kcal and 66g of protein per person per day available. This is around 300 fewer calories and 8g less protein per person per day than Crawford's households. In comparison with the average figure we have estimated from the Ministry of Labour 1937/8 survey, the Carnegie households have around 500 fewer calories and 13g less protein available per person per day.⁷⁴ The amount of calcium and iron available per person per day to households in the Carnegie survey is roughly similar to the average figures from Crawford's Food Enquiry or the estimates we have made using the Ministry of Labour 1937/8 survey, partly because of the calcium- and iron-rich foods provided at school that are recorded in the Carnegie survey.

The key finding of our analysis stems from a within-survey comparison. Homes with an unemployed head of household, and often recorded as being in receipt of public assistance, have roughly 500 fewer kcal available per capita compared to households where the head of household is working (2,034 compared with 2,530 respectively).⁷⁵ Unsurprisingly, shortfalls of this order of magnitude are evident throughout the range of nutrients examined here. Homes with an unemployed head of household have 13g less of protein available per capita per day, but calcium appears to be the macronutrient whose availability is most affected by labour market status. On average, the unemployed have just under 60 per cent of the calcium available compared to those in employment. However, this macronutrient is also particularly affected by state action. When the calcium available from foods consumed at school and provided by clinics is taken into account, available calcium per capita levels rise to around 70 per cent of the level for those households where the head is working.

This is primarily because of milk provided under the provisions of 1906 Education (Provision of Meals) Act, which was extended in 1921, and allowed local education authorities to provide school meals to children in elementary schools in their area. In addition, from 1923 a provision of one-third of a pint of milk for one penny was introduced, and in 1934, the Milk Marketing Board supplied milk to schools at half a penny a bottle. By 1939 just over 13 per cent of children received free milk under the provisions of the Education Acts and a further 55 per cent received milk supplied by the Milk Marketing Board.⁷⁶ Overall, school milk was likely to have been far more important nutritionally than school meals, because it

⁷⁴ The reasons for this are unclear, but are accounted for by either differences in mean income or household size between the Crawford and Carnegie surveys, or by the food composition tables used by Crawford and the Carnegie Trust, or differences in assumptions concerning the amount of inedible waste in foods purchased between the two surveys, or a combination of any of these factors. It is important to remember, however, that these comparisons are made on a per capita basis and the Carnegie households were on average significantly larger with more children than those surveyed by Crawford or the Ministry of Labour.

⁷⁵ The best-fed households are those with a head working in agriculture (this includes a significant number of farmers, grieves, and crofters), who have over 3,000 kcal per capita per day available, which is more energy available per capita than professional-headed households (who have just fewer than 2,700 kcal per capita day). It is likely, of course, that the physical activity rate of households working in agriculture greatly exceeded those of professional-headed households. Both of these groups have diets that are relatively protein rich and with significantly more calcium and iron available than the average working households. In the case of agricultural-headed households, almost all of their nutrients are supplied by food consumed at home. Female-headed households, most of who were working, have on average around 300 more kcal per capita day available than households where the head is unemployed, once the impact of energy from school meals and food at clinics is taken into account.

⁷⁶ See, for example, Harris, *Health of the schoolchild*, pp. 120–1; Hurt, 'Feeding the hungry schoolchild'; Welshman, 'School meals and milk', pp. 16–19; Atkins, 'Milk in schools scheme', pp. 6–9.

was much more prevalent. Under the provisions of the 1921 Act, local authorities were able to provide paying school meals to better-off households and free meals to children in public elementary schools from households that were unable to pay, in cases where it was considered that children were not benefiting fully from their education because of lack of food. There was a lack of uniformity in provision across the country and what constituted a school meal also varied between local education authorities. As Harris observes, ‘The authorities could provide breakfasts, dinners or teas (or a combination of these), or they could simply provide a bottle of milk. A number of authorities also offered other forms of “nutritional supplementation” in the form of cod liver oil, dried milk, or various proprietary foods’.⁷⁷ Scottish children had the lowest rates of access, especially those in rural areas outside the central lowlands.⁷⁸ During the 1930s, children’s eligibility for free school meals was ascertained primarily on the basis of medical inspection.⁷⁹ During the interwar period, the number of local education authorities providing some form of school meal increased, most sharply in the 1930s, so that by 1938/9, 272 local education authorities provided 176,767 children with solid meals.⁸⁰ Nevertheless, this total only represents around 3 per cent of schoolchildren in receipt of a solid school meal.⁸¹

In common with most household surveys of this period, we have no information about the distribution of food consumed at home within the household, but for all foods consumed at school and at clinics we are able directly to compare energy and macronutrient availability for school-aged children in the household with the 1991 COMA RNIs. Table 8 provides a summary of these results for children aged four to 14 years, by head of household labour market status. Children in households in receipt of some form of school meal (including milk) received around 15 per cent of their energy requirements from food provided at school. With regard to these children’s protein, calcium, and iron requirements, school meals and food in clinics provided 41 per cent, 62 per cent, and 27 per cent respectively of their total RNIs.⁸² The proportions are roughly similar for the sub-set of school-aged children from homes with an unemployed head of household and a little less for those in female-headed households. On average, energy and nutrient availability from food provided at school and in clinics had an important positive impact on household nutritional availability, especially among homes with an unemployed head of household.⁸³

⁷⁷ Harris, *Health of the schoolchild*, p. 121.

⁷⁸ Atkins, ‘Fattening children or fattening farmers?’, p. 60.

⁷⁹ Harris, *Health of the schoolchild*, p. 124.

⁸⁰ *Ibid.*, p. 122, tab. 7.1.

⁸¹ Webster, ‘Government policy’, p. 191.

⁸² The correlation between calcium from school and clinic food and total household calcium intakes relative to household requirements is 0.8, suggesting a very strong relationship between the provision of school and clinic calcium and households’ ability to meet calcium dietary requirements.

⁸³ Nutrition from school meals and school milk is not recorded separately in the Carnegie survey. From the calories recorded as consumed at school or in clinics, we estimate that around 10% of households in the survey had at least one child in receipt of school meals as well as school milk (assuming that one-third of a pint of whole milk provides around 120 kcal per school day, we estimate the number of calories from school milk as 600 * number of school aged children * 5 days). 10% of those households with children in receipt of some form of food at school exceeded this estimate by 2,000 kcal or more, which probably indicates that they were also benefiting from solid meals as well as from school milk. This is obviously very crude, but probably better than not attempting to calculate the proportion in receipt of school meals.

Table 8. *Carnegie 1938/9 survey: proportion of COMA (1991) RNI for children aged 4–14 years provided by school meals and milk*

	No.	Energy	Protein	Calcium	Iron
All households	1,352	0.09 (0.003)	0.26 (0.012)	0.40 (0.018)	0.18 (0.030)
Households in receipt of school meals or food at clinics	658	0.15 (0.060)	0.41 (0.172)	0.62 (0.040)	0.28 (0.053)
Working-headed	894	0.08 (0.046)	0.21 (0.127)	0.33 (0.019)	0.15 (0.033)
Unemployed-headed	322	0.14 (0.091)	0.41 (0.026)	0.59 (0.041)	0.27 (0.065)
Female-headed	40	0.12 (0.028)	0.30 (0.026)	0.43 (0.104)	0.17 (0.065)

Notes and sources: Calculated by authors from the Carnegie Trust nutritional data from the surviving returns held at the Rowett Institute, Aberdeen. Standard error of the mean is in parentheses. Relative to COMA 1991 LRNI, the proportions would be significantly higher. Food provided at clinics for children under 4 years of age is not included in the figures given above. This particularly affects households where the head was unemployed. 322/363 unemployed workers' children aged four to 14 years were in receipt of school meals or food in clinics. An additional 41 unemployed-headed households with children under four years of age received food in clinics. Note that some children aged under four years and their mothers received support at clinics, but the energy and macronutrient benefit of these foods have been excluded. (In an unknown number of these cases, the welfare support would have been for the mother.)

The only other study of the impact of school meals and milk on the nutrition of schoolchildren in Britain in the 1930s was carried out between 1935 and 1939 as part of Widdowson's investigation of 1,028 children's diets.⁸⁴ She carried out a detailed analysis of the diets of eight children from poor London homes, whose fathers were unemployed or earning low incomes, and found that the children's home diet only accounted for about one-third of animal protein, calcium, and vitamin C. With respect to calcium intakes, roughly one-third were derived from school milk and a similar proportion from canteen meals.⁸⁵ She concluded that 'it is evident that the canteen dinners and the milk at school were playing a very important part in the nutrition of these children'.⁸⁶ The findings presented here allow us to be confident that Widdowson's results can be generalized to low income per capita households across Britain in the late 1930s, where children were in receipt of both school meals and school milk. Where children were only in receipt of school milk (the majority of cases), it is likely that children's diets still remained deficient, to a much lesser extent.

Turning to an examination of the nutritional status of the households themselves, table 9 records the proportion and number of Carnegie households where the food consumed at home and elsewhere does not provide the energy and nutrition required for them to meet the 1991 COMA energy EAR, RNI, and LRNI (where energy and nutrition are measured contemporaneously and recorded within the survey). This table provides a comparison with our estimates derived from the food quantity data recorded in the Ministry of Labour 1937/8 survey reported in tables 5 and 6. Note that while the nutritional standard is the same for households in both enquiries, based on the needs of individual household members by their age and

⁸⁴ Widdowson, *Study of individual children's diets*.

⁸⁵ *Ibid.*, p. 157, tab. CIV.

⁸⁶ *Ibid.*, pp. 157–8.

Table 9. *Proportion (and within-group number in parentheses) of Carnegie households falling below (COMA 1991) EAR, RNI, and LRNI recommendations (nutrients as estimated by Rowett Institute)*

	<i>Energy EAR kcal</i>	<i>Protein RNI</i>	<i>Calcium RNI</i>	<i>Iron RNI</i>	<i>Vitamin A RNI</i>	<i>Vitamin B1 RNI</i>	<i>Vitamin C RNI</i>
Working-headed (n = 989)	0.13 (132)	0.01 (14)	0.52 (513)	0.34 (333)	0.36 (357)	0.13 (129)	0.35 (344)
Unemployed-headed (n = 363)	0.30 (110)	0.04 (16)	0.74 (270)	0.46 (166)	0.47 (171)	0.28 (100)	0.57 (208)
Female-headed (n = 40)	0.23 (9)	0.08 (3)	0.60 (24)	0.65 (26)	0.35 (14)	0.20 (8)	0.40 (16)
Urban working-class (n = 731)	0.16 (119)	0.02 (11)	0.61 (444)	0.38 (275)	0.34 (246)	0.16 (117)	0.39 (282)
All households (n = 1,352)	0.18 (242)	0.02 (30)	0.59 (798)	0.37 (499)	0.39 (529)	0.17 (229)	0.41 (552)
	<i>EAR kcal</i>	<i>LRNI</i>	<i>LRNI</i>	<i>LRNI</i>	<i>LRNI</i>	<i>LRNI</i>	<i>LRNI</i>
Working-headed (n = 989)	0.13 (132)	0	0.10 (95)	0.01 (10)	0.03 (29)	0	0.01 (12)
Unemployed-headed (n = 363)	0.30 (110)	0.003 (1)	0.19 (70)	0.02 (7)	0.09 (33)	0	0.03 (11)
Female-headed (n = 40)	0.23 (9)	0	0.15 (6)	0.10 (4)	0.05 (2)	0	0.025 (1)
Urban working-class (n = 731)	0.16 (119)	0	0.12 (84)	0.01 (6)	0.03 (19)	0	0.02 (11)
All households (n = 1,352)	0.18 (242)	0.001 (1)	0.12 (165)	0.01 (17)	0.05 (62)	0	0.02 (23)

Notes and sources: Calculated by authors from the Carnegie Trust nutritional data from the surviving returns held at the Rowett Institute, Aberdeen. ‘Urban working class’ refers to nuclear working households (not female-headed or professional- or agricultural-headed) and provides the smoothest comparison with the results of our analysis of the Ministry of Labour 1937/8 enquiry, though the figures in tabs. 5 and 6 are derived from modern food composition tables including assumptions about waste, whereas the figures in tab. 9 use the Carnegie Trust’s estimates of the nutritional composition of foods consumed.

sex, the estimation of nutritional availability differ and this may affect the estimates, as it is not clear whether the Carnegie estimates are already net of waste.⁸⁷

Across all Carnegie households, the level of energy deprivation is slightly greater than the average for all households in the Ministry of Labour 1937/8 survey (about

⁸⁷ For all foods consumed at home (but not foods provided in clinics or school meals), we are able to make our own estimates of the nutritional value of the quantities of foods recorded in the Carnegie survey, using McCance and Widdowson’s food composition tables, utilizing the same set of assumptions as described for the Ministry of Labour 1937/8 survey. It is clear that using recoded food consumption in conjunction with McCance and Widdowson food composition tables, with modern food waste assumptions, generates lower estimates of nutritional availability than those calculated by the Carnegie Trust at the time. Our estimates are around 80 to 88% depending on nutrient (energy is 85%) of those reported by the Carnegie Trust. Using modern food composition tables without any allowance for wastage produces estimates closer to those reported in the Carnegie survey. This might suggest that the food consumption data recorded within the survey are already net of wastage or have minimal waste deductions. See online app. tab. S1. There is evidence to support this conjecture from the Ministry of Food’s attempt to replicate the Carnegie Trust calculations in the 1950s, using the Rowett Institute’s original record sheets for all households in the Tarves geographical area, which notes that there was sometimes confusion between the use of ‘as purchased’ quantities and ‘edible proportions’ in the Carnegie data. TNA, MAF 300/18, ‘The Family Food Survey. Carnegie Survey 1938–1939’, letter from Ministry of Food to Dr D. Harvey, Rowett Institute Aberdeen, 9 Dec. 1955, paragraph (h), states, ‘The most important discrepancy, however, concerns the relation between quantities purchased and edible proportions ... The sources of difference arise, namely that the Rowett Institute coders have either (i) not converted E.P to A.P, or (ii) converted E.P to A.P. using a different conversion from ours’.

18 compared with 15 per cent). The smoothest comparison that we can make between the Carnegie and Ministry of Labour households is for the Carnegie group 'urban working class', which excludes professional- and agricultural-headed along with female- and unemployed-headed households, and attempts to mirror as far as possible the target reference group of the Ministry of Labour survey which was male-headed nuclear working-class households in employment. The proportion of households with levels of nutrient availability less than the RNI is not that dissimilar on average in this Carnegie sub-sample compared with the average across all Ministry of Labour households. This is true of all minerals and vitamins. Households in both surveys have similar levels of energy deprivation and show little evidence of protein deficiency, but around a third to one-half in both do not have sufficient calcium, iron, vitamin A, and vitamin C available in their diets. This is despite the lower levels of average energy and nutrient per capita availability recorded in the Carnegie budgets. This is because the assessment of adequacy takes account of the significant reductions in energy and nutrient intakes required by children, who are significantly more numerous among the Carnegie households. Estimated deficiencies are reduced to very low proportions when the LRNI is used as the comparator (table 9, bottom panel). Whichever benchmark is used, within the Carnegie sample, the greatest level of energy deprivation and likely nutritional deficiency is found in larger households, as figure 1 shows. In nearly all households with three or fewer members, less than 3 per cent do not meet the EAR for energy, whereas in households of 10 or more, 26 per cent do not meet the EAR. For household intakes of protein and calcium, the same pattern of deficiency relative to RNI is evident, though at a higher level.⁸⁸

V. Poverty and progress

We are able to situate our new estimates of nutritional deprivation in a long-run analysis, dating back to the Napoleonic Wars. In addition, we are able to make more detailed comparison with the findings from Board of Trade survey of 1904, which was the Ministry of Labour's most recent official large-scale expenditure survey comparator.

Turning first to the long-run trend, table 10 provides estimates of average daily per capita energy availability for rural and urban households and estimates of average nutritional attainment using a common methodology.⁸⁹ There are variations, however, in the original survey design and the investigators' target groups, and these affect the estimation of household energy availability. Most obviously the table includes results from surveys that were concerned with the condition of the very poor. Leaving these to one side, it is clear that the average

⁸⁸ We have already noted the difference in malnutrition levels between homes with working and unemployed heads of household. Part of this is the result of larger households among the latter group (the mean household size for working households is 5.73, compared with 6.48 for those with an unemployed head of household). This difference in average household size persists if professional- and agricultural-headed households are removed from working households. Urban working-class households with a head in employment have an average household size of 5.84 persons.

⁸⁹ All the estimates in tab. 10 are the result of the application of McCance and Widdowson's food composition tables, adjusted so as to remove the benefit of fortification and include their food waste assumptions. Energy deprivation is consistently estimated using SACN 1991 recommendations.

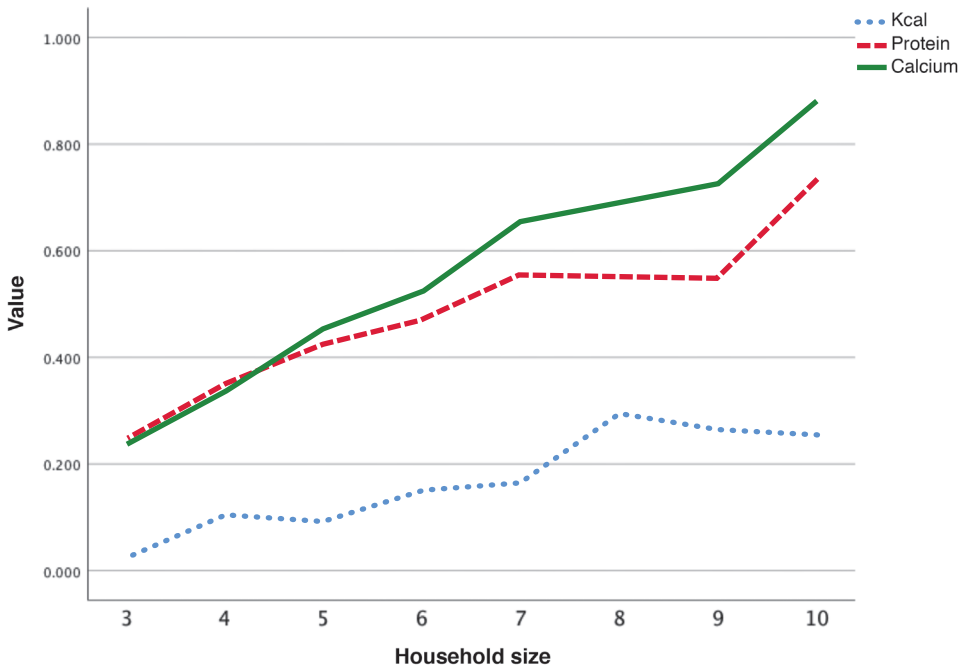


Figure 1. *Proportion of Carnegie households below estimated average requirement (EAR)/reference nutrient intake (RNI)*
 [Colour figure can be viewed at wileyonlinelibrary.com]

Notes: 1,352 households by household size in parentheses: 3 or fewer (143), 4 (231), 5 (256), 6 (264), 7 (181), 8 (114), 9 (67), 10 or more (96).

Sources: Calculated by authors from the Carnegie Trust nutritional data from the surviving returns held at the Rowett Institute, Aberdeen.

level of per capita energy availability among working-class households in the 1930s was greater than for similar households during the nineteenth and early twentieth century. Similarly, average energy deprivation was significantly lower in the 1930s surveys. Elsewhere we have examined the proximate reasons for the improvement in the twentieth century and concluded that it was due to a rightward shift of the wage distribution and a reduction in household size in roughly equal measure.⁹⁰

A more detailed comparison with Gazeley and Newell’s estimates of nutritional availability for working households in 1904 shows that there was significant improvement by 1937/8.⁹¹ Table 11 provides the evidence for this statement. The average working household in 1904 had available roughly 2,300 kcal per capita per day. The results reported here for the nutrient availability for the average household in the Ministry of Labour’s 1937/8 survey are 600 kcal per capita per day more (based on a smooth comparison using modern food composition tables for both estimates). Similar increases are evident for the other nutrients tabulated in table 11, with the exception of vitamin B1 availability, which improves only marginally.

⁹⁰ Gazeley and Newell, ‘End of destitution’, pp. 96–9.

⁹¹ Gazeley and Newell, ‘Urban working-class food consumption’.

Table 10. *1930s energy intakes in long-run perspective*

	<i>Budget study</i>	<i>Average energy per capita per day (kcal)</i>	<i>Proportion of households not meeting energy 1991 RNI</i>	<i>Target group</i>
1787–96	Eden & Davies	2,127	0.47	Agricultural labourers
1835–43	Purdy	1,862	0.71	Poor rural
1863	Edward Smith	2,338	0.25	Agricultural labourers
1889–90	US Commissioner of Labour	2,245	0.49	Skilled urban workers
1893–4	Royal Commission on Labour	2,153	0.70	Agricultural labourers
1904	Board of Trade	2,328	0.30	Urban workers
1912	Rowntree & Kendall	1,849	0.50	Poor rural
1937–8	Ministry of Labour	2,492	0.15	Urban workers

Sources: Rows 1–3, 5, and 7: Gazeley and Horrell, 'Nutrition', p. 768, tab. 3, and p. 774, tab. 6. Row 4: Gazeley, Newell, and Bezabih, 'Transformation of hunger revisited', p. 522, tab. 5. Row 6: Gazeley and Newell, 'Urban working-class food consumption', p. 111, tab. 5a. Row 8 calculated by authors.

Table 11. *Nutrient availability per day, Ministry of Labour 1937/8 survey and Board of Trade 1904*

<i>Income per capita group or skill group</i>	<i>Energy (kcal)</i>	<i>Protein (g)</i>	<i>Calcium (g)</i>	<i>Iron (mg)</i>	<i>Vitamin A</i>	<i>Vitamin B1</i>	<i>Vitamin C</i>
BoT 1904, 'Bowley poor'	1,653	47.7	0.25	6.7	268	0.8	26.1
BoT 1904, unskilled head of household	2,028	60.6	0.32	8.6	344	1.0	32.2
BoT 1904, average	2,328	68.0	0.43	9.3	415	1.0	42.3
MoL 1937/8, <10s.	2,039	51.9	0.38	7.58	315	0.73	23.7
MoL 1937/8, 10–15s.	2,369	61.6	0.49	8.88	443	0.85	36.4
MoL 1937/8, 15–20s.	2,671	70.4	0.61	10.22	545	1.00	45.5
MoL 1937/8, average	2,923	77.3	0.68	11.36	600	1.09	57.9

Notes: BoT: Board of Trade. MoL: Ministry of Labour.

Sources: Rows 1–3 from Gazeley and Newell, 'Urban working-class food consumption', p. 111, tab. 5(a). Rows 4–7 from tab. 7 above.

Among the poorest households, there was an equally striking improvement between the two surveys. Energy availability for those households and the bottom of the distribution in 1904, not meeting Bowley's poverty-line income ('Bowley poor'), was only 1,650 kcal per capita. The poorest income class per capita in 1937/8 had available 400 kcal per capita per day more than this. This is a significant gain that has important implications for overall health and possibly for labour productivity. It is also reflected in an improvement in average heights by birth cohort reaching maturity in Hatton and Bray's data, which is noted in section I.⁹²

For the vast majority of working-class households, life was immeasurably better than it had been a generation earlier. Real wages were higher, households were smaller on average, and the state was providing additional help with feeding children at school. This translated into significantly better diets than those enjoyed by their forefathers before the First World War, but as Priestley reminds us, there

⁹² Hatton and Bray, 'Long run trends'.

was more than one England in the 1930s.⁹³ If the head of household lost their job, or the wife was deserted or forced to survive alone in widowhood, 1930s Britain could look remarkably similar to the struggle for survival that characterized life for the working poor in the Edwardian period, in all but one important respect. State interventions in the 1930s did make a difference. School food of all kinds was providing a significant addition to household calcium intakes (and, to a lesser extent, energy and protein). For the children in receipt of school meals in poor households in the 1930s, their experience of poverty would have been different from the childhood experience of their parents' generation, where long periods of constant nagging hunger would have been commonplace.

An unanswered question is the extent to which children's experience of poverty in the late 1930s resulted in ill health and the extent to which this morbidity was mitigated by school meals and milk. From 1908 school medical officers were required by the Board of Education to classify the nutrition of children (as good, normal, below normal, or bad). These assessments at the time of inspection were highly subjective and, further, the published figures often bore little relationship to these assessments.⁹⁴ Even after the reform of the classification system in 1934, the assessments of school medical officers remained seriously unreliable.⁹⁵ As Harris points out, 'The absence of any agreed system for defining, measuring or classifying nutrition was one of the greatest difficulties facing the school medical service in the interwar years'.⁹⁶ The absence of clinical testing of nutritional deficiencies makes it impossible to utilize the assessments of school medical officers to examine the impact of state provision of food and milk.

The Rowett Institute also collected anthropometric data and an assessment of the health of the schoolchildren in the Carnegie survey, and these data have been analysed by Hatton and Martin.⁹⁷ They found that food expenditure per capita had a strong positive influence on height, and that family size had a negative effect on height, independent of family expenditure per capita. They also identified a role for the disease environment and housing quality, but did not investigate the impact of state actions *per se*.⁹⁸

There were a number of investigations of the impact of school milk on children's health in the interwar period.⁹⁹ In his Royal Society lectures, McCarrison was unequivocal that free school meals and cheap milk had a positive impact upon children's health in the 1930s,¹⁰⁰ and this view was echoed by the research

⁹³ There were three according to Priestley, *English journey*, pp. 372–5: the old England of 'cathedrals and minsters and manor houses and inns'; the nineteenth century England 'of coal, iron, steel, cotton, wool, railways'; and the postwar England of 'arterial and by-pass roads, of filling stations and factories that look like exhibition buildings'.

⁹⁴ Harris, *Health of the schoolchild*, p. 131; Hurt, 'Feeding the hungry schoolchild', p. 196.

⁹⁵ In 1940 Dr J. A. Clover examined a large proportion of returns provided by school medical officers in the preceding five-year period and concluded that 'a very large proportion of the returns are so unreliable as to be valueless for any purpose'; quoted in Harris, *Health of the schoolchild*, p. 133.

⁹⁶ *Ibid.*, p. 130.

⁹⁷ Including height, leg length, weight, incidence of medical conditions, and dental decay. Hatton and Martin, 'Effects on stature', p. 164. Note that these data were collected and digitized independently by a team of medical researchers at Bristol University and are not in the public domain.

⁹⁸ A one-shilling increase in food expenditure per capita increased height at the age of eight years by 0.5cm; *ibid.*, pp. 177–82.

⁹⁹ Atkins, 'Fattening children or fattening farmers?', pp. 60–4, provides a summary and assessment.

¹⁰⁰ McCarrison, *Nutrition and national health*, pp. 59–60.

carried out by the Milk Nutrition Committee (1939).¹⁰¹ Gilbert has described the advent of free school milk under the provisions of the 1906 Education Act as a transformative development in the history of social policy in Britain. He maintained that ‘Never before had the British State offered to support its citizens without reciprocal deprivation of right for those who applied for relief’.¹⁰² Most metrics of health continued to improve over the years of the Second World War.¹⁰³ In part, this improvement was due to an extension of the state’s actions described here, such as food subsidies, free school meals, and welfare food schemes (along with rationing and price controls), and partly because of a multitude of other factors, such as the continued fall in household size, full employment, and the absence of any serious epidemics.¹⁰⁴ However, as Titmuss pointed out in 1950, the improvements in health that occurred during the 1940s were in part caused by improvements before the war began: ‘Changes in the average environment to which children born in successive periods of time are exposed in their early years tend to impress themselves on subsequent rates of dying throughout life’.¹⁰⁵ Indeed, more recently, Hatton found empirical evidence in support of the importance of a reduction in scarring on children’s heights and health in the first half of the twentieth century, brought about by an improvement in the net disease environment.¹⁰⁶

For the majority of homes with an unemployed head of household, public assistance payments, along with the earnings of other household members, were providing the means to satisfy immediate energy needs, even if the shortfalls with respect to some micronutrients were severe. In 30 per cent of households this was not true (as shown in table 9, column 1),¹⁰⁷ but overall still indicative of significant progress since the turn of the century. Where unemployment was of relatively short duration, these severe shortfalls were unlikely to lead to a marked deterioration in health. However, as the Pilgrim Trust made clear, there could be significant health consequences of long-term unemployment, especially for those households where the head had previously been employed in well-paid skilled work.¹⁰⁸ For unskilled and casual workers, it is generally harder to identify the impact of unemployment *per se* on health, as these households were more likely to be on low incomes.¹⁰⁹

VI. Conclusions

In this article we have presented new estimates of food consumption and nutritional availability from individual data recorded in two household surveys carried out in the late 1930s. The first of these, carried out by the Ministry of Labour in 1937/8,

¹⁰¹ Milk Nutrition Committee, *Part IV*, p. 31.

¹⁰² Gilbert, *Evolution of National Insurance*, p. 112.

¹⁰³ Ministry of Health, *Public Health*, pp. 114–21.

¹⁰⁴ Titmuss, *Problems of social policy*, pp. 533–6. There were only two short mild epidemics of influenza and three of paratyphoid fever; Ministry of Health, *Public Health*, p. 3.

¹⁰⁵ Titmuss, *Problems of social policy*, p. 535.

¹⁰⁶ Hatton, ‘Infant mortality’, pp. 969–70. Hatton acknowledges that both nutrition and the disease environment played a role here.

¹⁰⁷ This is probably an overestimate as it assumes a PAL of 1.4 for the head of household, which may not have been required during periods of unemployment.

¹⁰⁸ Pilgrim Trust, *Men without work*, pp. 109–20.

¹⁰⁹ See Stern, ‘Unemployment and morbidity’, for a precis of the literature on the relationship between unemployment and health in the 1930s, as well as a review of the estimation problems posed in identifying a causal relationship using aggregate data.

stands as an exemplar of modern empirical investigation based upon interwar advances in sampling. This two-stage stratified random sample of working-class households with a head of household in employment provides better evidence on average household food consumption and associated estimates of energy and nutritional availability than the existing estimates provided by Boyd Orr and Crawford. We concur with the Ministry of Food's assessment that 'neither the Orr or Carnegie samples can be representative of Great Britain as whole, or of any particular class throughout the country'.¹¹⁰ These data show significant improvement in average household food consumption and nutritional availability than was evident in the Board of Trade's 1904 survey, or any time before. More meat, dairy products, fresh fruit, and fresh vegetables were being consumed by working-class households in the 1930s, as might be expected given the progress of real incomes per capita for those in employment between the dates of the two surveys.

The other household survey was carried out by the Rowett Research Institute for the Carnegie Trust in 1938/9. This survey lacked the sophistication of sampling method evident in the Ministry of Labour survey and did not systematically record total household income or expenditure. However, despite these drawbacks, its design allows us to investigate the experience of households without a working head and female-headed households, and the impact of state interventions (particularly school meals and milk) on food consumption and nutritional availability. We find that where the head of household was unemployed, household levels of energy and nutritional availability are significantly lower than their working contemporaries and quite similar to those households that Edwardian investigators would have described as destitute, the important difference being that these turn-of-the-twentieth-century households formed part of the working poor. The Carnegie survey also shows that female-headed households in employment fared worse than male-headed households, but significantly better than households without a working head.

Using household expenditure survey data, we have illustrated how a shift in social policy also led to a fundamentally different experience of poverty and hunger among households in the late 1930s compared with their Edwardian counterparts. Although a relatively small proportion of poor households in Britain on the eve of the Second World War were likely to have children that received one decent meal a day, a much greater proportion received school milk. We have demonstrated the importance of both interventions for children's nutritional attainment; particularly the school milk scheme, which provided a vital source of calcium for children whose diets were otherwise likely to be significantly deficient in this macronutrient. Households without work were also supported by the state in their own homes, rather than in the workhouse, albeit not always at a level that would fully meet their nutritional needs. For those household heads that remained out of work for a considerable length of time, the nutritional deficiencies presented here are consistent with the findings of contemporaries who highlighted the potentially deleterious impact long-term unemployment could have on health.¹¹¹

¹¹⁰ TNA, MAF 300/1, Crawford Broadley Comparisons, notes on the comparability of pre-war budgetary samples, p. 2.

¹¹¹ See, for example, Pilgrim Trust, *Men without work*.

What of the picture painted by Boyd Orr of widespread levels of malnutrition across working-class income groups in 1930s Britain? On the basis of the estimates we have derived from the Ministry of Labour 1937/8 working-class expenditure survey, it is difficult to accept the view that malnutrition was as widespread across the British population in the 1930s as Boyd Orr and some subsequent writers have claimed. One other feature of interwar food consumption is also clear: diets were more varied and contained greater quantities of milk, cheese, meat, eggs, fruit, and fish than they had done a generation earlier and *ceteris paribus* we would expect these diets to be less deficient in macro- and micronutrients as a consequence.

The widespread contemporary concern, and the fierce debate among historians, relating to malnutrition in Britain prior to the Second World War is partly the consequence of evaluating adequacy by applying contemporary standards, and partly the consequence of a failure to acknowledge the co-existence of more than one Britain in the 1930s. The debate is also one that touches a raw political nerve, as the interwar period, with its reputation for poverty, mass unemployment, and hunger marches, is the most obvious comparator by which to judge subsequent economic crises.

DOI: 10.1111/ehr.13079

Footnote references

- Aldcroft, D. H., *The interwar economy: Britain, 1919–1939* (1970).
- Atkins, P. J., 'Fattening children or fattening farmers? School milk in Britain, 1921–41', *Economic History Review*, LVIII (2005), pp. 57–78.
- Atkins, P. J., 'The milk in schools scheme, 1934–45: "nationalization" and resistance', *History of Education*, 34 (2005), pp. 1–21.
- Boyd Orr, J., *Food, health and income: report on a survey of adequacy of diet in relation to income* (2nd edn., 1937).
- Boyer, G. R. and Hatton, T. J., 'New estimates of British unemployment, 1870–1913', *Journal of Economic History*, 62 (2002), pp. 643–75.
- Crafts, N. F. R. 'Long-term unemployment in Britain in the 1930s', *Economic History Review*, 2nd ser., XL (1987), pp. 418–32.
- Crawford, W. and Broadley, H., *The people's food* (1938).
- Engineers' Study Group on Economics, *Interim report on the design of a family budget with special reference to food* (1936).
- Feinstein, C. H., *National income, expenditure and output of the United Kingdom 1855–1965* (Cambridge, 1972).
- Fenner Brockway, A., *Hungry England* (1932).
- Floud, R., Fogel, R. W., Harris, B., and Hong, S. C., *The changing body: health, nutrition, and human development in the western world since 1700* (Cambridge, 2011).
- Gazeley, I. and Horrell, S., 'Nutrition in the English agricultural labourer's household over the course of the long nineteenth century', *Economic History Review*, 66 (2013), pp. 757–84.
- Gazeley, I. and Newell, A. T., 'Poverty in Edwardian Britain', *Economic History Review*, 64 (2011), pp. 52–71.
- Gazeley, I. and Newell, A., 'The end of destitution: evidence from urban British working households 1904–37', *Oxford Economic Papers*, 64 (2012), pp. 80–102.
- Gazeley, I. and Newell, A., 'Urban working-class food consumption and nutrition in Britain in 1904', *Economic History Review*, 68 (2015), pp. 101–22.
- Gazeley, I. and Newell, A., 'The British Living Standards Project', data available at UK Data Archive, Living standards of working households in Britain, 1904–1954, <http://doi.org/10.5255/UKDA-SN-7916-1>.
- Gazeley, I., Newell, A., and Bezabih, M., 'The transformation of hunger revisited: estimating available calories from the budgets of late nineteenth-century British households', *Journal of Economic History*, 75 (2015), pp. 512–25.
- Gilbert, B. B., *The evolution of National Insurance in Great Britain: the origins of the welfare state* (1966).
- Harris, B., 'The health of the schoolchild: a history of the school medical service in England and Wales, 1908–1974 (1995).
- Hatton, T. J., 'Infant mortality and the health of survivors: Britain, 1910–50', *Economic History Review*, 64 (2011), pp. 951–72.
- Hatton, T. J., 'How have Europeans grown so tall?', *Oxford Economic Papers*, 66 (2014), pp. 349–72.

- Hatton, T. J. and Bray, B. E., 'Long run trends in the heights of European men, 19th–20th centuries', *Economics and Human Biology*, 8 (2010), pp. 405–13.
- Hatton, T. J. and Martin, R. M., 'The effects of stature on poverty, family size, and birth order: British children in the 1930s', *Oxford Economic Papers*, 62 (2010), pp. 157–89.
- Hatton, T. J. and Martin, R. M., 'Fertility decline and the heights of children in Britain, 1886–1938', *Explorations in Economic History*, 47 (2010), pp. 505–19.
- Hurt, J., 'Feeding the hungry schoolchild in the first half of the twentieth century', in D. J. Oddy and D. S. Miller, eds., *Diet and health in modern Britain* (Oxford, 1985), pp. 186–97.
- Lawrence, J., 'Class, "affluence" and the study of everyday life in Britain, c. 1930–64', *Cultural and Social History*, 10 (2013) pp. 273–99.
- McCarrison, R., *Nutrition and national health: the Cantor Lectures* (1936).
- M'Gonigle, G. C. M. and Kirby, J., *Poverty and public health* (1937).
- Mason, T., 'Hunger . . . is a very good thing: Britain in the 1930s', in N. Tiratsoo, ed., *From Blitz to Blair* (1997), pp. 1–24.
- Mayhew, M., 'The 1930s nutrition controversy', *Journal of Contemporary History*, 23 (1988), pp. 445–64.
- Mitchell, M., 'The effects of unemployment on the social condition of women and children in the 1930s', *History Workshop Journal*, 19 (1985), pp. 105–27.
- Mowat, C. L., *Britain between the wars 1918–40* (1968).
- Nicholson, J. L., 'Variations in working class family expenditure', *Journal of the Royal Statistical Society. Series A (General)*, 112 (1949), pp. 359–418.
- Paul, A. A., and Southgate, D. A. T., McCance and Widdowson's *The composition of foods* (1979).
- Pilgrim Trust, *Men without work* (Cambridge, 1938).
- Priestley, J. B., *English journey* (1934).
- Rowett Research Institute, *Family diet and health in pre-war Britain: a dietary and clinical survey* (Dunfermline, 1955).
- Rowntree, B. S., *Poverty: a study of town life* (1901).
- Rowntree, B. S., *The human needs of labour* (1937).
- Rowntree, B. S., *Poverty and progress: a second social survey of York* (1941).
- Stern, J., 'The relationship between unemployment, morbidity and mortality in Britain', *Population Studies*, 37 (1983), pp. 61–74.
- Stone, R. and Rowe, D. A., *The measurement of consumers' expenditure and behaviour in the United Kingdom 1920–1938*, vol. 1 (Cambridge, 1954).
- Titmuss, R. M., *Problems of social policy* (1950).
- Vernon, J., *Hunger: a modern history* (Cambridge, 2007).
- Webster, C., 'Healthy or hungry thirties?', *History Workshop Journal*, 13 (1982), pp. 110–29.
- Webster, C., 'Government policy on school meals and welfare foods, 1939–70', in D. F. Smith, ed., *Nutrition in Britain: science, scientists and politics in the twentieth century* (Oxford, 1997), pp. 190–213.
- Welshman, J., 'School meals and milk in England and Wales, 1906–45', *Medical History*, 41 (1997), pp. 6–29.
- Widdowson, E. M., 'A study of individual children's diets', Medical Research Council, *special report ser.*, no. 257 (1947).
- Winter, J. M., 'The decline of mortality in Britain 1870–1950', in T. C. Barker and M. Drake, eds., *Population and society in Britain 1850–1980* (1982), pp. 101–20.

Official publications

- COMA (Department of Health Committee on Medical Aspects of Food and Nutrition Policy), *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom* (1991).
- Milk Nutrition Committee, *Part IV, The Effects of Dietary Supplements of Pasteurised and Raw Milk on the Growth and Health of School Children (Final Report): Summary of All Researches Carried out by the Committee and Practical Considerations* (Reading, 1939), as reported in *Analyst*, 65 (1940), pp. 31–2.
- Ministry of Health, *On the State of the Public Health During Six Years of War* (1946).
- Stiebeling, H. K., *Food Budgets for Nutrition and Production Programs* (Washington, DC, 1933).

Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

S1. Food consumption estimates