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Urban Working-Class Food Consumption and Nutrition in Britain in 1904

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Abstract: This article re-examines the food consumption of working class households in 1904 and compares the nutritional content of these diets with modern measures of adequacy. We find a fairly steep gradient of nutritional attainment relative to economic class, with high levels of vitamin and mineral deficiency among the very poorest working households. We conclude that the average unskilled-headed working households was better fed and nourished than previously thought. When proper allowance is made for the likely consumption of alcohol, household energy intakes were significantly higher still. We investigate the likely impact of contemporary cultural food distribution norms and conclude on the basis of the very limited evidence available that women were receiving about 0.8 of the available food, which was consistent with their nutritional needs. We adjust energy requirements for likely higher physical activity rates and smaller stature and find that except among the poorest households, early twentieth century diets were sufficient to provide energy for reasonably physically demanding work. This is consistent with recent attempts to relate the available anthropometric evidence to long-run trends in food consumption. We also find that the lower tail of the household nutrition distribution drops away very rapidly, so that few households suffered serious food shortages.

JEL Classification: I14, I32, N34

Key Words: nutrition, well-being, Britain, early 20th century.

I

At the turn of the twentieth century the majority of working people in the United Kingdom could afford to feed, clothe and house their families and still have something left over for other types of consumption. Nevertheless, even in the most advanced industrial economy in the world at the time, a significant proportion of the population had insufficient income to secure their basic needs. These two statements are widely accepted, but beyond these the detail is both less well-known and controversial.

Food is the most basic of needs. Food consumption by economic and social group, the extent of energy and nutrient deficiencies and their relationship with stature and physical activity remain imprecisely understood for Britain during the late nineteenth and early twentieth century. Recent research by Fogel *et al* (2011) attempts to reconcile the available anthropometric evidence with what is currently known about food consumption and nutrition. Significant advances have been made in scientific knowledge relating to the physiological function of food and appropriate levels of consumption related to an individual's age, gender, stature and physical activity. Yet until recently the problem remained of finding suitable historical micro-data with which to analyse nutritional intakes in this period and evaluate their adequacy.

This article reports an investigation into available household food and nutrition at the turn of the twentieth century, using the best available large-scale set of data: the extant household returns to the Board of Trade's 1904 enquiry into the consumption and cost of food. From these data, we create benchmark levels of food consumption by socio-economic class, adjusting for regional biases. Among the novel features of this study, we account, as well as we can, for unrecorded alcohol consumption. We also study the allocation of food within the household. We compare our findings with an appropriate energy and nutritional standard, which is developed in detail, taking into account the workloads and likely stature of individual household members. Finally, we reconcile our estimates of the extent of nutritional inadequacy with recent estimates of the extent of poverty in Britain at the turn of the twentieth century.

Our key findings are that nutrition among working families was better than previously thought, though there were clear shortages of some key nutrients in the diet. We also find

that the lower tail of the nutrition distribution drops away very rapidly, so that few households suffered drastic food shortages. Among the poor, however, the depth of nutritional shortfall was greater, with almost half of poor households estimated to have less than 80% of their required calories intakes.

The remainder of this article is laid out as follows. Section II reviews the existing estimates, finds some problems with them, and revises them. Section III introduces the survey data we employ. Section IV sets out our estimates of the average *per capita* diets, by occupation of the head of household and adjusts these to be representative of Great Britain. In section V we convert the diets into nutrient intakes and present these by occupational group on a *per capita* and adult equivalent basis. In section VI we make allowance for the effect of alcoholic drink on estimates of available energy and examine the distribution of food within the household. Finally, in section VII we compare our results with the most recent official UK Recommended Nutritional Intakes (1991), adjusted for the smaller stature of early twentieth century individuals and their likely greater physical activity. Section VIII concludes.

II.

Drummond and Wilbraham famously claimed in the *Englishman's Food* (1957) that “It is no exaggeration to say that the opening of the twentieth century saw malnutrition more rife in England than it had been in the great dearths of medieval and Tudor times.”¹ Few would now take this view seriously, though there is support for the idea that malnutrition was still widespread at the end of the Victorian period.² Indeed, the 1904 Inter-Departmental Committee on Physical Deterioration, whose investigation was prompted by

¹ Drummond, J.C., and Wilbraham, Anne, (1957), *The Englishman's Food*, p.403

² All the evidence available to Drummond and Wilbraham in the 1950s, on the behaviour of real income growth during the second half of the nineteenth century, strongly suggested the opposite, making it difficult to view the ‘turn of the century’ as the worst of times. If there was dearth in 1900, it must have been worse a generation earlier.

the poor physical condition of recruits to the army during the South African War (1899-1902), claimed that as many as one third of working-class children were malnourished.³

These findings provided evidence that appeared to corroborate the results of late nineteenth and early twentieth century social investigations of poverty and working-class diet. Late Victorian social investigators devised new methods of measuring the extent of the shortfall of household income necessary to meet basic needs. What all these enquiries had in common was a methodology that compared household income with the ability to meet a prescribed minimum basket of goods. Food was the key component of this needs based definition of poverty, although nutritional science was in its infancy in the late nineteenth century. Energy requirements and the relationship between food intake and activity level were understood and had been incorporated into Rowntree's first poverty line.⁴ Generally, these early poverty studies concentrated on the quantity, rather than the quality, of food consumed.⁵ Although the role of calcium and iron in the diet had been identified, contemporary science had not isolated specific vitamins and amino acids and did not fully appreciate the relationship between diet and health, though, of course, in general terms some key foods had been identified as being able to prevent illness and disease. The best known example is the discovery by Lind in 1747 that scurvy was prevented by the consumption of citrus fruits.

It was not until the very end of the nineteenth century, however, that the relationship between the constituents of foods and specific diseases began to be more fully understood. In 1886 Eijkman discovered that the consumption of unpolished rice led to a paralytic disorder in chickens similar to human beriberi, but credit is usually given to Fletcher in 1905 for the discovery of a 'special nutrient' in the husk of rice that prevented the disease in humans. In 1906 Hopkins pointed to the importance of other 'unsuspected dietary factors', in addition to proteins, carbohydrates, fats and minerals, that were essential to health and in 1912 these factors were named as vitamins by Funk, who discovered vitamin

³ *Report of the Inter-Departmental Committee on Physical Deterioration*, BPP 1904 (Cd.2175) Concerns were also expressed about levels of domestic hygiene, food preparation and practices with respect to the feeding of young children.

⁴ Rowntree, B.S., *Poverty: A Study of Town Life* (1901) pp.86-118.

⁵ Mayhew, Madeline (1988) 'The 1930s Nutrition Controversy', *Journal of Contemporary History*, Vol.23, No.3 p.445 See also, Vernon, James (2007) *Hunger: A Modern History*, p.81 *et seq*

B1 in the same year.⁶ This was followed by the discovery of vitamin A by Osborne and Mendel in 1913, vitamin D by Mellanby in 1922, vitamin E by Evans and Bishop in 1922, vitamin B2 by Smith and Hendrick in 1926, folic acid by Wills in 1933, vitamin B6 by Gyorgy in 1934 and niacin by Elvehjem in 1937.⁷

Towards the end of the nineteenth century an increasing number of social investigators collected household data relating to working class diets as part of a wider agenda relating to poor livings. A number of these attempted to evaluate household food consumption in relation to prevailing standards of nutritional adequacy. The most famous among these late Victorian investigations are Booth's survey of London carried out between 1887-1891 and Rowntree's survey of York carried out in 1899.⁸ These were followed in the years immediately prior to the Great War by a small number of surveys that were explicitly concerned with the adequacy of working class diets, rather than with general conditions of poverty among the labouring poor. The first of these was the Paton, Dunlop and Inglis investigation of the nutritional adequacy of the labourers' diets in Edinburgh in 1900.⁹ This survey was followed by two studies carried out in the years immediately prior to the First World War. Lindsay analysed the nutritional adequacy of sixty household diets collected in Glasgow in 1911-12 and Carver carried out a similar survey of forty working class households' diets in Birmingham around the same time.¹⁰ Carver and Lindsay's enquiries stand as a culmination of Victorian concern with the relationship between poverty, poor nutrition, ill-health and disease.¹¹

⁶ Semba, Richard D., (1999) 'Vitamin A as "Anti-Infective" Therapy, 1920-40 in *The Journal of Nutrition*, p.784

⁷ Combs, Gerald F (2008) *The Vitamins: Fundamental Aspects in Nutrition and Health*, pp.15-27

⁸ Rowntree, B.S., (1901) *Poverty: A Study of Town Life*, and Booth, Charles (1892), *Life and Labour of the People in London*, Volume 1.

⁹ Paton, C.N., Dunlop, J.C., and Inglis, E., (1901) *On the Dietaries of the Labouring Classes of the City of Edinburgh*. Paton was a physiologist at the School of Medicine in Edinburgh (later Professor of Physiology) and Dunlop and Inglis were also both medically trained.

¹⁰ Lindsay, D.E., (1913) *Report upon the study of the diet of the labouring classes of the city of Glasgow, 1911-12* and Carver, A.E. (1914) *An Investigation of the Dietary of the Labouring Classes of Birmingham, with special reference to its bearing on Tuberculosis*.

¹¹ Though the two earlier surveys by David Davies, *The Case of Labourers in Husbandry* (1975) and Fredric Eden, *The State of the Poor* (1797) had collected household food consumption records and carried out a rudimentary nutritional analysis of diets.

These surveys represented an advance in terms of survey method,¹² but they did not provide a significantly more sophisticated nutritional analysis of working class diets than Rowntree, as they predate the discovery of the dietary importance of most vitamins and minerals. Like Rowntree's survey, they were based on the American scientist Atwater's analysis of the nutritional composition of foods, which analysed only the protein, carbohydrate and fat content and provided estimates of the energy derived from consumption.¹³

The first modern analysis of the late nineteenth century and early twentieth century working class food consumption patterns and nutrition was carried out by Oddy (1970, 1976, and 2003), who writing in 2003 concluded that:

The evidence from almost 2,500 budgets of working-class families over the period from the 1890s to 1914 indicates that inadequate diets extended more widely among unskilled workers than mere casual labourers earning a pound a week or less who were the principal target of social investigators. Whatever objections there may be to assessing diets per head, the conclusion is inescapable that, with an income below 30s per week and the normal number of growing children for the period before the First World War, families might well obtain only 2,000 to 2,200 kcal and 50 to 60g of protein per head per day. This nutritional analysis provides quantitative evidence in support of the contention by Drummond that malnutrition was widespread in Britain before the First World War.¹⁴

Oddy's conclusion was based on the analysis of diets derived from late nineteenth century and early twentieth century dietary and expenditure records collected by contemporary social investigators and from the official Board of Trade enquiries. Most of these surveys were small-scale enquires of less than 40 households, carried out using different survey methods and by different investigators. Only a small number of these surveys were

¹² In particular, Lindsay's study records the food already in the house immediately before and after the period of study, which was used in conjunction with household food expenditure records to provide a more accurate estimate of household food consumption during the study period. Food waste was also collected and measured. Most late nineteenth century social surveys just collected food expenditure records. *Report upon the study of the diet of the labouring classes of the city of Glasgow, 1911-12* pp.7-8

¹³ Atwater developed the first human calorimeter in 1893 and compiled data on the composition of foods. He was also instrumental in setting up a number of nutritional investigations in Europe funded by the U.S. Department of Agriculture. For more detail, see Carpenter, K.J 'The Life and Times of W.O. Atwater (1844-1907)' *Journal of Nutrition*, 1994 Sept;124 (9 suppl): pp.1707-1714

¹⁴ Oddy, Derek, J., *From Plain Fare to Fusion Food. British Diet from the 1890s to the 1990s*, (2003), p.70. See also 'A Nutritional Analysis of the Historical Evidence: The Working-Class Diet, 1880-1914' in Oddy, Derek J., and Miller, Derek S., (Ed) *The Making of the Modern British Diet* (1976), pp 214-231, Oddy, D.J., 'Working-Class Diets in Late Nineteenth-Century Britain' *Economic History Review*, second series, (1970) pp.314-323

specifically designed to investigate food consumption or nutrition. The largest survey of the period, carried out by the Labour Department of the Board of Trade in 1904, was only available in aggregate summary form.¹⁵ Oddy's results are summarised in Table 1.¹⁶

<Table 1 here>

We have been unable to replicate Oddy's results from the published aggregate analysis of the 1904 Board of Trade Survey.¹⁷ Our calculations from the same source are given in parenthesis in Table 1. In particular we calculate that average *per capita* consumption of bread, flour and sugar were significantly below the level indicated by Oddy, while the consumption of potatoes was a little higher. Significantly more fats and cereals were consumed than Oddy's calculations suggest.. It seems that Oddy made some simple arithmetic errors in the translation of the published records. Nevertheless, with respect to the consumption of foods, Oddy's broad conclusions remain true: at the turn of the twentieth century the typical working class diet was based on a large quantity of bread and flour, though the largest expenditure was on meat. Sugar-based foods were used to make the diet palatable.

There are a number of advantages of investigating working-class diet using the original returns of the 1904 enquiry, rather than being restricted to the published returns. First, diets can be analysed on the basis of both income and skill group and they allow for a more sophisticated treatment of household size and composition.¹⁸ The published analysis is an aggregate summary by income group and region only. Analysis by skill group enables comparison with the findings of the 1918 Working Classes Cost of Living Committee, which repeated the 1904 survey (using the same questionnaire), but reported results by

¹⁵ Oddy, D.J., 'Working-Class Diets in Late Nineteenth-Century Britain' *Economic History Review*, second series, (1970) pp.314-323

¹⁶ Oddy seems to have made arithmetic errors when converting between imperial and metric units. Note that Table 3.5 provides quantities in imperial units and Table A1 in metric units. The figures for 'potatoes' and 'fats' from Table A1, when converted to imperial units, are not the same as those reported in Table 3.5 (2.9 lb and 8.0 oz respectively). Moreover, the value for 'Bread' and 'cereals' together is 7.16lb in Table 3.5 and 7.0 lb in Table A1 when converted back to imperial units. It is not clear why the reported values differ between Tables 3.5 and A1.

¹⁷ Cd 2337 provides tables of average food consumption for households in each income group. These are tabulated in imperial units and need to be divided by the average household size by income group. *British Parliamentary Papers*, (1905) 'Consumption and the Cost of Food in Workmen's Families in Urban Districts of the United Kingdom'

¹⁸ This involves assigning a skill category to each of the head of households in the 1904 BoTR sample, using their description of occupation.

skill rather than income category.¹⁹ Secondly, full information on the quantity of all foods purchased is available, rather than being restricted to aggregate totals for similar foodstuffs as published. Thirdly, some information is available in the original returns on the extent of self-resourcing. Fourthly, the original returns provide details of occupation, which allows us to model the household's energy requirements on the basis of the physical activity level (PAL) of the head of household, as some jobs are far more physically demanding than others.

III.

The Board of Trade enquiry collected details of income and items of food expenditure from workmen and their families for one week during July-September 1904, from all parts of the British Isles, including southern Ireland. In total 2,283 returns were collected, of which 1,808 were considered usable. These were combined with 136 returns collected from London and suburbs the previous year. The results of the 1904 enquiry were published as Cd 2337 in 1905 under the heading '*Consumption and Cost of Food in Workmen's Families in Urban Districts in the United Kingdom.*'²⁰

The enquiry made use of a fixed format questionnaire. The forms provide information on locality (often given very precisely); number and age of children; occupation of the head of household; household weekly income, including earnings of the head and average additional weekly family income; weekly house rent and number of rooms occupied. Fully half the questionnaire is concerned with expenditure and quantity of food consumed by the family, but no details of non-food expenditures were requested other than rent.

1,033 returns from the 1904 Board of Trade enquiry are extant. We will refer to these recovered returns from this survey as the BoTR sample. Gazeley and Newell (2011) provides a detailed discussion of the relationship between this sub-sample and the original enquiry. Readers interested in the detail are referred to that article, but it is necessary to re-iterate the main conclusions here. First, the recovered returns are not a simple sub-sample

¹⁹ See Gazeley, I.S and Newell, A.T 'Working-Class Food Consumption during the Great War', *IZA Discussion Paper No. 5297*, November 2010 and *European Review of Economic History* (2013) forthcoming

²⁰ 1,808 of the 2283 returns were considered usable. These were combined with 136 returns collected from London and suburbs during the 1903 enquiry.

of the 1,944 returns used in the Board of Trade's analysis that is published as Cd.2337 (1905). The recovered extant returns include a number of those that were received too late for the Board of Trade's analysis or were considered to be incomplete in some way. Gazeley and Newell carefully reviewed all of those in this category and most are useable. The elimination of those that are problematic in some way reduces the useable sample to about 990 returns. Secondly, the geographical distribution of BoTR returns is not a random sample of the original. The BoTR returns include most, if not all, of the original Scottish budgets and correspondingly fewer from England, and especially from London, than the original. Thirdly, the BoTR sample has slightly more children per household and a little higher average food expenditure. Finally, in terms of weekly household income distribution, the BoTR sample has a few more families in both extremes of the distribution, but otherwise the match between the two samples is very close.²¹

IV

Table 2 sets out the relationship between household incomes, food expenditure and skill category from the surviving 1904 returns. The head of household's occupation was classified into five social classes using Armstrong's (1972) nineteenth century occupational classification schema.²² Full details can be found in Gazeley and Newell (2013).²³ Note the survey over-samples the households of skilled workers. These are nearly two-thirds of all households in the sample and there are correspondingly fewer heads of household in semi-skilled and clerical occupations. In the recovered 1904 sample around one in ten have a head of household in a clerical occupation and only one in six are unskilled. Generally, household size decreases with skill, so that unskilled workers have the largest households and skilled and clerical workers the smallest.

<Table 2 about here>

²¹ Gazeley, I. and Newell, A.T. (2011) 'Poverty in Edwardian Britain', *Economic History Review*, 64, 1, 52-71.

²² Armstrong, W.A., 'The use of information about occupation' in Wrigley, E.A. (ed) *Nineteenth Century Society: Essays in the use of quantitative methods for the study of social data* (1972) , pp191-253.

²³ Gazeley, I.S and Newell, A.T 'Working-Class Food Consumption during the Great War', *European Review of Economic History* (2013) forthcoming

For all three categories of manual workers, Table 3 provides a summary of food consumption *per capita* in 1904 derived from the analysis of the BoTR sample, using the skill groups using Armstrong's classification. We also calculate the average food consumption of the poorest households in the sample. This group is composed of those households whose income is insufficient to meet Bowley's 1912-3 'northern towns' poverty standard at 1904 prices.²⁴

Recall that this was a fixed format survey that recorded household expenditure on foods and (generally) the quantity of food purchased. In the few cases where expenditure on a food type was recorded, but the quantity purchased was not, we have estimated quantity by deflating expenditure with the average unit price derived from the survey returns. In keeping with the methodology adopted by the 1918 Sumner Committee, the quantity of food grown in the garden or on allotments in 1904 is also included in these estimates, in the cases where respondents have noted it.

Comparing the published average values for quantities of food consumed for the working-class households in the 1904 enquiry with those derived from an analysis of the recovered original expenditure records from this enquiry (Table 3, column (1) compared with column (2)), there is a close correspondence for most articles of food. Quantities consumed are only reported for a sub-set of foods in the published report of the 1904 enquiry, whereas it has been possible to derive a full set of food quantities purchased from the extant returns. In the cases of bread and flour, bacon, all other meat, condensed milk, cheese, butter, margarine, rice and tapioca, sugar tea, coffee and cocoa, the correspondence between the two sets of values is very close.

<Table 3 about here>

There is, however, significant variation with respect to potatoes, fresh milk and oatmeal. The former is probably explained by the inclusion of garden and allotment produce in the estimates of consumption derived from the recovered original returns, whereas in the published results of the analysis of the original enquiry this was excluded. The much higher *per capita* consumption of oatmeal in the extant returns is due to the preponderance

²⁴ Gazeley, I. and Newell, A.T. (2011) 'Poverty in Edwardian Britain', *Economic History Review*, 64, 1, 52-

of Scottish households in the surviving sample. Similarly, buttermilk is included with fresh milk and buttermilk was consumed in large quantity in the households from Ireland. To take account of these factors, we have calculated weighted estimates of *per capita* consumption of foods, which exclude the households from Ireland and weight the households for England and Wales and Scotland in proportion to population size in 1901. These results are reported in Table 4. Weighting the BoTR sample in this way eliminates the discrepancy between the reported Board of Trade average figures and the average calculated from the BoTR sample with respect to oatmeal consumption. It also significantly reduces the discrepancy with respect to milk consumption, though it does not completely eliminate it. Taken as whole, with respect to food consumption *per capita*, it can be seen that the recovered sample of the Board of Trade enquiry budgets are fairly typical of the original survey, though a small number of important differences are apparent which are likely due to the regional bias of the sample we recovered.

<Table 4 about here>

Next we compare our results derived from the original household returns with Oddy's estimates from the published analysis of the survey. Table 5 reports weekly *per capita* consumption figures by skill group for key food groups based on an aggregation of the figures given in Tables 3 (for the Bowley Poor) and 4 (for all other groups). Notice that in comparison with Oddy's results, our estimates are lower in every case for bread. We suspect that this is because of an error in Oddy's conversion of expenditure to quantity.²⁵ For other food groups, our estimates for each skill class are generally above Oddy's. In particular, based on the evidence of the 1904 survey, unskilled workers were consuming more fats and sugar than Oddy's results suggest. The final row of Table 5 reports *per capita* consumption for the 'Bowley poor' and Oddy's results, with the exception of meat consumption, look more similar to this group than unskilled workers.

<Table 5 about here>

71..

²⁵ It appears that the discrepancies in Oddy's calculations are not restricted to the 1904 data, as similar differences are evident for other social surveys he analyses. This is especially true of estimates of per capita consumption of bread and flour, but there are also differences for potato and sugar consumption. See Gazeley, I.S 'The Standard of Living of the working Classes, 1881-1912: The Cost of living and the analysis of Family Budgets', unpublished University of Oxford D.Phil thesis (1985) pp.309-311.

To summarise, analysing the 1904 food consumption data by skill groups provides one way of circumventing the known sampling problems of the 1904 survey and allows us to investigate the way in which consumption varies within the working class. Our analysis suggests that the current received view, from the work of Oddy, of working-class food consumption actually better approximates the experience of the group of households that contemporary social investigators regarded as being in poverty. Average working class experience was of significantly higher *per capita* consumption levels of most key foodstuffs and this level of consumption is generally higher than previously suggested.

V

The estimates of household nutritional intake that can be obtained from these consumption records are subject to a number of potential errors. First, it is typically the case that the records lack some precision. So, 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. This is important because the nutritional composition of cuts of meat vary, especially in relation to fat content. Moreover, for each food type modern food composition tables make assumptions about the proportion of the food that is actually edible. Secondly, and related to this point, we cannot know exactly the way in which food was prepared in these households or how much was wasted from a given quantity of food purchased. Thirdly, some vitamins are destroyed by heat and also the vitamin content of certain foods declines over time and the rate of decline can be affected by the method of storage. Although we have some knowledge of prevalent working class food storage, preparation and cooking practices, we have no information pertaining to the individual households in the survey.²⁶

In translating food consumption data into nutritional intakes we have attempted to minimise these problems. We have used McCance and Widdowson's food composition tables, adjusted so as to remove the impact of the fortification of flour and margarine.²⁷ For meats, we take an average of three different cuts for each type, including both on- and off-

²⁶ See Oddy, Derek J., *From Plain Fare* (2003), pp.54-63

²⁷ Paul, A..A., and Southgate, D.A.T., *McCance and Widdowson's The Composition of Foods* (HMSO 1979). Values were adjusted to remove fortification with respect to flour, bread, and margarine.

the-bone cuts. We have adopted McCance and Widdowson's assumptions concerning the amount of waste associated with each food. The food groups most affected by waste assumptions are meat, fish and vegetables. Of course, we do not know whether their assumptions relating to waste, which are to some extent culturally determined, reflect the behaviour of these working class households seventy years earlier. However, it seems likely to us that poor households at the turn of the twentieth century would have minimised food waste and consumed as high a proportion of the food purchased as possible. In consequence, we believe our estimates are reasonably robust lower-bound measures of nutrients available to households.

Table 6a sets out our calculations by skill group and compares them with the existing estimates by Oddy (2003), though Oddy did not make estimates of vitamin consumption. Since Oddy's estimates were reported in terms of available nutrients *per capita*, we adopted a similar procedure here before going on to report available nutrients per equivalent adult in Table 6b. Notice that in comparison with Oddy's calculations, our *per capita* estimates given in Table 6a are generally a little lower where comparison is possible. There are three main sources of difference. First, as we have already seen, some of Oddy's calculations of *per capita* food consumption are flawed. Secondly, Oddy calculations are based upon mean food consumption values derived from the entire 1904 survey, and about one quarter of these were from households in Scotland, the majority of whom were better-off skilled workers. Finally, Oddy made different assumptions about the extent of waste in food preparation, cooking and consumption. He assumes that 90 percent of meat and vegetables and 80 percent of fish were available, which are significantly more generous than the edible proportion values given by McCance and Widdowson that we have adopted.²⁸

<Tables 6a & 6b about here>

Because the needs of young children are generally less than those of adults, moving from estimates of available nutrients per head (Table 6a) to estimates of available nutrients per

²⁸ Oddy, D.J., 'Working-Class Diets in Late Nineteenth-Century Britain' *Economic History Review*, second series, (1970) Appendix p.323

equivalent adult (Tables 6b) raises the estimates of available nutrients across the board. We adopt an equivalence scale based upon the 1991 UK Department of Health nutritional recommendations, which are discussed in Section VI.²⁹ In terms of energy values, for example, the different weighting of children raises the estimates of available nutrients by about 25 per cent and suggests that skilled workers' households had around 3000 kcal per equivalent adult available compared with just over 2300 kcal available *per capita*. For the sub-set of households that we classify as experiencing poor livings – the Bowley Poor – available energy increases from around 1650 kcal per head to 2600 kcal per equivalent adult, because poor households tended to be those that were on lower incomes and/or were larger with more non-working younger children.

VI

It is likely food was not distributed equally between members of the household, but there is no evidence pertaining to the distribution of food within households in this survey, though there is some information in other near contemporaneous social surveys. Dr Thomas Oliver collected 31 diets from households in the early 1890s and he is one of the few investigators to explicitly address differences in consumption between men and women. Of this total, however, only 6 diets were collected from women, and only two of these were married in households where the male head was still living. Overall, Oliver concluded that women were consuming about 80 per cent of the food men received – especially of protein rich foods.³⁰ This practice was probably still the norm forty years later, as similar conclusions were reached by Spring-Rice in her analysis of 15 working-class household budgets in the 1930s. Spring-Rice concluded that 'In a household in which deficiency plays a far larger part than fulfilment, it is certain that the mother, who is the chancellor of the family exchequer, will deprive herself, instinctively or deliberately, for the sake of her husband or children'.³¹

<Table 7 about here>

²⁹ The Board of Trade survey did not ask the ages of adults nor for the genders of children. In light of these restrictions we proceeded as follows. For each nutrient or measure of nutrition specified in the 1991 Department of Health Report, we took the average of the male and female age-specific requirements, and then multiplied those values by the number of household members in that age group, and then summed these to reach a household reference value. The age groups were: under one year; one to three years; four to six years; seven to ten years; eleven to fourteen years; fifteen to eighteen years; over eighteen years.

³⁰ Oliver, T., 'The Diet of Toil', *The Lancet*, June 29, 1895, p.1634.

Of the 15 diets collected by Spring-Rice, only two are sufficiently detailed to calculate the share of the wife's food consumption in total household consumption. These diets provide full details of the food purchased by the household and the woman's individual meal plans for each meal for seven days. Table 7 provides details of the proportion of weekly food consumed, for these two women, as well as the *per capita* and energy per equivalent adult shares. Notice that for nearly all foods, these two women are consuming more than their *per capita* share and often more than their energy equivalent adult share. However, in the case of protein rich foods the evidence is mixed with one woman consuming a greater share and the other a smaller share than the relevant energy adult equivalent proportion. It would be rash to make too much of this evidence, but since adult women's energy requirements are about 0.8 adult man's, Oliver's conclusion on the relative consumption of women and men would be consistent with a needs-based allocation. Of course, for nutrients, rather than energy, where adult men and women's requirements are more similar, it remains possible that women were not receiving a share of the household food in proportion to their needs.

Finally, it should be noted that the available energy figures given in Tables 6a and 6b are almost certainly an under-estimated because the 1904 survey, in common with most household expenditure surveys, does not fully record expenditure on alcohol. According to Dingle, beer and spirit consumption was around 30 gallons and 1 gallon per head per year respectively at this time.³² Based on Rowntree and Sherwall's 1898 estimates, Dingle maintains that, on average, men were consuming 73 gallons of beer per year, 2.4 gallons of spirits and 1 gallon of wine, while women were consuming half this amount and children under 15 years none.³³ If a working class household consumed no wine or spirits, but the husband and wife consumed the average amount of beer, an additional 436 calories per day of energy should be added to the totals given in Table 6a and 6b.³⁴ If they consumed the average amount of spirits too, this would provide a further 100 kcals per day.

³¹ Spring Rice, M., *Working-Class Wives* (1939, reprinted 1989), p.189

³² Dingle, A.E., 'Drink and Working-Class Living Standards in Britain, 1870-1914' *Economic History Review*, New Series, Vol. 25, No 4 (Nov. 1972), pp.609-10

³³ Dingle p.610

³⁴ Energy equivalents derived from McCance and Widdowson, p.255 and 259. Draught Bitter (specific gravity of 1.004) contains 32 kcal per 100 ml and 70% proof spirit 222 kcal per 100 ml). According to the estimates of Rowntree and Sherwall quoted by Dingle, and average adult man would consume 1.6 pints (909 ml) of beer per day and 0.052 pint (30 ml) of spirits and an adult woman half this amount.

<Insert Table 8 about here>

Table 8 illustrates the impact of allowing for alcohol consumption on the energy available to households in the 1904 survey. Although a small number of households recorded expenditure on alcohol, the vast majority did not. In consequence, we have adjusted the energy available using Dingle's (1972) average figures in conjunction with an estimate of the income elasticity of demand for beer from Fogarty (2008). Allowing for beer consumption in this way raises our estimate of average per capita and adult equivalent consumption to a little over 2,400 and 3,000 kcal per day respectively. Among skilled households in 1904, we estimate in excess of 2,500 kcal per capita and 3,100 per adult equivalent per day were available. Among those households that Bowley would have classified as being in poverty, available energy was significantly less at around 1,700 kcal per capita and 2,700 kcal per equivalent adult per day

VII

The 1991 UK Reference Nutritional Intake (RNI) values replaced the 1979 Recommended Daily Amounts (RDAs) and the change of language is important here. RDAs were defined as 'the average amount of the nutrient which should be provided per head in a group of people if the needs of practically all members of the group are to be met.'³⁵ In contrast, RNI were set so as to define more rigorously what 'practically all' meant. RNIs are set at a notional two standard deviations above the

Estimated Average Requirement (EAR), and assuming that requirements of a nutrient are normally distributed, this ensures an amount of a nutrient that is at least adequate for 97.5% of the population.³⁶

Recommended Dietary Allowances were developed and designed by nutritionists to evaluate food supplies for population groups, and were not intended as a tool for '...assessing either the adequacy of nutrient intakes or nutritional status.'³⁷ This is because an individual's nutritional status can only be identified by clinical assessment.

³⁵ Dietary reference values , 1991, p.1

³⁶ Dietary reference values , 1991, p.3

³⁷ Harper, A.E 'Evolution of Recommended Dietary Allowances – New Directions?' *Annual Review of Nutrition*, 1987 p.526

Nevertheless, in general terms, as Harper has observed, ‘if the intake of a nutrient is equal to or greater than the RDA, the risk of nutritional adequacy is remote. If it is less than 50% of the RDA, the risk of inadequacy is high. However, when intake falls between these extremes all that can be said is that the farther intake falls below the RDA the greater is the risk of deficiency.’³⁸

It is worth remembering, however, that the assumptions implicit in its formulation are unlikely to be entirely reasonable for the analysis of nutritional intakes ninety years earlier. In particular, the 1991 EAR for energy is based on a multiplier of the Basal Metabolic Rate (BMR), which is the amount of energy the body uses when at rest. This depends upon weight, sex and age. The appropriate multiplier of BMR depends upon an individual’s Physical Activity Level (PAL). For example, the 1991 energy values for 75kg adult men aged 30-59 years of 2,550 kcal per day is based on an overall PAL for a twenty-four hour period of around 1.4 or 1.5.³⁹ PAL values in the 1991 *Report* range from 1.4 (‘light’ occupational and non-occupational activity) to 1.9 (moderate/heavy’ occupational activity and ‘very active’ non-occupational activity). Practice in the UK prior to this *Report* was to specify different energy requirements for various levels of physical activity that were explicitly related to an individual’s occupation (from ‘very active’ to ‘sedentary’). The number of ‘very active’ occupations has declined over the twentieth century, and leisure activity now generally has a much greater influence on an individual’s energy requirements than it did earlier.⁴⁰

It seems likely that the appropriate EAR for energy would have been higher for working-class individuals in 1904 because of the preponderance of more energy demanding occupations and longer working hours. Very few of the occupations of head of household in the 1904 survey would be classified as ‘light’, as Table 2 shows (only 45 of 985 were clerical workers). Set against this, their BMR would have been lower because they were generally of smaller stature. Floud *et al* (2011) reckon that on average men who were born in the mid-1880s, and measured towards the end of the first decade of the twentieth century, were more than two inches (5cm) shorter than men in the 1980s.⁴¹ Citing

³⁸ Harper, A.E ‘Evolution of Recommended Dietary Allowances’ *Ibid* p.526

³⁹ Dietary Reference values, 1991, Table 2.7 p.27. 2550 kcal/d is about 10.6 MJ/d, which for an adult male aged 30-59 years of 75kg is between PAL 1.4 and PAL 1.5

⁴⁰ Dietary reference values , 1991, p.22 and Fogel *Escape from Hunger* p.?

⁴¹ Floud et al (2011) p.139

Rosenbaum's 1988 study, Floud *et al* (2011) give the average weight of army recruits over 25 years and older in 1900-4 as 63.7 kg and as 168.4 cm tall.⁴²

For adult men, if the average PAL was 1.8 (moderate activity) among 1904 heads of households, on an 1991 average body weight of 75kg, EAR would have been around 3128 kcal per day. Taking the smaller stature of 1904 men into account lowers this figure. If average body weight among 25-59 year old males in the civilian population in 1904 was 65kg, and average PAL was 1.8, EAR would have been around 2913 kcal per day.⁴³ Table 9 provides a plausible pattern of weekly activity for a 1904 male head of household aged 25-59 years working in an occupation for 54 hours a week with a fairly high activity rate of 4.0 (occupations such as motor vehicle repair, carpentry, bricklaying etc.) and who helps with the household chores and does a little gardening at the weekend. The average PAL for this individual of 65kg is around 2.2, which translates into an EAR of 3,558 kcal per day. Conversely, at the other end of the spectrum, those adult male heads of household employed in occupations requiring overall light physical activity levels of 1.4 would only require about 2,270 kcal/day if they were of average weight of 65kg.

<Insert Table 9 about here>

We have been able to classify our 1904 sample based on the physical activity of the male head of household, as the original returns for the 1904 survey record head of household's occupation, which we have categorised as 'heavy', 'moderate' and 'light'. All adult females were treated as undertaking 'moderate' physical activity, reflecting the greater energy requirement required for washing and cleaning, and we have adjusted adolescents and younger children's energy requirements for likely lower body weight.⁴⁴

Tables 10a and 10b report our estimates of nutritional attainment of 1904 households relative to the (modified) 1991 UK standard by skill group. Approaching this problem on a *per capita* basis, although having the merit of simplicity, does not allow us to take full account of the differing nutritional needs of household members depending upon gender, age and activity. In consequence, individuals in the households in the 1904 survey have

⁴² Floud *et al* (2011) Table 4.2 p.140

⁴³ Calculated from Dietary reference values, 1991, Table 2.7 p.27 using a MJ/kcal conversion of 238.84

⁴⁴ The recommended energy intake is derived from *Dietary Reference Values* (1991), Table 2.5 and Table 2.7, pp26-7. MJ/d values are converted to Kcal/d and averaged for male and female adolescents. For

been assigned to broad groups, defined by age and gender. On this basis, individual RNIs have been aggregated to create a household RNI value, which has then been compared with the available nutrients for the household derived from the household's food consumption data.

Tables 10a-10b about here>

Table 10a provides a summary of these calculations. Following Harper's judgement, we report the proportion of households who have less than 50 percent of RNI available to the household. It would be inappropriate to infer from this table that all households failing to meet 0.5RNI were necessarily deficient in a particular nutrient, but it does indicate the likely pattern of nutritional deficiency among the households taking part in the survey. Tables 10a reports estimates of this proportion with and without allowance for beer consumption. For skilled workers, there appears evidence of a modest number of households who are deficient in vitamin C and D intake and a larger proportion who are deficient in calcium, vitamin A, and riboflavin. For unskilled workers, the proportion of households not meeting 0.5RNI for these nutrients is higher and, in addition, there is a significant proportion of unskilled worker headed households who are deficient in vitamin B6. Among the Bowley poor, nearly half of all households have less than 0.5RNI for riboflavin, over half have less than 0.5RNI for vitamin A and calcium.

Table 10b reports averages of the ratio of total nutrient content to household RNI by skill group and shows a similar pattern of under-nourishment. In the case of energy requirements, the ratio of household energy available to RNI indicates that most households could potentially meet their energy needs, though in the case of poorer households this judgement is on the margin unless likely beer consumption is taken into account. Overall, the evidence from the Board of Trade 1904 survey suggests that in the early years of the twentieth century working class households' diets provided sufficient energy and nutrients, as judged by a modern standard, with the exception of calcium, riboflavin, vitamin A and vitamin C. The extent of the short-fall of nutrients varied by skill group, with, not unsurprisingly, poorer households faring worst of all. Aside from the likelihood of quite prevalent malnutrition in the poorest families, the array of nutrients in

women, we chose values reflecting a bodyweight of 55kg moderate PAL value of 1.8. For men we allowed

which deficiencies show more strongly, i.e. calcium, riboflavin and vitamins A, C and D, are those one might expect from a diet in which fruit and vegetables play a minor role. The UK Food Standards Agency today⁴⁵ recommends that fruit and vegetables constitute about thirty percent of a healthy diet, with starchy food, bread, potatoes and rice for instance, also at about thirty percent. By weight, in the average 1904 British household, fruit and vegetables constitute about six percent, while starch food occupies just fewer than sixty percent.⁴⁶

VIII

By investigating the recorded purchases of foods in the original returns of the Board of Trade's enquiry into urban working class households, we provide a revised and more nuanced record of nutrition in 1904. We find that, compared to Oddy's (2003) estimates, taken from the published summary statistics of the same survey, average working class food consumption was higher. On analysing the nutritional content of the diet, we find very limited purchases of fruit and vegetables and this leads to likely shortages of vitamins A, C and D, riboflavin and calcium. With respect to energy available to the household, we find that on average just over 3,000 kcal were available per equivalent adult per day. For poorer households, there was about 10-15% less energy available. If allowance is made for the likely consumption of alcohol, which is not systematically recorded in the 1904 survey, available energy for adult members of the household might be about 400 kcal higher per day, though the impact on our per equivalent adult calculations is much less (because of non-alcohol consuming children), at around an additional 100 kcal per day. Our best guess, taking into account likely beer consumption is an average of around 3165 kcal for skilled workers and 2,700 kcal per equivalent adult per day for poor workers.

Did these 1904 diets provide sufficient energy to maintain physically demanding work? Fogel (2004) argues that during the nineteenth century British workers physiological capital increased. As diets provided more energy, both physical stature and productivity increased. The calories available for work (total energy intakes less 1.27 basal metabolism) increased from around 858 kcal per equivalent adult male in 1800 to 1,074 in 1850. Fogel

the PAL to vary with occupation

⁴⁵ <http://www.eatwell.gov.uk/healthydiet/eatwellplate/>

(2004) calculates that 1,793 kcal per adult equivalent male were available by 1980.⁴⁷ For Floud *et al* (2011), the increase in the energy available from the late eighteenth century had the effect of increasing the labour force participation rate (by facilitating sustained work among those who previously had insufficient energy intakes) and also raised the productivity of those in work, both of which made substantial contributions to the growth in *per capita* income over the long run.⁴⁸ This increase in available energy also facilitated increased average height and weight over the same period.

For the households in the 1904 survey, 1.27 basal metabolism is around 1550 kcal per equivalent adult male. Thus, skilled workers in 1904 would have had around 1615 kcal per equivalent male available for work, while poor workers would have had around 1150 kcal per equivalent adult male available for work, which fits comfortably within Fogel's long-run time series. Floud *et al* (2011) maintain that the increase in available energy for work in the late nineteenth century, reduced pauperism and begging by providing the energy needed for physically demanding work.⁴⁹

Gazeley and Newell (2011) find that the depth of poverty was very low in 1904, as many of those households in poverty were only a little below the poverty line. Nutrition follows a similar pattern. The majority of households for which measured calories fall below the 1991 RNI standard have measured calories more than 80% of that standard. In other words, the lower tail of the calorie distribution drops very steeply. Among those that Gazeley and Newell (2011) classified as poor by the Bowley standard, the picture is less optimistic. We calculate that around 70% of these households were below the RNI calorie standard, and 46% were below 80% of the standard, so the tail is longer among the poor. Taken together with the findings presented here on diets, it would suggest that in 1900, Britain was on the cusp of having a working population where very nearly all households had a diet that provided sufficient energy for sustained work. Among better off sections of the working class, this physiological transition had been made by 1900, but among those subject to poor livings there was still a substantial minority for whom energy intakes were incompatible with sustained physically demanding work.

⁴⁶ Diseases associated with deficiencies in these nutrients include: Cheilosis, Hypocalcaemia, Rickets, Osteomalacia, Scurvy and Xerophthalmia.

⁴⁷ Fogel (2004) Table 1.3 p.11

⁴⁸ Floud *et al* (2011) pp.126-7

⁴⁹ *Ibid* pp.125-6

References

- Booth, C., *Life and Labour of the People in London*, Volume 1 (1892)
- Bowley, A.L. *Wages and Income in the United Kingdom since 1860* (Cambridge 1937).
- Boyd-Orr, J., *Food Health and Income* (1937).
- British Parliamentary Papers ‘*The Cost of Living of the Working Classes: Report of an Enquiry by the Board of Trade into Working-Class Rents and Retail Prices together with the Rates of Wages in Certain Occupations in Industrial Towns in the united Kingdom in 1912.*’ Cd 6955 1912/13
- British Parliamentary Papers *Report of the Inter-Departmental Committee on Physical Deterioration*, 1904 (Cd.2175)
- British Parliamentary Papers, (1905) ‘*Consumption and the Cost of Food in Workmen’s Families in Urban Districts of the United Kingdom*’
- Carpenter, K.J ‘The Life and Times of W.O. Atwater (1844-1907)’ *Journal of Nutrition*, 1994 Sept;124 (9 suppl): pp.1707-1714
- Carver, A.E. *An Investigation of the Dietary of the Labouring Classes of Birmingham, with special reference to its bearing on Tuberculosis.* (1914)
- Combs, Gerald F (2008) *The Vitamins: Fundamental Aspects in Nutrition and Health* (Oxford)
- Davies, D., *The Case of Labourers in Husbandry* (1795)
- Department of Health, ‘*Dietary Reference Values for Food, Energy and Nutrients for the United Kingdom: Report of the Panel on Dietary Reference Values of the Committee on Medical Aspects of Food Policy*’, HMSO 1991.
- Drummond, J.C., and Wilbraham, Anne, *The Englishman’s Food* (1957)
- Eden, F, *The State of the Poor* (1797)
- Floud, R, Wachter, K and Gregory, A. *Height, Health and History. Nutritional Status in the United Kingdom 1750-1980.* (1990)
- Floud, R., R.W. Fogel, B. Harris and S.C. Hong, *The Changing Body*, Cambridge (2011).
- Fogarty, J. (2008) ‘The Demand for Beer, Wines and Spirits: Insights from and Meta-Analysis Approach’, *American Association of Wine Economists Working Paper No 31.*
- Fogel, R.W. *The Escape from Hunger and Premature Death, 1700-2100* (Cambridge, 2004)
- Gazeley, I.S ‘The Standard of Living of the working Classes, 1881-1912: The Cost of living and the analysis of Family Budgets’, unpublished University of Oxford D.Phil thesis (1985)
- Gazeley, I and Newell, A.T. ‘Nutrition in Interwar Britain: A re-evaluation of Boyd Orr’s findings’ *mimeo*, University of Sussex 2012
- Gazeley, I and A. Newell (2013, forthcoming) ‘The impact of WW1 on the consumer expenditure of British working households’, in press with *European Review of Economic History*
- Gazeley, I and A Newell (2011a) “The End of Destitution”, *Oxford Economic Papers*, doi: 10.1093/oep/gpr032 First published online: July 28, 2011
- Gazeley, I.S., and Newell, A.T. ‘Poverty in Edwardian Britain’, *Economic History Review* 64, 1 (2011b)
- Gazeley, I.S., Newell, A.T, and Scott, P., ‘Why was urban over-crowding much more severe in Scotland than in the rest of the British Isles? Evidence from the first

- (1904) official household expenditure survey' *European Review of Economic History*, Vol.15, 01 (2011)
- Harper, A.E 'Evolution of Recommended Dietary Allowances – New Directions?' *Annual Review of Nutrition*, 1987
- Hollingsworth, Dorothy F., 'Developments leading to present day nutritional knowledge', in Oddy, D.J. and Miller, D.S. (Ed) *The Making of the Modern British Diet* (1976)
- Lindsay, D.E., (1913) *Report upon the study of the diet of the labouring classes of the city of Glasgow, 1911-12* and Carver, A.E. (1914) *An Investigation of the Dietary of the Labouring Classes of Birmingham, with special reference to its bearing on Tuberculosis.*
- Mayhew, Madeline 'The 1930s Nutrition Controversy', *Journal of Contemporary History*, Vol.23, No.3 (1988)
- McKeown, T. *The Modern Rise of Population* (1976),
- Miller, D.S., 'Nutritional surveys' in Oddy, D.J. and Miller, D.S. (Ed) *The Making of the Modern British Diet* (1976)
- Newsholme, Sir Arthur, *Fifty Years in Public Health*, (1935).
- Oddy, D.J., 'Working-Class Diets in Late Nineteenth-Century Britain' *Economic History Review*, second series, (1970)
- Oddy, Derek, J., 'A Nutritional Analysis of the Historical Evidence: The Working-Class Diet, 1880-1914' in Oddy, Derek J., and Miller, Derek S., (Ed) *The Making of the Modern British Diet* (1976)
- Oddy, Derek, J., *From Plain Fare to Fusion Food. British Diet from the 1890s to the 1990s*, (2003),
- Oliver, T., 'The Diet of Toil', *The Lancet*, June 29, 1895
- Paton, C.N., Dunlop, J.C., and Inglis, E., *On the Dietaries of the Labouring Classes of the City of Edinburgh*. (1901)
- Paul, A.A., and Southgate, D.A.T., *McCance and Widdowson's The Composition of Foods* (HMSO 1979).
- Rein, M 'Problems in the definition and measurement of poverty', in Townsend, P., *The Concept of Poverty* (1971)
- Rosenbaum, S., '100 Years of Heights and Weights', *Journal of the Royal Statistical Society, Series A (Statistics in Society)* .Vol. 151. No.2 (1988),.
- Rowntree, B.S., *Poverty: A Study of Town Life* (1901)
- Rowntree, B.S., *The Human Needs of Labour (1920 and 1937)*
- Rowntree, B.S., *Poverty and Progress (1941)*.
- Semba, Richard D., 'Vitamin A as "Anti-Infective" Therapy, 1920-40 in *The Journal of Nutrition*, (1999)
- Smith, Edward, Medical Officer's Report to the Committee of the Privy Council. Sixth Report (1863) Appendix VI and VII, Food of the Lowest Classes, *British Parliamentary Papers*, 1864, XXVIII
- Smith, Edward, Medical Officer's Report to the Committee of the Privy Council. Fifth Report (1862). Appendix V: The Cotton Famine *British, Parliamentary Papers*, 1863, XXV and Medical Officer's
- Spring-Rice, Margery *Working-Class Wives* (1939, reprinted 1989).
- Stone, R. (1945) 'The Analysis of Market Demand', *Journal of The Royal Statistical Society*, 108, 3/5 286-391.
- Szreter, S., 'Economic Growth, Disruption, Deprivation, Disease, and Death: On the Importance of the Politics of Public Health for Development', *Population and Development Review*, Vol 23, No.4 (1997) pp.693-728

Truswell, A.S., 'Minimal estimates of needs and recommended intakes of nutrients'. In Yudkin, J., (Ed), *The Diet of Man: Needs and Wants* (1978)

Table 1: Oddy's estimates of working class food consumption per capita from various surveys.

	<i>Bread</i> (<i>lb</i>)	<i>Potatoes</i> (<i>lb</i>)	<i>Sugar</i> (<i>oz</i>)	<i>Fats</i> (<i>oz</i>)	<i>Meat</i> (<i>lb</i>)	<i>Milk</i> (<i>pt</i>)	<i>Cereal</i> (<i>oz</i>)
1887-01 surveys	6.7	1.6	14.4	5.2	1.4	1.4	
1902-13 surveys	6.6	3.0	15.5	7.6	1.2	1.8	
1904 Mean Income	6.8	2.8	17	8.6	1.3	1.8	5.7
	(5.7)	(3.0)	(15.2)	(10.9)	(1.4)	(1.8)	(8.4)
1904 Income <25s	6.4	2.5	14	6.7	1.0	1.2	5.7
	(5.6)	(2.8)	(12.1)	(8.5)	(1.1)	(1.1)	(8.0)

1904 Income 25-30s	6.8 (5.7)	2.9 (3.0)	16 (13.9)	7.9 (9.1)	1.2 (1.2)	1.6 (1.5)	5.4 (8.0)
1904 Income 30-35s	6.7 (5.7)	2.9 (3.1)	16 (14.7)	8.6 (10.7)	1.4 (1.4)	2.0 (1.9)	6.2 (9.0)
1904 Income 35-40s	6.8 (5.6)	2.9 (2.9)	18 (15.4)	9.1 (10.7)	1.4 (1.5)	2.1 (1.9)	5.4 (7.6)
1904 Income >40s	7.1 (5.9)	3.0 (3.1)	19 (16.8)	10.6 (12.4)	1.5 (1.6)	2.1 (2.0)	5.7 (8.5)

Notes Table 1:

For the 1904 Board of Trade enquiry the italicised numbers are recalculated for this research from the Board of Trade's published summary.

Row 1: Oddy's estimates Oddy, Derek and Miller, Derek (Ed) *The Making of the British Diet* (1976) p.221

Row 2: Oddy's estimates Oddy, Derek and Miller, Derek (Ed) *The Making of the British Diet* (1976) p.221

Row 3, 5, 7, 9, 11,: Oddy's estimates *From Plain Fare to Fusion Food*, Table 3.5 p59. A fuller list of foods is provided in Appendix A1 p.237.

Rows 4, 6, 8, 10, 12 (in parenthesis): authors' calculations from average quantity purchased by households by income group divided by household size as reported in Cd2337

Table 2: Household size, income and expenditure 1904 by skill category

	<i>Number of cases</i>	<i>Total household income</i> (d per week)	<i>Total household expenditure</i> (d per week)	<i>Household food expenditure</i> (d per week)	<i>Household size</i>
1904					
Skilled	672	4651		278	5.75
Semi-Skilled	75	403		249	5.84
Unskilled	156	321		211	6.28
Clerical	90	533		284	5.77
Total	993				

Source: 1904 data derived from the extant original returns to the Board of Trade survey as calculated by Gazeley and Newell (2011). Of the 1038 recovered BoTR returns, there are 1004 returns with reliable total household income, of which 993 are classifiable by skill of the head of household. See the text for a discussion of our skill classification.

Table 3: 1904 per capita weekly consumption of food by skill category (including Ireland, unweighted average for England & Wales and Scotland)

	<i>Average BoT published</i>	<i>Average BoTR</i>	<i>Skilled Working- Class</i>	<i>Semi- Skilled Working- Class</i>	<i>Unskilled Working- Class</i>	<i>Bowley Poor</i>
Bread	n/a	4.36	4.50	4.42	4.43	3.65
Flour	n/a	1.25	1.15	1.27	1.34	1.23
Bread & Flour	5.61	5.60	5.66	5.68	5.77	4.87
Biscuits & Cake	n/a	0.21	0.24	0.15	0.08	0.06
Meat	n/a	1.00	1.05	0.97	0.79	0.58
Sausages	n/a	0.09	0.11	0.07	0.05	0.04
Bacon	0.25	0.22	0.22	0.20	0.17	0.11
Offal & tinned meat	n/a	0.09	0.09	0.11	0.13	0.07
All meat	1.16	1.41	1.47	1.36	1.14	1.19
Fish	n/a	0.39	0.41	0.40	0.27	0.23
Lard suet etc	0.17	0.12	0.12	0.13	0.10	0.09
Eggs	n/a	2.80	3.07	2.76	1.52	1.15
Milk	1.57	2.30	2.44	2.01	1.49	1.11
Cond Milk	n/a	0.03	0.03	0.03	0.04	0.03
Cheese	0.16	0.15	0.16	0.15	0.10	0.09
Butter	0.33	0.38	0.40	0.37	0.26	0.22
Margarine	0.03	0.02	0.01	0.02	0.05	0.04
Potatoes	2.67	3.97	4.12	3.89	3.49	3.02
Vegetables	n/a	0.74	0.77	0.64	0.56	0.42
Fruit	n/a	0.31	0.34	0.20	0.12	0.09
Rice & Tapioca	0.18	0.21	0.23	0.18	0.17	0.12
Oatmeal	0.22	0.60	0.66	0.70	0.49	0.43
Sugar	0.94	1.02	1.04	0.99	0.89	0.73
Jam	n/a	0.30	0.33	0.23	0.19	0.14
Syrup	n/a	0.07	0.07	0.08	0.07	0.08
Dried Fruit	n/a	0.09	0.10	0.07	0.06	0.05
Tea	0.11	0.11	0.12	0.12	0.10	0.08
Coffee	0.02	0.01	0.01	0.01	0.01	0.01
Cocoa	0.03	0.02	0.02	0.02	0.01	0.01

Notes: All foods are measured in lbs per head, except milk (pints per head) and eggs (number), The Bowley poor are the households for which recorded weekly income falls below the Bowley and Burnett -Hurst (1913) 'northern towns' poverty line.

1904 per capita weekly consumption of food by skill category (excluding Ireland, weighted for England & Wales and Scotland)

	<i>Average BoT published</i>	<i>Average BoTR</i>	<i>Skilled Working- Class</i>	<i>Semi- Skilled Working- Class</i>	<i>Unskilled Working- Class</i>
Bread	n/a	3.76	3.88	3.94	4.26
Flour	n/a	1.73	1.70	1.74	1.54
Bread & Flour	5.61	5.50	5.58	5.68	5.79
Biscuits & Cake	n/a	0.17	0.20	0.10	0.08
Meat	n/a	1.02	1.10	0.96	0.86
Sausages	n/a	0.05	0.05	0.03	0.04
Bacon	0.25	0.26	0.30	0.23	0.17
Offal & tinned meat	n/a	0.09	0.10	0.07	0.10
All meat	1.16	1.42	1.55	1.29	1.17
Fish	n/a	0.34	0.38	0.31	0.25
Lard suet etc	0.17	0.18	0.19	0.20	0.13
Eggs	n/a	2.15	2.47	1.75	1.10
Milk	1.57	1.79	1.92	1.59	1.08
Cond Milk	n/a	0.05	0.05	0.02	0.06
Cheese	0.16	0.16	0.19	0.11	0.12
Butter	0.33	0.35	0.37	0.36	0.24
Margarine	0.03	0.02	0.02	0.01	0.06
Potatoes	2.67	3.34	3.59	3.01	2.93
Vegetables	n/a	0.92	1.07	0.69	0.60
Fruit	n/a	0.40	0.47	0.30	0.18
Rice & Tapioca	0.18	0.22	0.22	0.18	0.20
Oatmeal	0.22	0.22	0.24	0.26	0.20
Sugar	0.94	1.02	1.12	0.98	0.79
Jam	n/a	0.23	0.26	0.13	0.18
Syrup	n/a	0.06	0.05	0.09	0.07
Dried Fruit	n/a	0.14	0.16	0.12	0.08
Tea	0.11	0.11	0.13	0.12	0.09
Coffee	0.02	0.02	0.02	0.01	0.01
Cocoa	0.03	0.03	0.03	0.02	0.01

Notes: All lbs per head, except milk (pints per head) and eggs (number)
All meat is butcher's meat plus offal

Table 5: Working class food consumption by skill (BoTR 1904 compared with Oddy)

	<i>All Bread (lb)</i>	<i>Potatoes (lb)</i>	<i>Sugar (oz)</i>	<i>Fats (oz)</i>	<i>Meat (lb)</i>	<i>Milk (pt)</i>	<i>Cereals (lb)</i>	<i>Vegetables & Fruit (lb)</i>	<i>Fish (lb)</i>
Oddy 1902-13	6.6	3.0	15.5	7.6	1.2	1.8			
Unskilled	5.9	3.5	18.3	8.1	1.1	1.5	0.7	0.7	0.3
Semi – skilled	5.8	3.9	20.7	10.6	1.4	2.0	0.9	0.9	0.4
Skilled	5.9	4.1	23.1	11.0	1.5	2.5	0.9	1.2	0.4
Bowley Poor	4.9	3.0	15.1	7.2	1.2	1.1	0.5	0.6	0.2

Notes: Bread = bread and flour and cake, Sugar = sugar and syrup and jam, Fats= butter, margarine, lard, cheese, Meat = all meats (including offal, bacon and rabbit), Milk = fresh and condensed, Cereal = rice, tapioca, oatmeal, Vegetables and Fruit = all fresh and dried vegetables and fruit, Fish = fresh and tinned fish.

Table 6a Nutrition available per head per day in 1904 by skill group (weighted, excluding Ireland, McCance and Widdowson's waste assumptions)

	<i>Oddy BoT average</i>	<i>BoTR average</i>	<i>Skilled</i>	<i>Unskilled</i>	<i>Bowley Poor</i>
Kcal	2511	2328.3	2434.3	2027.8	1653.4
Protein	68	68.0	71.4	60.6	47.7
Fat	77	69.6	74.0	53.0	44.4
Carbohydrate	388	392.5	406.6	361.6	293.6
Calcium	500	429.1	465.3	311.8	247.0
Iron	12.6	9.3	9.8	8.6	6.7
Vitamin A		415.5	447.3	344.0	267.7
Vitamin B1		1.0	1.1	1.0	0.8
Vitamin B2		0.7	0.8	0.6	0.4
Vitamin B3		9.5	10.0	8.9	6.9
Vitamin B6		1.0	1.1	0.9	0.7
Vitamin B12		2.9	3.2	2.5	1.7
Vitamin C		42.3	46.2	32.2	26.1
Vitamin D		2.2	2.4	1.5	1.1
Vitamin E		2.3	2.4	1.7	1.4

Source: authors' calculations and Oddy, *From Plain Fare to Fusion Food*. Table 3.8 p.66. Note these figures differ from those Oddy gives in Appendix Table A2 p.238, for reasons that are not clear.

Table 6b Nutrition available per equivalent adult per day in 1904 by skill group (weighted, excluding Ireland, McCance and Widdowson's waste assumptions)

	<i>BoTR average</i>	<i>Skilled</i>	<i>Unskilled</i>	<i>Bowley Poor</i>
Kcal	2945.3	3040.7	2487.7	2614.0
Protein	103.2	105.3	93.6	92.9
Fat	87.6	91.3	64.2	70.8
Carbohydrate	498.3	512.0	446.0	462.5
Calcium	520.0	556.8	370.5	384.8
Iron	12.0	12.4	10.7	11.0
Vitamin A	519.3	552.1	401.6	422.8
Vitamin B1	1.4	1.4	1.2	1.2
Vitamin B2	0.9	0.9	0.7	0.7
Vitamin B3	11.9	12.5	10.9	10.8
Vitamin B6	1.3	1.4	1.1	1.1
Vitamin B12	3.8	4.1	3.2	2.9
Vitamin C	52.2	55.8	39.2	39.4

Source: authors' calculations from BoTR data. Adult equivalences derived from Department of Health (1991) recommended dietary intakes. Since adult intakes are not given for Vitamins D and E, these nutrients are absent from this table.

Table 7: Proportion of household food consumed by 1930s working class woman

	<i>Mrs D</i> 2A, 5C	<i>Mrs D</i> <i>Per</i> <i>capita</i>	<i>Mrs D</i> <i>Per</i> <i>equivalent</i> <i>adult</i> <i>energy</i>	<i>Mrs V</i> 2A, 3C	<i>Mrs V</i> <i>Per</i> <i>capita</i>	<i>Mrs V</i> <i>Per</i> <i>equivalent</i> <i>adult</i> <i>energy</i>
Bread	0.14- 0.28	0.14	0.16	0.25-0.50	0.2	0.21
Butter	0.59	0.14	0.16	0.26	0.2	0.21
Eggs	0.25	0.14	0.16	0.37	0.2	0.21
Bacon	0.25	0.14	0.16	0.06	0.2	0.21
Meat	0.25	0.14	0.16	0.13	0.2	0.21
Fish	-	0.14	0.16	0.27	0.2	0.21
Potatoes	0.30	0.14	0.16	0.15	0.2	0.21
Vegetables	0.13	0.14	0.16	0.25	0.2	0.21
Fruit	0.28	0.14	0.16	0.25	0.2	0.21
Cheese	0.00	0.14	0.16	0.36	0.2	0.21
Cake/Biscuits	-	0.14	0.16	0.31	0.2	0.21
Tea	0.28	0.14	0.16	0.26	0.2	0.21
Cocoa	0.40	0.14	0.16	0.13	0.2	0.21

Notes:

Mrs D aged 35, wife of unemployed labourer; Mrs V aged 40, wife of railway porter. Calculated from Spring Rice (1939), pp.176-178 and pp.172-174. The proportion of food consumed by the wife has been calculated by aggregating the total consumption of the wife for each meal for 7 days and expressing this as a proportion of the total weekly food purchased. Where weights have not been given, the following assumptions have been made, several of which rely upon Thomas Oliver's assumption given in the Diet of Toil.⁵⁰ Bread: one slice = 2.5 oz (Thomas Oliver). This seems high, so a range has been given which is 1.25 - 2.5 oz per slice. Meat: one serving = 2oz. Note that this is less than half the quantity suggested by Thomas Oliver. Potatoes: three medium sized potatoes = 8 oz (Thomas Oliver). Butter: 1oz sufficient to cover 3 or 4 slices of bread (Thomas Oliver). Bacon: 1lb = 16 rashers, 1 rasher = 1 oz. Sausage: 1lb = 8, 1 Sausage = 2oz. Tablespoon peas = 1oz. Tablespoon of cocoa powder = 0.2 oz. Cake: 1 serving = 2oz. 1 oz loose tea = 12 cups of tea.

Per equivalent adult (energy) proportions derived from Department of Health (1991) Dietary Reference Values Table 1.1 p.xix. As the ages of the household members other than the women are unknown it has been assumed that the husband is aged 18-50 years and they have one child aged 1-3 years, 4-6 years and 7-10 years in the case of Mrs V and additionally one infant aged 7-9 months and one child aged 11-14 in the case of Mrs D. EARs have been averaged for boys and girls. The total Estimated Average Energy requirement for 2A and 3 Children of this age is 38.27 and for 2A and 5C it is 50.19. An adult woman aged 19-50 is 8.1.

Table 8 : The energy impact of supplementing the diet with estimates of alcohol consumption

	<i>BoTR</i>	<i>Skilled</i>	<i>Unskilled</i>	<i>Bowley poor</i>
Kcals per person per day	2418	2531	2097	1705
Kcals per equivalent adult per day	3060	3165	2575	2694

Notes on calculations: Alcohol intakes and imputed as follows. The average of 436 calories discussed in the text, and BoTR mean income, plus and estimated income elasticity allow us to model alcohol intake as a function of income. A comprehensive list of income elasticities for alcohol are given in Fogarty (2008). The earliest estimate for the UK the Fogarty gives is from Stone (1945). Stone finds a small income elasticity, and he comments that it is mostly very close to zero across the various specification he tried. The other estimates that Fogarty gives in his Table 2 (2008, p20) are more-or-less uniformly distributed between 0.2 and 1.0. We use the expression $\log(\text{Kcals from alcoholic drinks}) = 2.48 + 0.6\log(\text{family income})$ to generate an estimate and then add this to arrive at the estimates in Table 8.

Table 9: Plausible physical activity rates for active male occupation in 1904, based on 54 hour working week

	<i>Average PAL</i>	<i>Hours Mon-Friday</i>	<i>PAL* Hours</i>	<i>Hours Saturday</i>	<i>PAL* Hours</i>	<i>Hours Sunday</i>	<i>PAL* Hours</i>
Sleeping	1.0	8	8	8	8	9	9
Dressing	3.0	0.5	1.5	0.5	1.5	0.5	1.5
Eating	1.2	1.5	1.8	1.5	1.8	1.5	1.8
Walking (to work etc.)	3.0	0.5	1.5	0.5	1.5	1	3
Work	4.0	10	40	4	16	0	0
Sitting reading/ etc.	1.2	3	3.6	6	7.2	7	8.4
Light household chores	2.1	0.5	1.05	0.5	1.05	1.0	2.1
Heavy household chores (mopping floor, cleaning windows etc)	3.8	0	0	0	0	2	7.6
Gardening/chopping wood etc.	5.2	0	0	1	5.2	2	10.4
Music Hall/Pub	1.2	0	0	2	2.4	0	0
Total		24	57.45	24	44.65	24	43.8

Notes: PAL data from Dietary Reference Values (1991) Annex 3 p.203

Overall average PAL = $2.24 [(57.45*5) + 44.65 + 43.80]/168$. 1 M/J = 238.84 Kcal

⁵⁰ Oliver, Thomas, 'The diet of toil and its relation to wages and production: a paper read at the Congress of Hygiene and Demography, Budapest, September, 1894'. LSE Selected Pamphlets (1895p.7), LSE Library. This is a considerably expanded version of Oliver's *Lancet* article of the same name

Table 10a: Percentage of households buying less than 50% of UK 1991 RNI, by nutrient

	<i>BoTR average</i>	<i>Skilled</i>	<i>Unskilled</i>	<i>Bowley Poor</i>
Kcal (no beer)	0.7	0.6	2.0	3.8
Kcal (with beer)	0.6	0.3	1.3	3.8
Protein	0.4	0.4	0.0	2.4
Fat	6.9	3.2	23.4	26.6
Carbohydrate	0.2	0.4	0.3	1.5
Calcium	76.4	74.0	84.8	83.4
Iron	3.8	3.7	5.7	10.2
Vitamin A	27.7	23.3	41.3	45.7
Vitamin B1	2.5	1.5	5.2	8.3
Vitamin B2	22.9	17.4	38.2	52.6
Vitamin B3	16.4	11.6	21.0	31.4
Vitamin B6	4.9	2.3	12.5	19.2
Vitamin B12	3.4	3.0	5.7	9.3
Vitamin C	7.4	4.5	19.2	17.8

Source: authors' calculations

Notes: Energy requirements are based on the 1991 recommendations modified as described in the text.

Table 10b: Ratio of average total nutrient content to household RNI by skill group (weighted, excluding Ireland, McCance and Widdowson's waste assumptions)

	<i>BoTR average</i>	<i>Skilled</i>	<i>Unskilled</i>	<i>Bowley Poor</i>
Kcal (no beer)	1.15	1.19	0.98	1.03
Kcal (with beer)	1.23	1.26	1.19	1.15
Protein	2.01	2.06	1.84	1.81
Fat	1.00	1.04	0.74	0.81
Carbohydrate	1.64	1.68	1.47	1.52
Calcium	0.35	0.37	0.25	0.26
Iron	0.98	1.01	0.88	0.89
Vitamin A	0.78	0.83	0.61	0.64
Vitamin B1	1.32	1.38	1.22	1.22
Vitamin B2	0.71	0.76	0.56	0.55
Vitamin B3	0.78	0.82	0.72	0.71
Vitamin B6	0.99	1.02	0.83	0.85
Vitamin B12	2.48	2.69	2.08	1.87
Vitamin C	1.28	1.37	0.97	0.96

Source: authors' calculations from BOTR data. Adult equivalences derived from recommended dietary intakes. see McCance and Widdowson (1991). Since no intakes are given for Vitamin E, this nutrient is absent from this table.

Notes : based on the same energy requirement assumptions as Table 10a