

CONTROL OF FOOD QUALITY AND FOOD ANALYSIS

Edited by
G. G. BIRCH
and
K. J. PARKER

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WITH 49 ILLUSTRATIONS AND 48 TABLES

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Control of Food Quality and Food Analysis or the Pursuit of Excellence

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ABSTRACT

About 100 years ago Ralph Waldo Emerson said: 'If a man write a better book, preach a better sermon or make a better mousetrap than his neighbour, tho' he build his house in the woods, the world will make a beaten path to his door'. This homespun truth illuminated the industrial awakening of the USA and many hold that it also made America the great power which she is today. Yet she also invented the slick salesman, and in turn she was to invent the science of marketing to put an apparently healthy skin on what had sometimes been a rotten peach.

Food quality can be considered from the viewpoint of either of these extremes. Historically, the food industry was a rotten peach as recently as 125 years ago. Starting with the first Food and Drugs Act of 1860, successive governments have tightened the legislative noose, despite cries of strangulation from the industry, to the point at which the victim loves the rope, having learned that when everyone is forced to be good, the whole industry and its customers benefit.

Of course all this is an old story and in the past half-century the industry has become ethical in its approach, fighting the cause of honest food at an honest price. Our hurt when the sins of our debauched forebears are thrown at us for poisoning the public with preservatives and giving them allergies with additives is sincere. To be latter-day saints in the service of the community and to be branded as sinners and money grabbers is hard to take. There are those who have an interest in denigrating the industry by making bombs of half-truths.

Attempts to correct the errors attract the Hamlet reaction: 'The

lady doth protest too much, methinks'. For two days the nuts and bolts of food quality control will be considered by the saints. For one night, the first night, a sinner seeks leave to whisper sweet heresies, if it be heresy to suggest that 40 years of quality control in our industry has given us powerful weapons to counter the bombs of ginning critics.

INTRODUCTION

If we are at our lowest intellectual ebb after supper and before night-caps, it follows that conference organisers, with this evening spot to fill, have the problem of finding a speaker guaranteed to impose no intellectual effort whatsoever on his audience. Having defined the problems thus it was easy to find the right speaker. 'A Professor', wrote the poet W. H. Auden, 'is someone who talks in other people's sleep'. Choose a professor of food science to give an authentic ring to the process, flatter him by describing the slot as a Keynote lecture, and you have the neatest of solutions to an intractable problem.

It was with thoughts such as these that I settled down to the task of preparing this talk. Just over a century ago the American writer and wit Ralph Waldo Emerson gave a lecture in which he is reputed to have said: 'If a man write a better book, preach a better sermon or make a better mousetrap than his neighbour, tho' he build his house in the woods, the world will make a beaten path to his door'. Just a few weeks ago I had a telephone call from a colleague on some technical matter. Now this man, having made several visits to Japan and South East Asia, became interested in the microbiology of soya sauce: so interested that he set a sequence of research students to study the problem. The students were successful, he concluded that the traditional process was very poor, and patented his own scientific technique. With help from others and publicity from local press and television he opened a soya sauce factory which came on stream some months ago. As our telephone call finished I said to him: 'By the way, how goes the factory?'. 'We're making plenty of sauce,' he said, 'but it's not true about the better mousetrap.'

Over the past 20 years I have been involved directly or indirectly with the beginnings of seven small food or food related businesses. The first of these I tried to start myself at the age of 32. I got out without losing any money but I learned a lot that had nothing to do with food science. In the other six cases, which included chocolate

confectionery, food preservation, sterilisable pouches, catering, shellfish farming and a whisky liqueur, I was drawn in to help or give advice. In every case, those who started these companies thought that they could produce a better mousetrap. Of the seven, only one has survived. The others failed each for different reasons. Good technology is not enough. Quality is a complex of concepts. Success depends on the understanding of this.

THE PURSUIT OF EXCELLENCE

At a recent BFMIRA lunch I found myself seated beside a stranger with whom I fell into an instant conversation which turned to early retirement. He told me of an acquaintance of his, the former managing director of a large industrial operation, who, forced into retirement as a result of successive take-overs at the age of 56, gave himself two months to recover from the shock. To pass the time he turned to his boyhood hobby of woodcarving. He carved a horse. When he was done, he looked at the three foot high model and wondered what to do with it. It was then he had his great idea. Suppose he were to mount his fine carving as a hobby-horse, get advice about replica leather reins and saddle and try to sell it. When he had finished it was a splendid thing, correct to the last detail and better far than even the best hobby-horse of his childhood. He was offered a price which totally surprised him. 'Now he regards himself as a truly happy man' said my new acquaintance, 'He has more work to do than he can ever finish, every horse he carves is different; he only works when the mood is on him but he enjoys it so much his production keeps rising; he employs no one; has no union troubles; no factory inspectors; no Safety at Work Act; no Security of Employment Act; and he makes a good living to supplement his already-generous pension. For the first time in his life he feels free, and all because he makes the best hobby-horses in the world.'

'Maybe Emerson was right after all', I began to think. Somewhere between the extremes of scientific soya sauce and hand-carved hobby-horses there seemed to be an elusive truth seeking to be grasped. It was associated somehow with the pursuit of excellence, which after all appears to be our mission when we talk of 'Control of Food Quality and Food Analysis'. Or is it?

In the academic world these days 'excellence' is the fashion word

which is rapidly replacing the vulgarity of Mr Wilson's 'white-hot technology'. It is even near-equal in competition with the term 'biotechnology', a word which had a clear and useful meaning a decade ago and which now has almost as many meanings as users. If you are a scientific civil servant it usually means the definition given in the Spinks Report; if you are a Member of Parliament it means the scientific miracle which will bring the party again into power; and if you are a working scientist it means patches of lush green grass in an arid desert of research grants. If these confusions give rise to sweet verdure in idiosyncratic locations, this is no concern of mine. However, it helps us to define academic centres of excellence as places of lush vegetation. Please hold that thought in your minds, since we must needs return to it. Meantime I want to discuss two medical problems.

GASTRIC CANCER, CEREBRAL HAEMORRHAGE AND FOOD QUALITY

For 30 years or more, cancer of the stomach has been related to nutritional or dietary factors. Between 20 and 30 different hypotheses have been put forward, some positively and some negatively linked to elements in diet. For example, high-starch and low-protein diets, smoked foods, pickled vegetables, the use of dried and salted fish or meat, and diets low in fresh fruit and vegetables have all been held to be contributory factors by various groups of research workers. Equally, high intakes of fresh fruits and vegetables, high intakes of vitamin C, high fat intakes, the use of milk in the diet, and the presence of selenium as a trace element in food have all been held to be protective factors. Yet while the statistics within any one country might tend to support one of these proposals as against another, comparisons of one country with another showed no consistent pattern. For example, smoked food was considered to be a causal factor in gastric cancer in Iceland but this would not apply in Japan where smoking of food is rare. Yet in both countries the incidence of this illness is high. Milk, in many countries has been held to be a protective factor, and the hypothesis looks good until one considers Finland where milk intakes and gastric cancer rates are both high. After years of such studies there has been a distinct tendency to suggest that cancer of the stomach is a multi-factorial illness.

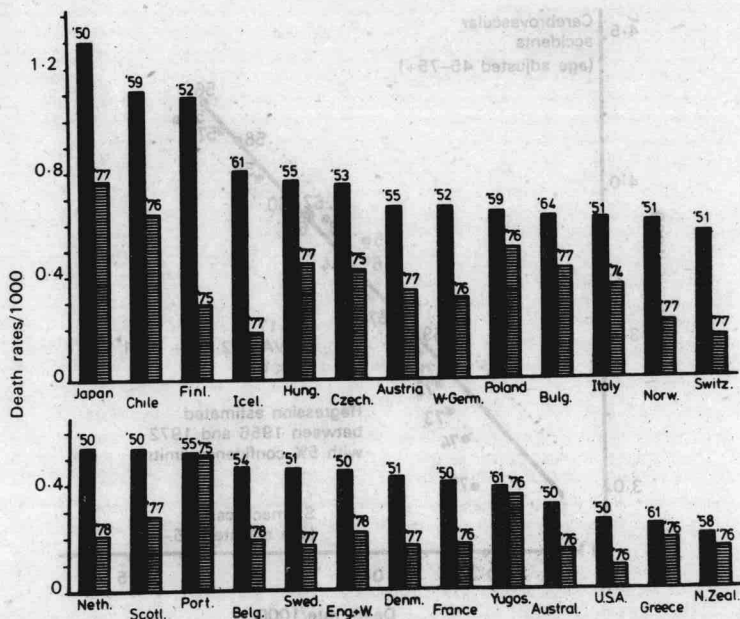


FIG. 1. Time variation and gastric cancer death rates in 26 countries. The numbers at the top of each double column show the first and last available year for the given country.

There is no effective treatment for gastric cancer, and the five-year survival rate after diagnosis is much the same as it was 30 years ago. However, in almost every country studied, the death rate has dropped in recent years (Fig. 1).

Since no effective treatment is available and since the illness is linked with diet, it seems that the falling incidence must be linked to dietary change over the period represented by the figures. Joossens, an epidemiologist working in the public health department of the University of Leuven in Belgium, noticed by chance that there appeared to be a link between cerebrovascular accidents (that is to say, strokes) and gastric cancer. As the years passed, he worked this out in detail for some 12 countries and obtained the results shown in Fig. 2. The link seems so strong and the statistical confidence limits so high that it is reasonable to infer that a common dietary factor is involved in both cases. But the figures start to show a steady but continuing drift from 1972 onwards. Suddenly to Joossens, everything became clear. Salt in diet is known to be a contributory

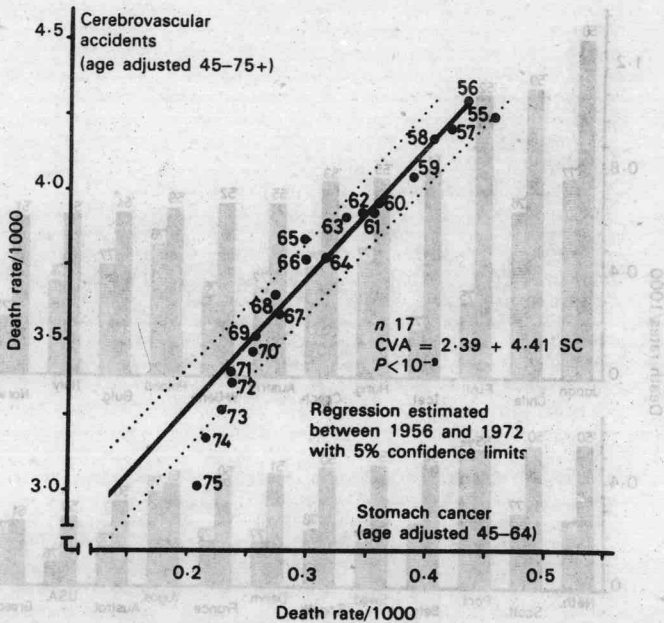


FIG. 2. Gastric cancer and stroke. Each point is the average of 12 countries, between the years 1956 and 1975. (From reference 1.)

factor in essential hypertension, and essential hypertension is the major cause of strokes. But for each country studied, and in any year between the years 1956 and 1975, there was about one death from gastric cancer for every eleven deaths from strokes. And in all 12 countries the incidence of both illnesses was declining. Looking at a broader range of 26 countries there were two in which the decline had been very small, namely Portugal and Yugoslavia. Joossens offers no evidence for Yugoslavia but does show that in Portugal the intake of salt is still very high.

But perhaps his most convincing evidence is from his own country, Belgium. The Belgian Ministry of Health mounted a systematic campaign through the mass media to persuade Belgians to take sensible steps to steadily reduce their salt intakes and the results were monitored between 1966 and 1980 by urine collections from 2493 individuals. From these it can be shown that the campaign led to a drop in average salt intake over the period of just under 40%. Over the same period, the mortality figures for strokes and gastric cancer fell

faster in Belgium than in any other Common Market country. There is nothing so convincing in confirming a hypothesis as experiment.¹

The decline in gastric cancer rates in the USA began as far back as 1930 and perhaps a little earlier. In Japan it did not start until 1960. In Finland the decrease has been dramatic, the mortality in 1975 being rather less than a quarter of that in 1952. In Iceland the figures are even more dramatic. In Sweden, the figures have always been fairly low, but even here, the 1977 figures for mortality are less than half the 1951 figure.

Joossens is quite clear in his conclusions. The incidence of gastric cancer and strokes declines as salt as a preservative is replaced with refrigerated and frozen foods. It is the unique common factor in the dietary patterns of both conditions.¹ He pointed out that the decline in USA began at just about the time that Birdseye introduced the concept of quick freezing, and that the Japanese figures began to decline in 1960 at the commencement of Japan's industrial success. And the argument persists for other countries such as the UK, where the death rates for both these illnesses have more than halved since frozen foods began to become an important item of diet in the early 1950s.

The introduction of frozen foods was a major step forward in improving food quality. But in the decade before it began, other steps had been taken which were also to lead to improvements in food quality.

In the 1920s tuberculosis was the dread in people's minds, and milk was known to carry the organism. In 1929, Dr Norman Wright of the Hannah Institute published figures for the incidence of tuberculosis infection in the milk supplies of Edinburgh, Glasgow and Aberdeen, the percentage of infected samples from each of these cities being 8.5, 2.6 and 5.5. At that time, in the UK, the death rate from tuberculosis was about 2000, with 4000 new cases being reported per annum. Pasteurisation had been developed in the USA by Bitter as early as 1890 as a means of extending the storage life of milk and it was known that, when properly applied, the process destroyed the dangerous tuberculosis bacillus as well as other pathogens likely to find their way into the milk supply. The process involved holding milk at a temperature of between 145 and 150°F for 30 min after which it had to be cooled. In Scotland there was much opposition, vocal but uninformed, it being held that the process in some way damaged the essential goodness of the milk. The Hannah Research Institute saw

the idea of having tuberculin-tested herds as the answer to the problem and in 1929 began an investigation into the feasibility of eradicating the disease in cattle. As a consequence, Ayrshire became the first county in the UK to be free from bovine tuberculosis. The invention of the plate heat exchanger by Richard Seligman in 1923 opened up the possibility of making pasteurisation a semi-continuous or continuous process with heat recovery systems cooling the heated milk with the incoming milk. This greatly reduced fuel costs and made for more compact processing systems better adapted to the needs of large dairy companies. It was soon found that the job could be done better and with less thermal damage to the heat-labile milk constituents by using much higher temperatures with a dwell-time of only a few seconds but the idea, for which the plate heat-exchanger was well suited, was to lie fallow until 1941 when the UK government legislated in favour of high-temperature short-term processes.²

At around the same period, Dr John Boyd Orr (as he then was) published his report *Food, Health and Income*,³ which showed that a substantial section of the UK population were suffering from serious malnutrition as a result of incomes too low to allow them to purchase an adequately balanced diet. It was a follow-up to earlier work by Orr and David Lubbock in which large-scale supplementation of children's diet with school milk led to dramatic improvements in their health. Orr was the son of an Ayrshire family, brought up in the Calvinist tradition of the presbyterian religion. His hatred of needless suffering was kindled by the squalor and misery of the Glasgow slums he encountered during his student days and the tragedy of the lice-ridden, malnourished children he tried to teach when the Glasgow School Board offered him his first job in a slum school. These early experiences launched him from teaching to medicine, then from medicine to nutrition and led, not only to the founding of the Rowett Research Institute, but also to his later advocacy of the cause of the undernourished throughout the world. The Food and Agriculture Organisation of the United Nations was a direct result, its existence proposed and its early structure designed by Orr, and it is by this, his greatest achievement that he will be remembered. But his first major achievement, the Rowett Institute, lives on in Scotland, and continues to influence, not only the prosperity of its farmlands which is its official function, but also the pattern of scientific thought on agriculture, food and nutrition.