

Sophistication detected: or, the adulteration of the milk supply, 1850-1914

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But the milk ... should not pass unanalysed, the produce of faded cabbage leaves and sour draff, lowered with hot water, frothed with bruised snails; carried through the streets in open pails, exposed to foul risings discharged from doors and windows, spittle, snot, and tobacco quids, from foot-passengers; overflowings from mud carts, splatterings from coach wheels, dirt and trash chucked into it by roguish boys for the joke's sake; the spewings of infants, who have slobbered in the tin measure, which is thrown back in that condition among the milk, for the benefit of the next customer; and, finally, the vermin that drops from the rags of the nasty drab that vends this precious mixture, under the respectable denomination of milkmaid.

Tobias Smollett, *The Expedition of Humphrey Clinker* (1771)

INTRODUCTION¹

In England there is an 800-year history of food control.² In the early centuries this was mainly with respect to price and fair measure, poor quality and deliberate adulteration being much more difficult to police. From the mid-eighteenth century both the problem and the public response were heightened. The greater separation of the producer from the consumer, which was the inevitable result of urbanization and the increased specialization of industrial and commercial functions, provided fertile soil for the growth of fraud. Fresh food was less readily available, and the urban diet gradually comprised a higher proportion of processed foods. Town dwellers were less familiar with the genuine output of agriculture than their rural forebears and perhaps therefore more gullible, but a more likely reason for their submission to a 'sophisticated' diet was that their choice of alternatives and room for complaint were constrained.

Unscrupulous practices were numerous, most falling into one or more of the following categories:

1. Foodstuffs in short supply could be profitably 'stretched'. Where the food system was inefficiently organized or quite simply unable to keep up with demand, retail prices were often high per unit of sale and the rewards of adulteration therefore substantial.
2. Foodstuffs where demand could be encouraged: many foods were coloured or otherwise modified to make them look, smell or taste more attractive.
3. Perishable foods were treated in order to prolong their shelf life and deteriorated items were 'recovered'.

¹ Versions of this paper have been delivered at a Joint Conference of the Historical Geography Research Group and the British Agricultural History Society, and as part of the seminar series 'Health and Medicine since 1800' at the Wellcome Unit for the History of Medicine, University of Oxford. I am grateful to various colleagues for their comments, but I retain sole responsibility for errors of fact or interpretation.

² F. A. Filby, *A History of Food Adulteration and Analysis* (1934), 69.

Pamphleteering in the eighteenth century was of a passionate but exaggerated nature, which exemplified a growing public awareness. It was not, however, until the publication of the work of Friedrich Accum in 1820 that there was a general surge in interest.³ Accum had a detailed scientific knowledge of the purity of food and drugs which he used to analyse and itemize outrageous adulterations, many of which involved the use of poisonous substances. Unfortunately his credibility and reputation were ruined in 1821 by a scandal over alleged thefts from a library and it took over twenty years for the issue to resurface. By mid-century there had been no improvement in the honesty of the food industry,⁴ but there was now a sustained public outcry, resulting this time from the investigations in London of an 'analytical and sanitary commission', whose results were published in *The Lancet*. The doctor and chemist, A. H. Hassall, conducted this wide-ranging enquiry, which was to last for four years (1851-4) and which, by its outspoken yet scientific approach, was to mark a turning point in investigative journalism. The daily press took up the story and the publication of the names and addresses of individual traders, along with the results of each analysis, confirmed a popular suspicion that much of the capital's food was adulterated. Hassall later extended his researches to provincial cities and found similar problems.

Official reaction was slow because the free trade mentality, responsible among other measures for the abolition of the Assize of Bread in 1815, had inspired in the legislators a deep-seated reluctance to interfere in the food industry. There were indeed laws to control adulteration, but these were intended to protect the government's excise revenue rather than the consumer.⁵ Another restraining factor was the respectable social status and political lobbying power of the middle-class shopkeeper. Successive governments preferred to give them the benefit of the doubt.

Set against this from about the 1830s was the emerging environmental view of hygiene and health, most strongly advocated by Chadwick and his followers, which argued that a reduction in mortality and morbidity could only follow a concerted attack upon dirt and pollution. Significant sections of the statute book in the second half of the century were devoted to sanitary measures, with housing, water supply and refuse disposal as the main thrusts. Central governments were also aware of the political power of the food issue, but their actions were focused upon the supply of plentiful, cheap provisions, rather than food quality.

The utilitarian philosophy which validated notions of state intervention in public health in the name of the general social good, especially as expressed in work efficiency, ought to have been equally relevant to the food supply. However, such rationalities were still subordinated in the 1850s and 1860s to the same vested interests which had smeared Accum and forced him into exile in 1821. Adulteration was a direct route to windfall profits, the greater the undetected fraud the greater the return, and the food trade was at first unwilling to relinquish this perquisite. In the late 1850s there does, however, seem to have been a change of commercial tactics, with a few of the more astute traders now appealing to the new consumer

³ J. Burnett, 'History of Food Adulteration in Great Britain in the Nineteenth Century, with Special Reference to Bread, Tea and Beer' (London Ph.D. thesis, 1958); J. Burnett, *Plenty and Want: A Social History of Diet in England from 1815 to the Present Day* (1966), chap. 5.

⁴ J. Mitchell, *A Treatise on the Falsifications of Food, and the Chemical Means Employed to Detect Them* (1848), 74-83.

⁵ The Board of Excise was responsible for preventing the adulteration of tea, coffee, tobacco, hops and sugar. There were also acts against the adulteration of bread in London (1822) and the rest of England and Wales (1836). I. Paulus, *The Search for Pure Food: A Sociology of Legislation in Britain* (1974), 16.

demand for pure food.

There may have been voluntarism by some ‘respectable’ traders, but the majority of wholesalers and retailers continued with their by now traditional ‘trade practices’ such as ‘mixing’ until such time as there was a probability of prosecution. The Lancet's investigations caused such a furore that the government was obliged to appoint a Select Committee of the House of Commons to examine the matter further. The evidence adduced there corroborated Hassall's findings and parliament was forced to admit the widespread existence of food fraud. Five bills aimed at curbing the abuse were debated, but the privately sponsored act which eventually reached the statute books in 1860 was a pale compromise. No provision was made for sampling to be undertaken by local authorities, nor were they compelled to appoint analysts. In fact only seven public analysts were appointed in the whole of the United Kingdom and Ireland in the next twelve years, and few of them were active.⁶ Only Dr C. A. Cameron, appointed as Medical Officer of Health and Public Analyst in Dublin in 1862, managed to secure many convictions. The number of milk samples taken by his department in the next decade surpassed fivefold the total for the rest of the United Kingdom put together. Despite the good intentions which lay behind it and the potential deterrent effect, the 1860 act was little more than a ‘dead letter’ legalistically speaking.

An amended act in 1872 was more positively framed, with sampling emphasized, but the definition of adulteration remained a problem, the prosecution having to prove deliberate intent.⁷ By this date the issue of food purity was becoming another Victorian moral crusade and should be seen in that ideological context. Another Select Committee (1874) and further acts (1875, amended 1879 and 1899) followed as political interest accelerated.⁸ Despite vigorous lobbying, trade interests could no longer be sure of blocking progress, their biggest defeat being the shift of responsibility from a proof of the *mens rea* (fraudulent intent) to the ‘strict liability’ of the trader for the product(s) s/he sold.⁹ This crossed the psychological threshold from *caveat emptor* to *caveat venditor*.

Better technical facilities for detective analysis, such as the use of the microscope, were becoming available and the nascent profession of public analysts was providing the necessary skills.¹⁰ By the end of the 1880s bread, beer and tea were virtually free of adulteration, but milk was still causing concern. More samples were taken of dairy produce than any other foodstuff, and a higher rate of fraud was detected. It is the purpose of this article to reveal the extent of this dishonesty in the milk trade and recount the efforts that were made for its elimination.

THE MILK TRADE

Before the mid-nineteenth century most milk for sale in liquid form was produced close to or even within the large cities where demand was concentrated. From further afield suitable means of transport and preservation were lacking for this most perishable of foodstuffs. The marketing channel may have been truncated but, unfortunately for the consumer, this was no

⁶ Most were summary actions in the magistrates' court.

⁷ There had been four other previous amending bills. Paulus, *op. cit.*, 137.

⁸ For various technical reasons, effective legal enforcement of this legislation was impossible until about 1880. Paulus, *op. cit.*, 104.

⁹ *ibid.*, 16-17.

¹⁰ The first constituent analysis of milk was performed in the late eighteenth century, however, and a lactometer was patented in 1800. Filby, *op. cit.*, 51-2.

guarantee of a high quality product. Some consumers even preferred to have the cow brought to the doorstep as the only way to avoid watering of the milk.¹¹

At the beginning of the nineteenth century it was common for retailers to buy from suburban cowkeepers, and for their own milkmaids to do the milking. The milk was set for about twelve hours and the cream taken off. The skim milk was then watered down, ‘bobbed’ or ‘washed’ in the trade jargon, and sold in the streets by the same milkmaids. Middleton (1807) calculated the profit of this combined abstraction and adulteration to be about 22 per cent, or fourpence on every gallon of milk sold. There was a lack of concern by the authorities, and Middleton's suggestion in 1807 that dairymen should be licensed was not put into practice in London for over fifty years.¹² London cowkeepers were licensed from 1862, under the Metropolitan Local Management Act of that year. Milk retailers had to be registered from 1885, but the authorities had no powers of deregistration until the London County Council (General Powers) Act of 1908. They could, however, enforce cleanliness under clauses 8-13 of the Public Health (London) Act of 1891.

Table 1. Evidence of the adulteration of London milk before 1872

Item	Samples	Adulterated (%)	Average dilution (%)	Average fat abstraction (%)
1.	24	52	11.7	—
2.	20	—	20–50	—
3.	100	74	24.2	—
4a.	5	80	33.6	36.2
4b.	82	73	—	—
4c.	20	40	—	—
5.	10	90	18.9	31.9
6.	16	75	29.5	29.5
7.	15	80–87	20.6	35.6
8.	617	93.4	—	—
9.	33	93.9	—	—
Mean		75.5	24.8	33.3

Sources: 1. *The Lancet* (1850–4); 2. T. Hillier, *Annual Report of the Medical Officer of Health on the Sanitary Condition of the Parish of St Pancras* (1856); 3. W. L. Scott, ‘On food, its adulterations, and the methods of detecting them’, *Journal of the Society of Arts*, ix (1861), 153–5; 4a. A. Voelcker, quoted in J. C. Morton, ‘On London milk’, *Journal of the Society of Arts*, xiv (1865), 65–78; 4b. Druitt, quoted in Morton, *op. cit.*; 4c. Whitmore, quoted in Morton, *op. cit.*; 5. A. Voelcker, ‘London milk’, *British Medical Journal* (23 November 1867), 479–80; 6. Dr Divers, ‘On London milk’, *British Medical Journal* (11 April 1868), 356–7; 7. A. H. Hassall, *Food, Water and Air in Relation to the Public Health*, vol. 1 (1871); 8. *The Milk Journal* (1871–2); 9. Islington Medical Officer of Health, *Annual Report* (1871).

Table 1 is a record of the available evidence of the adulteration of milk in London before 1872. The data are miscellaneous and probably subject to a substantial margin of error. We can, however, identify a broad consensus about the extensive nature of ‘sophistication’. It seems that milk at this time contained on average approximately 25 per cent of water added after one-third of the cream had been skimmed.

To hide the ‘thin’ or ‘bluish’ appearance of milk modified in this way, some dairymen restored its natural look by the addition of various substances. Flour or starch were used to

¹¹ The author has seen this practice still in operation on the streets of south Asian cities.

¹² Middleton, *General View of the Agriculture of Middlesex*, 2nd edn (1807).

thicken its consistency, the juice of boiled carrots to give 'a fullness and sweetness', chalk for whiteness, and even brains to froth the milk.¹³ By 1871 advertisements were appearing in the dairy trade press for the vegetable dye anatto, and later various aniline and sulphonated azo-dyes were used.¹⁴ The synthetic chemical dyes were very strong and could therefore be used in cheap dilutions of 1: 200,000. About half the milk sold in towns seems to have been coloured, a proportion which was higher in London if data from Lewisham are representative.¹⁵ A circular sent out by the Central Chamber of Commerce in 1900 showed that, of those traders who used colouring, 65 per cent preferred anatto, the rest using brands such as 'Silver Churn' and 'Cowslip Colouring'.¹⁶ Apparently London consumers were especially keen on a rich, yellowish look to their milk.¹⁷ Mr Hattersley, Managing Director of the Aylesbury Dairy Co., reported in 1901 that he had been trying for years to stop the practice but had received complaints from his customers.¹⁸ Artificial colouring of milk was forbidden in 1912 under the Public Health (Milk and Cream) Regulations.¹⁹

Adulteration was especially common in situations where the retailer was making casual sales. Henry Mayhew noticed this among the informal sector dealers who worked in summer in London's markets on weekdays and on Sundays in open spaces such as Hampstead Heath.²⁰ They sold their watered skimmed milk by short measure as 'whole' milk.

Suppliers of Poor Law institutions were also notorious for their cheating. For reasons of economy the Guardians usually accepted the lowest tenders, and these in most cases were incompatible with the supply of whole milk. Dr J. Challice found that the Bermondsey Guardians had taken a tender of fivepence halfpenny per barn gallon when no other offer had been below one shilling. He concluded not surprisingly that 'all the milk was adulterated; it turned sour, and was altogether bad milk'.²¹ In 1871 the Milk Journal investigated the Shoreditch and Holborn Unions, both of which were supplied by the reputable Express Country Milk Co. Analysis showed the milk to contain 47 and 29 per cent of added water respectively.²² Such was the public interest that questions were asked in parliament. A. J. Wanklyn extended these enquiries to fifty-seven London workhouses, of which only two received even 'best skimmed milk'.²³ In 1872 the British Medical Journal found that the milk supplied to the eight major London hospitals had, on average, 63 per cent of its fat extracted and 23 per cent added water.

¹³ Professor J. T. Queckett found one sample with calves' brains. B.P.P., S.C. ... into the Adulteration of Food, Drinks, and Drugs, 1856 (379), viii, Report and Evidence, Q. 396. The more exotic adulterations were rarely found: *ibid.*, 1854/5 (432), VIII, Q.5.

¹⁴ B.P.P., *Select Committee on Food Products Adulteration*, 1894 (253), xii, Report and Evidence, Q. 1351; *ibid.*, 1896 (288), ix, Q. 260. Anatto was added at the rate of one teaspoon to two gallons of milk. Anon., 'Three months in the London milk trade', *The Economic Review*, iv (1894), 180.

¹⁵ B.P.P., S.C., 1894, *op. cit.*, Q. 1383. The *Annual Reports* of the Medical Officer of Health for the Metropolitan Borough of Lewisham show an incidence of colouring matter in milk which peaked at 77.4 per cent of samples in 1906, falling away to 21.9 per cent in 1913.

¹⁶ B.P.P., D.C. ... into the Use of Preservatives and Colouring Matters in the Preparation and Colouring of Food, 1902 (Cd. 833), XXXIV, Report and Minutes of Evidence, Q. 4458.

¹⁷ B.P.P., S.C., 1894, *op. cit.*, Qs. 2542-6.

¹⁸ B.P.P., D.C., 1902, *op. cit.*, Q. 5861.

¹⁹ Made by the Local Government Board under the Public Health Act (1896) and the Public Health (Regulations as to Food) Act (1907).

²⁰ H. Mayhew, *London Labour and the London Poor. Volume I: The Street Folk* (1861), 191-3.

²¹ B.P.P., S.C., 1856, *op. cit.*, Qs. 1485-6.

²² *The Milk Journal* (1 March 1871), 57.

²³ B.P.P., *Report of the Superintendent of Contracts, Admiralty, Relative to the System of Supply of Provisions and Stores for the Workhouses of the Metropolis*, 1872 (275), LI, 619; *The Milk Journal* (1 August 1872); V. J. Johnston, *Diet in Workhouses and Prisons, 1835-1895* (1985), 122.

The poor were the worst sufferers from these frauds.²⁴ The highest incidence of chronic adulteration was in the small general provisions shops in slum areas (Table 2).²⁵ They provided 'cheap' goods to people who were unable to exercise much choice. Many of their customers were in debt to the shopkeeper and therefore in a weak position to complain. Only small quantities were purchased, for a farthing or a halfpenny at a time. Skimmed milk, when sold as such, was a boon to the poor. In the slums of London they could buy it at a fraction of the price of 'whole' milk in Lord Vernon's depots, and in cities such as Glasgow it dominated the market.²⁶

Table 2. *Legal action for adulteration against different size retailers in St Pancras, 1901-3*

<i>Milk sold daily</i>	<i>Outlets</i>	<i>Prosecutions/100 samples</i>
1-2 gallons	309	17.3
1-2 churns	76	7.2
Several churns	54	6.1
A van load	29	5.3

Source: Medical Officer of Health to the Metropolitan Borough of St Pancras, Annual Report (1903)

THE DEBATE ABOUT MILK STANDARDS

The Food and Drugs Act (1872) was more satisfactory than its predecessor. Penalties were increased and allowance was made for sampling by public analysts. Problems, however, arose with implementation. The Select Committee charged with assessing the impact of the act found that

previous to the passing of the Act of 1872, milk was very generally adulterated with water. It has since greatly improved in quality, wherever the Act has been enforced, but the good results in improving the milk supply have not been attained without some serious injury and injustice to the milksellers.²⁷

The standards adopted by some analysts had been too high and rigid, making no allowance for the natural variations in milk composition.²⁸ Moreover, unfortunate retailers were sometimes convicted for the sins of their wholesale supplier or milk producer. The elite of dairy companies also thought themselves disadvantaged that there was no provision in the act for milk with a warranty or guarantee of quality.²⁹ They and others in the trade must have

²⁴ B.P.P., *S.C. on Food Products Adulteration*, 1895 (363), x, Report and Evidence, Q. 578.

²⁵ Local Government Board, *Annual Report* (1890-1).

²⁶ R. H. Rew, 'An inquiry into the statistics of the production and consumption of milk and milk products in Great Britain', *Journal of the Royal Statistical Society*, LV (1892), 244-78.

²⁷ B.P.P., *S.C. on Adulteration of Food Act (1872)*, 1874 (262), vi, Report and Evidence, iv.

²⁸ *ibid.*, iv.

²⁹ A warranty was in effect a certificate that the retailer obtained from the wholesaler/ supplier guaranteeing that the goods were unadulterated. Large dairy companies were sufficiently powerful to insist upon this safeguard. After the 1899 Act a criminal prosecution had to be suspended if a warranty was produced in court, the action then only being capable of civil proceedings against the supplier. Paulus, *op. cit.*, 97.

thought it curious that the abstraction of cream continued to be legal.

These and other shortcomings prompted the Select Committee to recommend modifications to the act. The 1875 amending act introduced two important new concepts. First, there was the notion that the sale of goods might be to the prejudice of the purchaser without actually injuring his/her health. Second, there was a duty imposed upon local authorities to appoint a competent analyst or use the services of a neighbouring county or borough.

From the late 1870s we are fortunate to have a data series which can help us to identify trends in adulteration, although there are some problems with its interpretation. First, most of the samples were collected officially, very few private samples being analysed. This is probably a source of the underestimation of fraud because there is proof that shopkeepers adulterated goods sold to their regular customers more than those sold to strangers.³⁰ Second, only samples which failed a specific gravity test with a lactometer were forwarded for analysis, a problem because it was possible artificially to simulate a natural specific gravity.³¹ Third, analysts could not agree among themselves about the composition of genuine milk.

J. A. Wanklyn in his work for the Milk Journal (1871-2) chose a minimum standard of 12 per cent total solids, which was high enough to condemn many samples.³² He found that 10 per cent of the London samples tested had been adulterated. His dry extraction technique remained the state-of-the-art until about 1885 when it was found to overestimate the solids non-fat and underestimate the butterfat. After that Adams' Paper Coil Process was preferred and advances in technology later meant a proliferation of approaches, some highly accurate, others quicker and cheaper.³³ The 1901 Departmental Committee listed eight of the main methods.

In 1874 the Society of Public Analysts was formed to co-ordinate the action of these new civil servants.³⁴ In a series of meetings in 1874 and 1875 they decided that their thresholds would be for liquid milk 9 per cent (later 8.5 per cent) by weight for solids non-fat and 2.5 per cent (later 3 per cent) of butterfat, and for butter 80 per cent butterfat.³⁵ They also declared themselves to be unhappy with the 1875 act's provision of a 'court of appeal' for disputed analyses in the shape of the laboratory of the Inland Revenue in Somerset House. The government analysts wished to make allowances for genuine but abnormally 'thin' milk, such as that produced by cows fed on brewers' grains, those at the beginning of their lactation, and milk taken in the morning. This brought them into conflict with the public analysts in a quarter of cases referred to them between 1875 and 1894.³⁶ The dispute occasionally flared up in public, for instance when F. J. Lloyd, consultant chemist to both the British Dairy Farmers' Association and the Metropolitan Dairymen's Society, neither of them organizations with any interest in exaggerating the situation, stated to the 1896 Select

³⁰ *ibid.*, 99.

³¹ G. W. Wigner, *Pure Milk* (1884), 17.

³² B.P.P., S.C., 1874, *op. cit.*, Q. 6446.

³³ A. W. Blyth, *Foods: Their Composition and Analysis*, 7th edn (1927), 247-50.

³⁴ B. Dyer and C. A. Mitchell, *The Society of Public Analysts ... Some Reminiscences of its First Fifty Years and a Review of its Activities* (Cambridge, 1932), 2.

³⁵ By no means all analysts followed these standards, however. The adulteration rates recorded in different local authority areas are therefore not strictly comparable, but they are all we have.

³⁶ B.P.P., S.C., 1894, *op. cit.*, Qs. 555, 563. The Somerset House standard was 2.5 per cent butterfat until 1894, when it was raised to 2.7 per cent. In 1899 it became 3.0 per cent. B.P.P., D.C. ... *upon the Desirability of Regulations, under Section 4 of the Sale of Food and Drugs Act, 1899, for Milk and Cream (1901)*, 1901 (Cd 484), xxx, Report and Evidence, Qs. 10, 546-54.

Committee that

I am sorry to say that in my opinion the action of Somerset House in taking low standards for milk has been the cause of the enormous amount of adulteration at present in the country.³⁷

The debate about standards was not at first firmly grounded in scientific fact. Arguments were often based on the output of small and possibly atypical herds. It was really only with the opportunities for large-scale commercial sampling provided by the Aylesbury Dairy Co. that P. Vieth and H. D. Richmond, their analysts, were able to satisfy most of the demands of statistical representativeness. From 1881 they took 10-20,000 samples a year and their data became the definitive series.³⁸ A problem, however, was that this company bought only milk produced under good conditions, and they probably would not have seen much milk from poorly fed animals. Another potential difficulty was that the different dairy cattle breeds gave milk of varied composition. The Channel Island breeds, in particular, were renowned for their rich milk, whereas Friesians, which have become very popular in the twentieth century, have a high yield of milk low in butterfat. It is not known whether the Aylesbury drew their supplies from farms with a bias to one or other of these breeds, or indeed the Dairy Shorthorn or Ayrshire, which were also common at the time. S. W. Farmer, a large-scale Wiltshire producer, had a contract with the Aylesbury Dairy Co. to supply 1500 gallons of milk a day with a minimum of 8.75 per cent solids non-fat, a standard he claimed to have little difficulty in meeting.³⁹ He and other conscientious farmers benefited for the first time from the premium which quality attracted. This became a profitable alternative to watering.⁴⁰

The Select Committees of the mid-1890s elicited opinions from many sources, the majority being in favour of 3 per cent butterfat and 12 per cent total solids. It was said in 1896 that these had been the standards adopted by many of the large dairy companies for at least a decade.⁴¹ The Great Western and Metropolitan Dairies, the second largest wholesale firm in the country, stipulated a 3.5 per cent butterfat standard in their contracts. This was apparently most difficult to meet in the month of May.⁴² It was not, however, until 1901 that the Sale of Milk and Cream Regulations made the legal minima 3 per cent and 11.5 per cent respectively.⁴³ These are still the presumptive limits today.

THE INCIDENCE OF ADULTERATION

Much of the above discussion is really by way of alerting the reader to the inherent problems of analysing the national and London data on adulteration which exist from 1877. The series was compiled by the Local Government Board from the annual reports sent in by local

³⁷ B.P.P., S.C., 1896, *op. cit.*, Q. 353.

³⁸ Another famous series was that of C. A. Cameron who analysed 100,000 specimens of milk over a forty-year period, and found that 13-15 per cent total solids was the average for the cows supplying Dublin. B.P.P., D.C., 1901, *Op. cit.*, Q. 2414.

³⁹ B.P.P., S.C., 1894, *op. cit.*, Q. 3433. The Aylesbury's fat standard was 3.25 per cent. B.P.P., D.C., 1901, *op. cit.*, Qs. 8388-91.

⁴⁰ Prior to this farmers and dealers had defended themselves against the accusation of adulteration with a variety of excuses. The novel defence of a Wigton milkseller fined £4 for having added 10.6 per cent of water to his milk was that he had accidentally left the lid off the can overnight when it stood in the rain. It was calculated, however, that twelve inches of rain, equivalent to one-third of the annual rainfall, would have been required to fall to make this plausible! Local Government Board, *Annual Report* (1910-11), XLVII.

⁴¹ B.P.P., S.C., 1896, *op. cit.*, Q. 358.

⁴² B.P.P., D.C., 1901, *op. cit.*, Qs. 5238, 7869-83.

⁴³ Made under section 4 of the Sale of Food and Drugs Act (1901).

authorities as required under section 19 of the Sale of Food and Drugs (1875) Act. In 1877 milk samples constituted just over 30 per cent of all food and drug analysis nationwide, and in 1910, 47.5 per cent. A naive reading would see the data on an interval scale but, with professional analysts bitterly contesting what constituted 'zero adulteration', this would be unwise. At first the officers of the LGB themselves expressed doubts about comparability between districts in view of varied analytical techniques, so clearly we must proceed with caution.⁴⁴

Adulteration of milk was a more serious problem in London than elsewhere in England and Wales.⁴⁵ Although there seem to be some fluctuations common in time to both curves (see Figure 1), their absolute ranges are varied and the periods of accelerated change are lagged. The most rapid decline in the provincial adulteration rate took place between 1883/4 and 1885/6, a fall of over 5 per cent in just two years, while the marked fall in the metropolitan data, of over 10 per cent in four years, was between 1893/4 and 1897/8. The period of greatest divergence was in the late 1880s and early 1890s, and the two curves do not converge until 1907/8, by which time the national rate was just over 10 per cent.

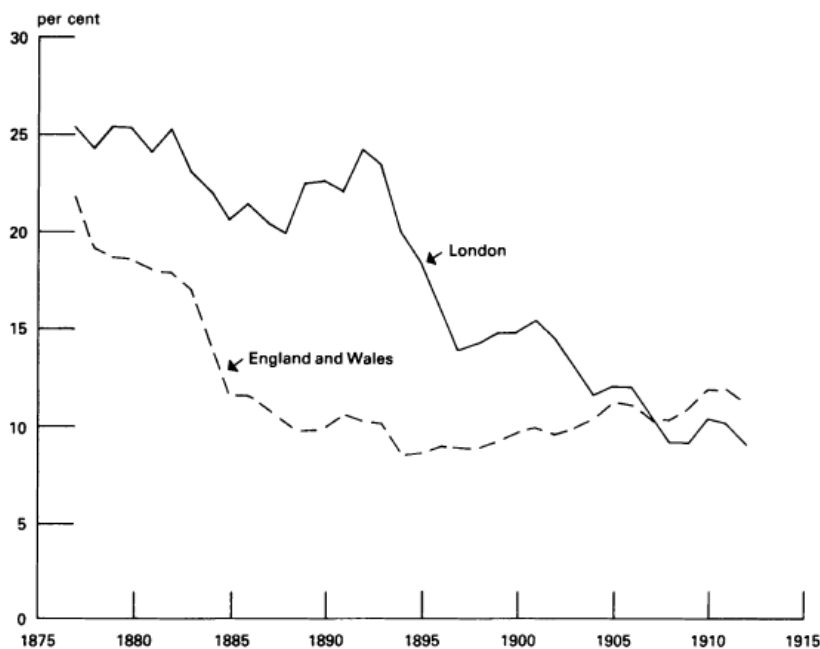


Figure 1. The adulteration of milk (per cent added water) in London and England and Wales, 1877-1913

Publicity surrounding the Sale of Food and Drugs Acts of 1872, 1875 and 1879 was probably responsible for a declining incidence of fraud in the 1870s, and in the 1880s a more general and effective legal enforcement took over. It is unfortunate that the LGB data series does not begin until 1877, because by then no doubt some of the amelioration had already taken place. The somewhat over-zealous action of a few analysts, coupled with a general public reaction against the abuses uncovered by both private and government enquiries, created a new psychological context in which most dairymen and retailers felt less inclined to take risks. State intervention helped to puncture the resignation with which consumers fatalistically accepted watered milk. From the 1870s the 'image' of milk began to improve and this must have contributed to the documented increase in consumption. Some dealers had to continue

⁴⁴ Local Government Board, *Annual Report* (1881/2).

⁴⁵ C. Hassard, 'The milk trade from within', *Economic Review*, xv (1905), 74.

adulterating milk in order simply to stay in business, but others found they could profit from the premium on fresh, ‘healthy’, whole milk.

Table 3. *Seasonal variations in Birmingham milk adulteration, 1894–9*

	Fat %	Solids non-fat %	Adult- eration %		Fat %	Solids non-fat %	Adult- eration %
<i>1894</i>				<i>1897</i>			
1st quarter	3.7	8.5	9	1st quarter	3.6	8.7	8
2nd quarter	3.8	8.5	7	2nd quarter	3.6	8.4	16
3rd quarter	3.5	8.5	26	3rd quarter	3.7	8.4	18
4th quarter	3.8	8.7	6	4th quarter	3.8	8.6	14
<i>1895</i>				<i>1898</i>			
1st quarter	3.8	8.4	24	1st quarter	3.7	8.5	19
2nd quarter	3.6	8.4	24	2nd quarter	3.8	8.6	5
3rd quarter	3.4	8.2	28	3rd quarter	3.8	8.4	12
4th quarter	3.8	8.7	4	4th quarter	4.2	8.4	9
<i>1896</i>				<i>1899</i>			
1st quarter	3.6	8.6	19	1st quarter	3.5	8.6	17
2nd quarter	3.6	8.5	13	2nd quarter	3.4	8.7	10
3rd quarter	3.8	8.4	12	3rd quarter	3.7	8.5	20
4th quarter	3.9	8.5	12	4th quarter	3.7	8.5	21

Source: B.P.P., D.C. . . . *Upon the Desirability of Regulations, Under Section 4 of the Sale of Food and Drugs Act, 1899, for Milk and Cream, 1901 (Cd. 484), xxx, Minutes of Evidence, Appendix II.*

London’s success in curbing fraud was at first limited. The rate of adulteration did not fall below the 12 per cent mark until nineteen years after the rest of England and Wales. The system of itinerant vending in a large-scale, anonymous city environment did not help, and the increasing dependence of London at the end of the nineteenth century upon rurally produced milk was an invitation to malpractice in seasons when demand exceeded supply, for instance in the 1890s when there were four years of below average hay and therefore milk yields (see Table 3 for Birmingham). This is not to say that provincial authorities were necessarily more efficient or their dairymen more righteous. In 1891 it was reported that, despite the adoption of regulations by most councils, the law was virtually inoperative in twenty-two counties, nineteen of the largest towns and two metropolitan districts.⁴⁶ The LGB sent out a circular to stimulate action, but little happened in many jurisdictions until the 1899 act insisted on the appointment of a competent analyst willing to execute the law, subject to the scrutiny of the LGB and the Board of Agriculture who, in the instance of a default, were empowered to draft in their own analyst at the expense of the local authority. In the light of these administrative advances the upward trend in provincial adulteration from 1894 to the First World War might seem puzzling, but it is probably the result of an improved monitoring system picking up previously undetected fraud.⁴⁷

⁴⁶ Local Government Board, Annual Report (1896-7).

⁴⁷ The use of the warranty defence became common after the 1899 act and will have reduced conviction rates. Paulus, *op. cit.*, 108.

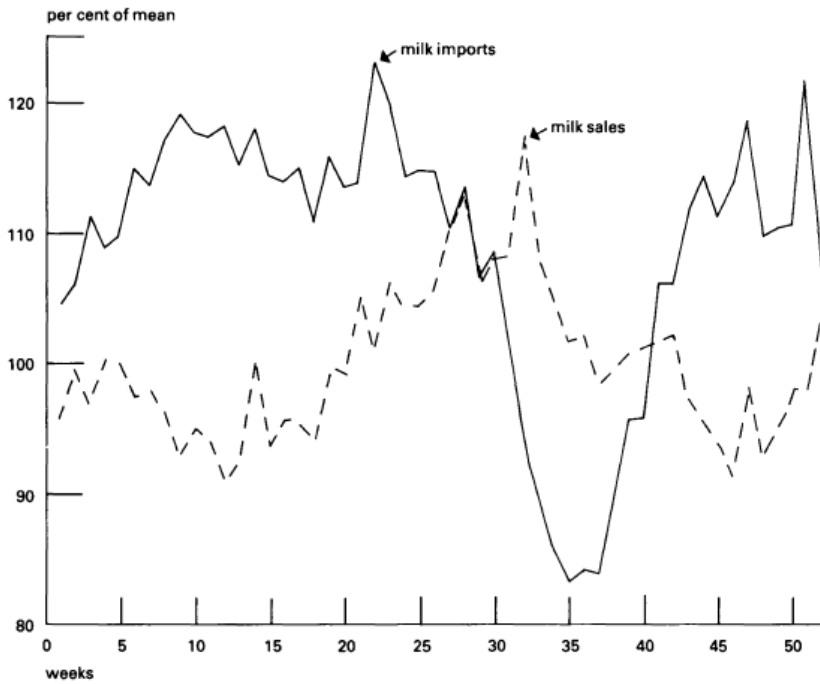


Figure 2. Average weekly variations (around an annual mean of 100) of milk imported into London by the Great Western Railway 1870-4, and the average weekly variations in shop sales of milk 1887-91

Sources: British Transport Commission's Historical Record Office, GW4/33; Records of Rowlings of Lambeth held in the Local History Collection of the Minet Library, Lambeth.

The trade was actually struggling to keep up with the rapid increase in demand in the 1880s and 1890s. The temptation to add water (possibly contaminated) to stretch the supply must have been especially high in August/September when grass-fed cows produce less. Ironically, receipts at Paddington Station (see Figure 2) reached their lowest point at almost the same time as retail sales peaked.

Table 4. Adulteration of milk in London and the provinces

	Samples	Population (million)	Samples per 10,000 people	Adulteration (%)
<i>England and Wales</i>				
1878-81	19,331	26.0	2.5	20.2
1889-91	35,714	29.0	4.1	13.2
1899-1901	71,227	32.5	7.3	10.9
1909-11	145,422	36.1	13.4	10.9
<i>London</i>				
1878-81	5,130	3.8	4.5	24.9
1889-91	9,121	4.2	7.2	22.2
1899-1901	18,660	4.5	13.7	14.9
1909-11	39,529	4.5	29.1	9.8
<i>Provinces</i>				
1878-81	14,201	22.2	2.1	18.5
<i>Counties</i>				
1889-91	9,580	15.0	2.1	11.9
1899-1901	22,851	16.6	4.6	8.8
1909-11	52,066	19.3	9.0	10.2
<i>13 most populated boroughs</i>				
1889-91	11,373	3.8	10.1	8.5
1899-1901	13,098	4.2	10.3	9.9
1909-11	22,393	5.0	14.9	11.2
<i>Other boroughs</i>				
1889-91	5,654	6.0	3.1	10.2
1899-1901	29,716	7.2	13.8	10.0
1909-11	31,535	7.0	15.0	13.3

Source: Local Government Board, *Annual Reports*.

The proportion of samples made the subject of a prosecution slipped from 61 per cent in 1891/2 to only 43 per cent in 1913/14. A decreasing share of these led to a fine being imposed, the average penalty being very small, on average little more than £2.⁴⁸ It seems that the gross fraud of the early period had, by the 1890s, been replaced by a subtler, more insidious adulteration.

One Medical Officer of Health commented in 1908 that

⁴⁸ W. H. Grigg, Chairman of the Sanitary Inspectors Association, complained of 'the ridiculous fines that are imposed for adulteration ... [which] are no deterrent at all to adulterators'. B.P.P., D.C., 1901, *op. cit.*, Q. 6662. A legal case in 1902 set an unfortunate precedent. By forming a company, an adulterator could escape personal liability for payment and imprisonment. By dissolving the company s/he could avoid the fine altogether. Paulus, *op. cit.*, 112.

Table 5. A comparison of milk adulteration in fourteen cities

	1879-81		1889-91		1899-1901		1909-11	
	Samples/ 10,000 popn	adultn (%)	Samples/ 10,000 popn	adultn (%)	Samples/ 10,000 popn	adultn (%)	Samples/ 10,000 popn	adultn (%)
Birmingham	1.7	53.2	4.9	19.1	8.0	20.7	18.2	10.8
Bradford	2.3	13.4	6.1	7.8	6.6	2.7	16.9	4.5
Bristol	9.3	22.4	8.2	8.4	9.5	7.6	18.4	13.6
Hull	-	-	10.0	5.5	6.7	7.7	20.2	10.4
Leeds	1.1	11.0	4.8	8.8	9.6	10.6	10.9	28.8
Leicester	-	-	5.3	11.3	7.2	3.7	6.8	5.9
Liverpool	3.8	17.3	12.6	12.6	13.3	12.1	12.9	15.1
London	4.5	28.8	7.2	22.2	13.7	14.9	29.1	9.8
Manchester	3.0	27.6	24.2	6.6	16.7	2.7	16.7	4.4
Newcastle	-	-	4.0	9.3	2.6	11.5	17.1	10.7
Nottingham	-	-	2.1	15.8	4.9	23.8	11.2	11.9
Portsmouth	-	-	7.0	14.1	5.5	23.0	22.4	7.7
Salford	21.4	23.7	31.9	3.2	14.6	4.8	17.1	4.4
Sheffield	1.3	12.5	1.1	9.5	5.0	16.1	10.5	9.6

Source: Local Government Board, *Annual Reports*.

The amount of detectable adulteration of milk is now less than at any preceding period, but it is very doubtful if adulteration is actually less. At one time it was the custom to add water in considerable quantities, but there is reason to think that the practice has been superseded by adulteration with separated milk which amounts to the same thing as depriving the milk of its fat or cream.⁴⁹

Dealers knew that blatant misdemeanours would be punished but that they stood a good chance of escaping with a conditional discharge or nominal fine if they scientifically ‘toned’ whole milk with skim milk or condensed milk.⁵⁰ This was hard to detect and few magistrates were willing to convict when there was reasonable doubt.⁵¹

There was surprisingly little difference between the provincial urban (borough) and rural (county) experiences (Table 4). Neither managed to reduce their adulteration rates by much from 1885-91 to 1909-11, whereas London progressed significantly. Some towns were more successful than others, Salford being the prime example of close supervision suppressing fraud (Table 5), but there seems to have been no clear correlation with the type or size of city.⁵² The independence of action so jealously guarded by Victorian local politicians and administrators resulted in an almost anarchic complexity of legislative implementation for social betterment. In effect, local whim and political context were at least as important as the ‘diffusion’ of pangs of social conscience through space or down the urban hierarchy.

There were three clear patterns by the end of the century (Figure 3). There was a high incidence of adulteration in an axis of counties running from the south coast, through London to East Anglia, and in another cluster including most, but not all, counties in Wales, the border and south-west England. The north of

⁴⁹ Medical Officer of Health to the Borough of Islington, *Annual Report* (1908).

⁵⁰ B.P.P., D.C., 1901, *op. cit.*, Q. 586.

⁵¹ Many magistrates were unwilling to convict their status equals, and others simply refused to accept the spirit of the anti-adulteration legislation by adopting their own informal standards for milk composition. The lenience and inconsistency of magistrates was a major factor in the persistence of food fraud. Paulus, *op. cit.*, 108-10, 124.

⁵² B.P.P., S.C., 1894, *op. cit.*, Q. 78.

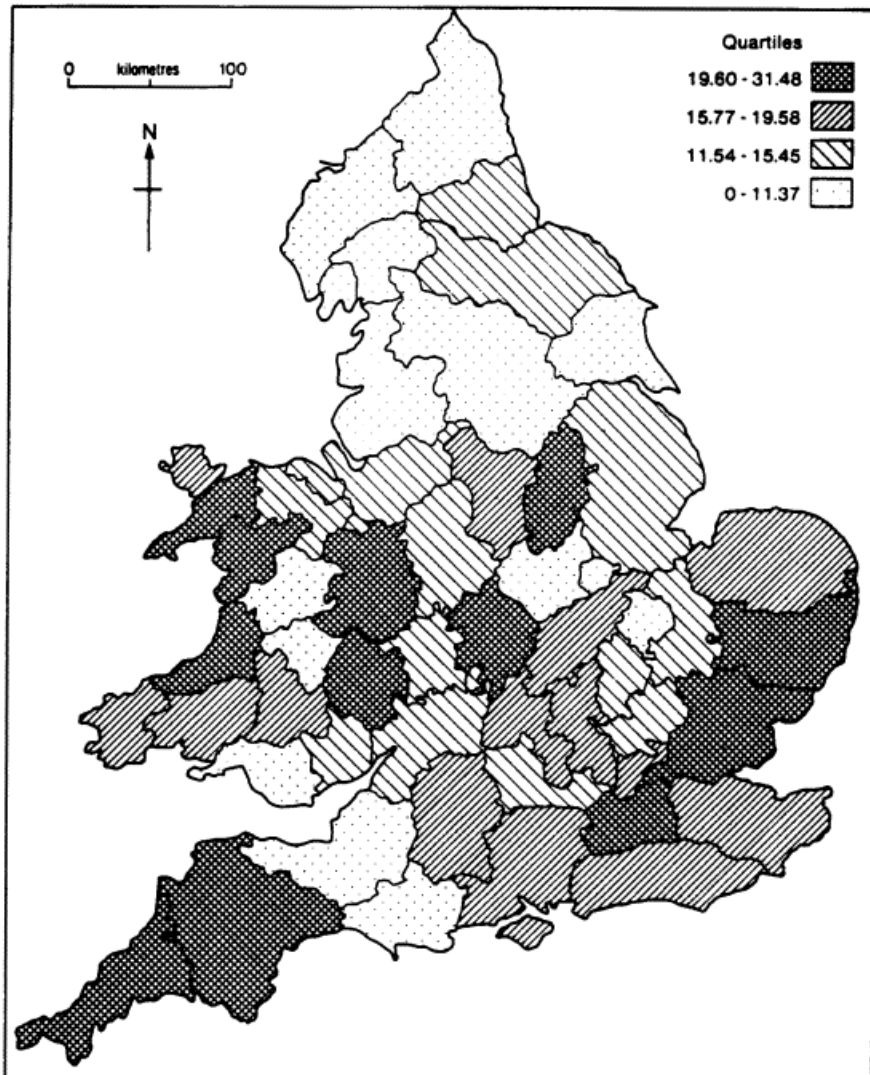


Figure 3. Regional variations in milk adulteration (per cent added water) in England and Wales, 1877-94

Source: Local Government Board, *Annual Reports*.

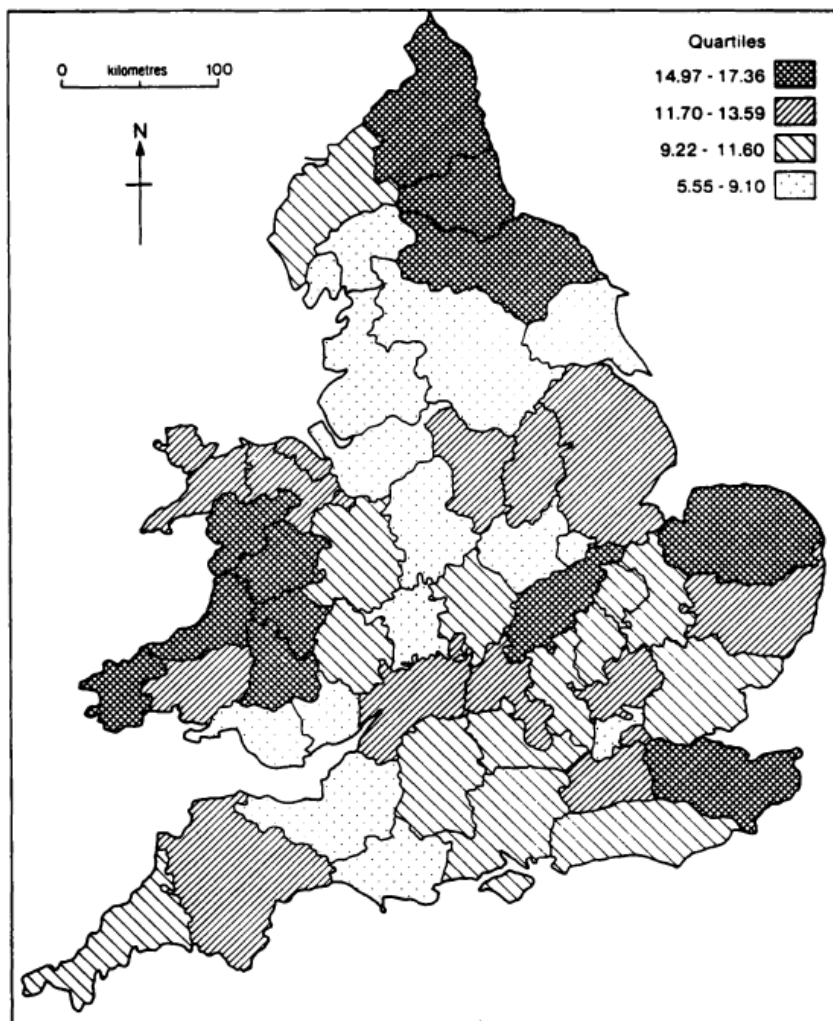


Figure 4. Regional variations in milk adulteration (per cent added water) in England and Wales, 1895-1913

Source: Local Government Board, *Annual Reports*.

England, by contrast, experienced less of a problem. In the later period, 1895-1913, there are similarities such as the top quartile position of Wales, London and some parts of the south-east and east, and the continued bottom quartile position of Lancashire, Cumbria and much of Yorkshire, but also significant changes including the adulteration cluster in the north-east (Figure 4). Variables such as the local dairy economy and the incidence of urbanization and industrialization might be expected to have had an effect but, in the absence of a multivariate statistical analysis, no firm conclusions can be drawn.

Table 6. *St Pancras and Lambeth: the type and amount of milk adulteration*

	<i>St Pancras</i>				<i>Lambeth</i>			
	<i>Samples</i>	<i>Adultn (%)</i>	<i>Average dilution (%)</i>	<i>Average fat abstraction (%)</i>	<i>Samples</i>	<i>Adultn (%)</i>	<i>Average dilution (%)</i>	<i>Average fat abstraction (%)</i>
1879	93	35.5	—	—	—	—	—	—
1880	—	—	—	—	197	8.1	—	—
1881	87	39.1	—	—	143	9.1	—	—
.								
1890	103	38.8	13.7	37.5	—	—	—	—
1891	171	40.4	12.9	26.7	—	—	—	—
1892	100	42.0	13.5	—	—	—	—	—
1893	112	46.4	—	—	—	—	18.7	39.9
1894	93	43.0	—	—	233	27.0	15.4	54.0
1895	104	30.8	13.3	31.3	249	20.5	14.4	45.8
1896	106	39.6	12.4	24.0	204	11.3	—	—
1897	112	30.4	12.0	17.5	209	10.1	10.0	44.0
1898	138	32.6	11.6	18.5	235	13.6	12.8	22.1
1899	188	34.0	14.8	16.1	203	10.8	11.5	17.3
1900	237	26.1	14.1	24.5	238	14.3	10.0	18.6
1901	234	31.6	13.7	14.7	285	17.5	11.4	18.5
1902	262	32.1	11.9	13.5	310	7.7	13.5	16.9
1903	257	30.7	15.8	16.5	494	10.3	—	—
1904	380	25.3	13.3	14.9	515	11.1	7.4	16.8
1905	399	18.3	12.8	17.0	716	6.8	12.8	15.2
1906	408	25.0	14.9	16.2	962	6.6	4.7	15.8
1907	400	20.5	7.8	14.3	832	12.0	8.2	16.2
1908	414	21.0	10.8	11.0	838	9.3	7.5	11.2
1909	401	13.7	16.1	13.1	741	8.6	8.0	8.3
1910	397	13.3	10.1	20.0	661	7.6	10.2	9.8
1911	426	12.4	12.8	17.2	743	11.4	9.3	8.7
1912	388	10.0	9.5	12.4	733	12.0	7.5	12.6
1913	396	11.4	11.8	11.1	492	10.2	10.2	9.7

Sources: Medical Officers of Health to the Vestries and Metropolitan Boroughs of St Pancras and Lambeth, *Annual Reports*; Local Government Board, *Annual Reports*.

For London itself, we are fortunate to have the analytical records of two boroughs, as published in the annual reports of their Medical Officers of Health. In both St Pancras and Lambeth in the twenty-year period before the First World War there was a substantial increase in the number of samples of milk taken, with a corresponding drop in the proportion adulterated (Table 6). From about the mid-1880s, while cream abstraction declined, there was very little change in the amount of added water in each adulterated sample. This bears out the point made about gross fraud giving way to careful ‘toning’. At the same time there appear to be marked variations in the incidence of adulteration in London. While its high incidence in the East End and the inner city might be expected, since exploitation of the poor here was an entrenched feature of everyday life, a similar level in Kensington and St George, Hanover Square was not anticipated.⁵³

SOUR MILK AND PRESERVATIVES

In the second half of the nineteenth century the deterioration of milk must have been common during its long rail journeys to London, especially in hot summer weather, and the milk trade was hard put to find a solution.⁵⁴ The Lawrence refrigerator was pressed into service from

⁵³ B.P.P., D.C., 1902, *op. cit.*, Q.5490.

⁵⁴ P. J. Atkins, ‘The growth of London's railway milk trade, c. 1845-1914’, *Journal of Transport History*, new series, IV (1978), 208-26.

the brewing industry in 1872, but it merely cooled the milk to 50-60° F before despatch.⁵⁵ For the train journey and period of marketing, the addition of chemicals became common to slow down the process of decomposition. These did not kill harmful bacteria but merely persuaded people, falsely, that the milk they were buying was reasonably fresh. Four-day-old milk with an overdose of chemicals was hardly the ideal infant food.⁵⁶ Many contemporaries were convinced that preservatives, added in double dose in the hot summer months, exacerbated the problem of infantile diarrhoea.⁵⁷

Additives were common in the milk trade from an early date. These ranged from simple, domestic substances, such as sugar to make watered milk palatable and increase its specific gravity, to sodium carbonate to neutralize the lactic acid in the souring process. Fulwood's patent 'Antiseptic' was the market leader in the 1870s, but dairymen seem to have been experimenting widely, with compounds based on borax and/or boric acid gaining many adherents. A British patent for a boracic milk preservative had been taken out in 1869, but it took several years to make an impact. In 1876 'E. K.', or 'Kimberley's Food Preservative', was advertised in *The Dairyman* on free trial.⁵⁸ By mid-1877 it had 'found its way into some of our largest dairies, where [it was] in constant use, more or less throughout the year'.⁵⁹ The year 1876 also saw the launch of another borax product 'Glacialine' which, along with its rivals 'Preservitas' and 'Arcticanus', was to hold a large portion of the dairy preservatives market for the next thirty years.⁶⁰

Other chemicals were also used. In 1871 Wanklyn had prepared a solution of two parts glycerine to one hundred of milk and in 1878 Burgoyne, Burbidge & Co. marketed salicylic acid.⁶¹ The latter was especially effective but proved uncompetitively expensive by comparison with borax. From the mid-1890s formalin was tried, a 40 per cent solution of formaldehyde added at five ounces to a gallon of milk, and found both cheap and efficient.⁶² By 1901 it was beginning to challenge boron-based compounds as the mainstay of the dairy trade: 18 per cent of the dairy farmers and traders replying to a Central Chamber of Agriculture circular in 1901 were by then using formalin.⁶³ It was an easy preservative to apply and could be masked with sodium or potassium nitrite.⁶⁴ Brands included 'Mystin', 'Accoine', 'Lactic Fluid' and 'Steryl'.⁶⁵ Sodium and potassium benzoate, naphthol, sodium

⁵⁵ The Manchester Pure Milk Supply Co. followed the example of the Copenhagen Milk Supply Co. by insisting that its farmers use ice to cool their milk. Ice was delivered to their local station at twelve and sixpence per ton, but the experiment proved expensive and the product reached only the middle class. B.P.P., D.C., 1902, *op. cit.*, Q. 7048. It was not until the Milk and Dairies Order of 1926 that regulations were introduced insisting on the cooling of milk in certain circumstances. C. R. A. Martin, *Practical Food Inspection* (1933), 125-6.

⁵⁶ B.P.P., *Inter-Departmental Committee on Physical Deterioration*, 1904 (Cd 2644), xxxix, Evidence, Q. 1267.

⁵⁷ B.P.P., D.C., 1902, *op. cit.*, Qs. 1436, 2374, 5009-10, 5465, 6787.

⁵⁸ *The Dairyman*, iv (1876). Kimberley's Food Preservative in 1876 cost three guineas for a twelve pound jar, reduced in 1877 to thirty-three shillings for seven pounds or two shillings for a gallon of fluid.

⁵⁹ *The Dairyman*, II, 4 (1871), 56.

⁶⁰ Glacialine was marketed by the Antitropic Co. of Stamford Street, London S.E.

⁶¹ Patent no. 1861, 1871.

⁶² A. E. Annett, 'Boric acid and formalin as milk preservatives', *The Lancet* (11 November 1899), 1282-5. Fifteen thousand gallons of formalin were sold to milk vendors in 1894. A. C. Houston, Report on the Bacteriological Examination of Milk (1905), 9.

⁶³ B.P.P., D.C., 1901, *op. cit.*, Qs. 2383, 3931.

⁶⁴ Filby, *op. cit.*, 200.

⁶⁵ W. G. Savage, *Milk and the Public Health* (1912), 387; Blyth, *op. cit.*, 250. 'Mystin' was a cocktail of 0.30 per cent formaldehyde, peppermint essence to hide the smell, and 9.85 per cent sodium nitrite to render ineffective the Hehner Test. 'Accoine' contained 13.97 per cent sodium benzoate. G. W. Monier-Williams, 'On analyses and methods of detection of certain proprietary substances sold as preservatives for milk, cream, etc.', *Reports to the Local Government Board on Public Health and Medical Subjects*, New Series, LX (1912), 1-2.

sulphite, potassium metabisulphite, potassium hydrogen fluoride and hydrogen peroxide were also tried.⁶⁶ The last of these was especially dangerous because of residual arsenic and other impurities.⁶⁷

The extent of chemical use is not easy to quantify. In 1886 the Metropolitan Dairyman's Directory listed the names of five manufacturers in London, but we have no idea of their output. Over 40 per cent of the samples examined by E. G. Clayton from 1893 to 1898 contained some boric acid, as did 27 per cent of the milk analysed in Islington in 1899.⁶⁸ In evidence to the Departmental Committee investigating the use of preservatives in food, Mr L. Bosely, the Aylesbury Dairy Co.'s chemist, estimated that about half of London dairymen used one or more compounds, and claimed that 'the milk trade as it is at present ... cannot be carried on without the use of preservatives'.⁶⁹ These were even more important in cream and butter marketing.

Advertisements in the trade press of the day show the wide range of preparations which were available. Wallace counted twenty-one brands in four dairy papers and in 1901 the Central Chamber of Agriculture prepared a list of eighteen.⁷⁰ Manufacturers' instructions were given for their use but many dairymen were involved in the marketing chain and it is possible that preservatives may have been added more than once. The Departmental Committee found one example of eighty grains of boric acid in a pint of milk, against a normal dose of four to five grains.⁷¹ Chemical preservatives, although they inhibited the visible souring of milk, killed microbes only selectively and therefore may have lulled the unsuspecting consumer into a false sense of security.⁷²

The Aylesbury Dairy Co. stipulated in its contracts that no preservatives were to be used, but Welford's, another prestigious London company, implied their own guilt by refusing to give evidence to the 1901 enquiry. The smaller dairymen were not fully in control of the condition of the milk sent to them and were in a difficult situation. Their consigning producer might have been on a branch line with an inconvenient train timetable and therefore mixed the cows' morning and evening 'meals'.⁷³ Inappropriate rolling stock did not help.⁷⁴ Milk might

⁶⁶ Savage, *op. cit.*, 390-1; H. D. Richmond, *Dairy Chemistry*, 3rd edn (1920), 403. 'Budeised milk' was heated to 122° F and pure hydrogen peroxide added at 3 per cent. The mixture was stirred for 15-30 minutes, put into stoppered bottles, heated again in a water bath for 2-3 hours at 122°, and then cooled. The treated milk had a bitter taste. Savage, *op. cit.*, 390.

⁶⁷ Formalin and boric acid are highly toxic, even in small amounts. W. D. Halliburton, 'The use of borax and formaldehyde as preservatives in food', *British Medical Journal* (7 July 1900), 1-2; S. Delepine, 'Some of the dangers of boracic acid and formaldehyde as food preservatives', *Transactions of the Epidemiological Society of London*, new series, xxii (1902/3), 56; M. M. Kaplan et al., 'Diseases transmitted through milk', in M. Abdussalam et al., 'Milk hygiene: hygiene in milk production, processing and distribution', *World Health Organization Monograph Series*, XLVIII (1962), 61.

⁶⁸ E. G. Clayton, *Report of the Medical Officer of Health to the Islington Vestry* (1899).

⁶⁹ B.P.P., D.C., 1902, *op. cit.*, Q. 3928.

⁷⁰ R. H. Wallace, *The Adulteration of Dairy Produce* (Edinburgh, 1898), 79; B.P.P., D.C., 1902, *op. cit.*, Q. 4458.

⁷¹ B.P.P., D.C., 1902, *op. cit.*, Qs. 3439-40. The presumptive limits in the Local Government Board's 1906 circular were 1:40,000 of formalin, 1:100,000 of formaldehyde, and 1:1,750 of boric acid (40 grains/gallon). Trade practice had varied between 1:625 and 1:7,300 for boric compounds and 1:32,000 and 1:82,000 for formaldehyde. A. G. R. Foulerton, 'The influence on health of chemical preservatives in food', *The Lancet* (25 November 1899), 1427; S. Rideal and A. G. R. Foulerton, 'On the use of boric acid and formic aldehyde as milk preservatives', *Public Health*, xi (1899), 9; Savage, *op. cit.*, 319-20, 386-7.

⁷² A. H. Hill, 'Antiseptics in food', *Public Health*, xi (1899), 527-38.

⁷³ B.P.P., D.C., 1902, *op. cit.*, Q. 3948.

⁷⁴ Atkins, *op. cit.*, 211.

take a day or more to reach the city and in hot weather this inevitably led to deterioration without some form of intervention. Neither cooling nor heat treatment were yet common, and the use of chemicals was a cheap and essential part of the system. In Professor Blyth's view:

In the height of summer I should imagine that quite a third of the milk supply would be spoilt before it reached the metropolis, unless some preservative was used.⁷⁵

Provincial cities which drew their milk from town cowhouses or from their nearby hinterland seem to have had less of a problem keeping their milk fresh. In Liverpool only 2 per cent of samples contained chemicals, and in Birmingham 9 per cent.⁷⁶ Leeds, on the other hand, suffered a 51 per cent rate of additives.⁷⁷

On Sundays, when there were fewer deliveries, preservatives were used to prevent losses.⁷⁸ Their use was also common when whole milk was set for the cream to rise, a process taking anything up to twenty-four hours.⁷⁹ The skimmed milk was then sold cheaply in poor districts, where yet more chemical treatment was likely in those small general shops without ice-cooling facilities.⁸⁰

Chemical addition did not become a major issue until the 1880s and even then the chief concern was that it constituted a form of cheating, rather than any worry about toxicity.⁸¹ The Select Committee of 1896 and the Departmental Committee of 1901 recommended that both milk colours and preservatives should be banned, but this was not honoured until the Public Health (Milk and Cream) Regulations of 1912. In the interim action was taken under section 6 of the Food and Drugs Act (1875) which forbade the sale 'to the prejudice of the purchaser of any article ... which is not of the nature, substance, and quality ... demanded'.⁸²

CONCLUSION

The adulteration of milk proved very difficult to curb. The first stage of the campaign, lasting from 1820 to 1856, was to convince the public and legislature that a serious problem existed. In the years 1856-79 there was political activity on the one hand to promulgate laws to prevent fraud and on the other to smother their effectiveness. After about 1880 there was growing concern and acceptance of the need for action which resulted in an uneasy truce between trade and enforcement agencies. For milk the situation was not helped by scientific disagreements about the composition of the pure article. This led to public confusion and a

⁷⁵ B.P.P., D.C., 1902, *op. cit.*, Q. 3447.

⁷⁶ *ibid.*, Q. 2332. Another report suggested the problem in Birmingham was more serious, with 18.2 per cent of milk containing preservatives. J. Thresh and A. E. Porter, *Preservatives in Food and Food Examination* (1906), 99.

⁷⁷ B.P.P., D.C., 1902, *op. cit.*, Q. 2528.

⁷⁸ Watering was supposedly also common on Sundays. In Liverpool the weekday rate of adulteration was 13 per cent, but 30 per cent on Sundays. Local Government Board, *Annual Report* (1893-4). In Finsbury the corresponding figures were 11.5 per cent and 19.2 per cent. Local Government Board, *Annual Report* (1906-7). In Islington, however, the evidence is less clear. In the period 1896-1920 the analysis of 13,900 samples revealed an average weekday adulteration of 12.0 per cent, compared with 12.3 per cent on Sundays, and only 3.2 per cent at railway stations. Medical Officer of Health to the Borough of Islington, *Annual Reports*.

⁷⁹ In 1899 only 0.5 per cent of Liverpool's whole milk contained preservatives, but 5.4 per cent of the skimmed and 15.4 per cent of the mechanically separated milk. B.P.P., D.C., 1902, *op. cit.*

⁸⁰ B.P.P., D.C., 1902, *op. cit.*, Q. 4058.

⁸¹ Anon., 'The Lancet Special Sanitary Commission on the Use of Antiseptics in Food', *The Lancet* (2 February 1897), 56-60.

⁸² Local Government Board Circular (July 1906).

legal loophole which was exploited by the 'toners' even after legal standards were adopted in 1901.

The law was unable to shame the small dairyman into changing the habits of a lifetime. Fines were pitifully inadequate and the mild actions of magistrates sent altogether the wrong message. The larger companies, which expanded towards the end of the nineteenth century, were more jealous of their reputations and were certainly instrumental in enforcing higher standards of behaviour by their suppliers. However, even they were constrained by the structure of a trade which needed chemical additives to keep its product 'fresh' at certain times of the year. The ethics of dairy traders were, of course, relative to those of the rest of society and changed accordingly, but they were also situational in as much as liquid milk was an unusually perishable commodity demanded on a daily basis. The significance of this discussion relates to the role of the state in enforcing the mores of an evolving social conscience, as mediated through struggles first, between vested interests in the status quo and their protagonists, the environmental and moral reformers, and, second, between central authority and the secondary line of enforcement in the shape of local government and the magistracy. Food adulteration in general, and liquid milk in particular, serves well to highlight these issues.

Moreover, we should not neglect the consequences which flowed from adulteration. Not only were the consumers defrauded, but also their health was threatened by the additives used. Quite apart from potential toxicosis from chemical preservatives, the water so frequently introduced was often contaminated and exacerbated a general lack of cleanliness in the milking and handling processes. Cows' milk was indeed a dangerous commodity to consume in the nineteenth century.⁸³

⁸³ The health implications of this are explored in P. J. Atkins, 'White poison?: The social consequences of milk consumption in London, 1850-1939', *Social History of Medicine* (forthcoming, 1991).