The British diet : finding the facts the twenty-third report of the Steering Group on Food Surveillance, the Working Party on Nutrients.

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

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The Working Party on Nutrients

Food Surveillance Paper No. 23

LONDON
HER MAJESTY'S STATIONERY OFFICE
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STEERING GROUP ON FOOD SURVEILLANCE

This report was considered and recommended for publication by the Steering Group on Food Surveillance whose membership was then as follows:

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STEERING GROUP ON FOOD SURVEILLANCE

Terms of Reference

To keep under review the possibilities of contamination of any part of the national food supply, to review where necessary the intake of individual additives and nutrients and to recommend to Ministers responsible for food quality and safety the programme of work necessary to ensure that the food intake of the population is both safe and nutritious. To appoint expert Working Parties, acting according to such instructions as the Steering Group may give, to carry out specialist parts of the programme of work.

To consider reports made by Working Parties and to decide what action, including consultation with the Government's advisory committees and other bodies having an interest in the subject matter or the implications of the reports, should be recommended.

To submit the findings of the Working Party reports, where appropriate, to the Ministers with appropriate recommendations as to publication.

WORKING PARTY ON NUTRIENTS

This report was prepared by the Working Party on Nutrients whose membership was then as follows:

Dr W H B Denner (Chairman)	BSc, PhD	Ministry of Agriculture, Fisheries and Food
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WORKING PARTY ON NUTRIENTS

Terms of Reference

To identify areas in which information on the content and availability of nutrients in foods is required to ensure that the nation's food supplies and diets can be adequately monitored; to review programmes for maintaining *McCance and Widdowson's The Composition of Foods* and the Ministry's nutrient databank; to assess priorities; and to propose means of obtaining the information.

To propose or, when requested, advise on the planning of dietary surveys for the Steering Group on Food Surveillance in order to determine normal and extreme intakes of dietary constituents in groups of the population; and to oversee the Total Diet Study.

To advise other committees and Departments as appropriate.

CONTENTS

	Paras.	Page
INTRODUCTION	1–9	1
BACKGROUND	10–24	2
Food Composition	10–14	2
Dietary Studies	15–24	3
The nation's food supplies	17–18	4
The National Food Survey	19–20	5
The Total Diet Study	21–23	5
Special studies	24	6
RECENT AND CURRENT PROGRAMME OF WORK	25–53	6
Food Composition	25–39	6
Effects of methods of analysis	32–34	8
Continuous programme of nutrient analysis	35–36	10
National nutrient databank	37–39	11
Dietary Studies	40–53	11
Duplicate diet studies	42	12
Recall methods	43–44	12
Record keeping	45–46	12
Evaluation of dietary studies	47	13
Recent dietary studies	48	13
Dietary study of adults	49–52	15
Other recent studies	53	15
FUTURE PRIORITIES	54–65	15
Criteria for Setting Priorities	55	17
Food Composition	56–63	18
Nutritive values of food	56	18
Nutritional effects of food irradiation	57	18
Effects of new domestic practices	58	18
Catering	59	18
Methods of analysis	61	19
Bioavailability	62–63	20
Future Dietary Studies	64–65	20
CONCLUSIONS AND SUMMARY OF RECOMMENDATIONS	66	21
REFERENCES	–	23

		Paras.	Page
APPENDICES			
Appendix I	Committee structure of the Steering Group and its relation to other committees	–	27
Appendix II	National food supplies — methodology	–	28
Appendix III	The National Food Survey	–	29
Appendix IV	The Total Diet Study	–	30
Appendix V	Extract from the report on nutritional aspects of irradiated foods by the COMA Panel on Novel Foods	–	36

INTRODUCTION

1. The Ministry of Agriculture, Fisheries and Food (MAFF) aims to ensure that an adequate, safe and varied food supply is available at all times from which consumers can choose, with confidence, a healthy and enjoyable diet. To help achieve this aim, there is within the UK Government an extensive advisory system on all aspects of food safety and quality, including nutrients, additives, contaminants, packaging, labelling and composition (Appendix I). The Steering Group on Food Surveillance plays a key role in ensuring that up-to-date information is available on the concentration of various substances, including nutrients, in the food we eat and that appropriate analytical methodology is developed where this is necessary. The terms of reference of the Steering Group are set out on page (iv).

2. MAFF has always been actively involved with nutrition. From 1965 the nutrient composition of the UK food supply was kept under surveillance by the Committee on Food Composition. In 1977 this became the Committee on the Composition of Food and Food Products. The terms of reference of the latter were 'to identify areas in which information on the nutrient content of food is insufficient for monitoring the national diet adequately, to assess priorities and to arrange for that information to be obtained'. In practice much of its work was carried out through its Sub-group on Food Composition Tables. This committee and sub-group have now been replaced by the Working Party on Nutrients, which was formed in 1984, under the auspices of the Steering Group on Food Surveillance. The Working Party's terms of reference (page vi) were extended to include advising on dietary surveys and overseeing the Total Diet Study as well as continuing the work on food composition.

3. Reliable and up-to-date information on the amounts and types of foods eaten and on the nutrients provided by foods is needed by Government for a number of reasons:

(i) To measure and predict changes in food consumption patterns as they may be influenced by economic, technological or other developments, as an aid to development of effective food, agriculture, social and health policies.

(ii) To measure the effectiveness of these policies and to enable identification of ways in which they may, if necessary, be improved. Recent examples include use by the DHSS's Committee on Medical Aspects of Food Policy for comparing nutrient intake and susceptibility to cardiovascular disease[1] and for assessing the nutrient intakes of school children and the contribution of school meals to their diets[2].

(iii) To assess the nutritional consequences of actual or potential emergencies so that appropriate action can be taken.

(iv) To identify the size and nature of any population who may be at risk because of an inadequate or excessive intake of a nutrient or other food constituent.

(v) To identify foods that are the main contributors of nutrients in the diet for various groups.
(vi) To determine the nutritional consequences of changes in agricultural, food industry, catering or domestic practices.
(vii) To assist with planning diets for closed communities such as hospitals, the armed forces or prisons.

4. The Working Party on Nutrients and its predecessors have generated information which is published both in the scientific literature and in the form of books and reports so that those needing the information may have ready access to it. The information is relevant to a wide range of users.

5. Dietitians and clinicians form the largest group of users of food composition data. The data are used in prescribing diets as an essential part of the management of certain disease states. The data are also widely used by research workers involved in dietary studies and are vital to any assessment of the relationship between diet and disease.

6. Information on the composition of foods is also used by workers in nutrition education. The general public are becoming increasingly interested in the relationship between diet and health and in the nutrient content of the foods they buy. The reliable up-to-date information generated as part of the Working Party's analytical programme will continue to provide valuable information to both the nutrition educators and consumers.

7. Dietary surveys are also useful to nutrition educators, who need information on the main sources of nutrients in the average diet as well as in the diets of specific target groups such as children, teenagers, pregnant women and immigrants. Surveys which identify factors conducive to having poor diets also help nutrition educators in the formulation of appropriate advice.

8. The food industry are further users of the data. Their primary use of the data is in assessing the nutritional value of product formulations. With the growing interest in nutrition labelling, use by food manufacturers and by retailers may increase. The UK data are also used very widely internationally because of the quality and scope of the information.

9. In view of the current level of interest in nutrition, the Steering Group requested this general review of the work that has been carried out by the Working Party on Nutrients, and its proposed future programme of work.

BACKGROUND

Food Composition

10. The Government has for a long time been involved in collecting information on the nutrients in foods. Indeed the first authoritative series of analyses

on the energy content of common UK foodstuffs was initiated by the War Office during the first World War[3].

11. It was in the 1920's that Professor McCance started his research on the composition of UK foods. He was joined in the 1930's by Dr Widdowson. New knowledge of diabetes and its treatment created a need to measure the nutrient intake of individuals and to prescribe special diets. For this purpose reliable 'food tables' were essential.

12. The first collected edition of their work, *The Chemical Composition of Foods*[4], in 1940 led the world in that it included cooked dishes and analytical values for a wide range of minerals, for sugars, starch and unavailable carbohydrates (now known as dietary fibre) as well as protein, fat and energy. The work was expanded in a second edition which included wartime foods[5] and subsequently underwent a major revision[6] in 1960. This both extended the range of foods covered and for the first time included values for individual vitamins and the amino acid composition of foods.

13. In 1965 an interdepartmental Committee on Food Composition was set up to co-ordinate Government analyses of the nutrient composition of foods. By 1969 it was apparent that so many new and changed foods had become available that a major analytical programme was needed. This Committee therefore accepted the responsibility for revising the 3rd edition of *The Composition of Foods*[6]. A Steering Committee, which later became the Sub-group on Food Composition Tables, was appointed to advise those responsible for the revision. The new (fourth) edition entitled *McCance and Widdowson's The Composition of Foods* was published[7] in 1978. It included more foods and more nutrients such as fatty acids, cholesterol and zinc. The work documented the sources of the data and the associated analytical methods – information which is now considered essential for the appropriate use of nutritional data. The material was also made available in computer readable form and now provides the basis for a number of computerised nutrient databases for UK foods.

14. In 1978 MAFF accepted full responsibility for revising and extending *McCance and Widdowson's The Composition of Foods*. Two supplements, one expanding the values for the amino acid and fatty acid composition of foods and one giving nutrient information on immigrant foods have since been published[8,9].

Dietary Studies

15. Dietary studies are made by Government and by others to provide information about intakes of foods and hence of nutrients either in the diet of the nation as a whole or in particular sections of the population. In recent years there have been many changes in lifestyle such as increased home freezer and microwave use, increased numbers of working women and of unemployed and

single parent households and more foreign travel. A much wider variety of fresh and manufactured foods is now available and new food technologies are in use. As a result, the pattern of food consumption has changed (Table 1). Some of these changes may lead to improvements in diet; others may result in less varied eating patterns and lower intake of individual nutrients. Consequently, there is a continuing need to monitor the diet.

Table 1: Household consumption of selected foods, 1975–1985 (grams per person per week except where otherwise stated).[10]

	1975	1980	1985
Liquid whole milk (litres)	2.70	2.36	1.89
Liquid skimmed milks (litres)	—	—	0.24
Carcase meat	434	475	375
Other meat and meat products	619	664	668
Eggs (no.)	4.14	3.69	3.15
Butter	160	115	80
Margarine	74	109	107
Fresh potatoes	1,245	1,161	1,161
Fresh vegetables	719	801	722
Processed vegetables	417	459	524
Fruit juice (ml)	38	87	148
White bread, standard loaves	785	620	549
Wholemeal bread	20	44	102
Breakfast cereals	86	99	114

16. Surveys can be performed at three different levels which give information on (i) the nation's food supply, (ii) household food purchases, and (iii) details of individuals' diets. These are outlined in paragraphs 17–24.

The nation's food supplies

17. The Ministry's statistical series of food and drink supplies available for human consumption represents the annual national average supplies of food and nutrients moving into the distribution chain and thus potentially available for consumption by the UK population. Statistics on agricultural production in this country, and on imports and exports of food had been available for many years, but the first official statistics on the supplies of foods as such[11] began in 1943. Food composition values are applied to the supply data to calculate the amount of nutrients available per head of the population in the UK. Further details are given in Appendix II. The results were initially used as a guide in the allocation of wartime food supplies but later were recognised as a useful source of information for forecasting future demand for food. The most recently published results[12] are for 1986.

18. Similar series now exist for other countries (e.g. the FAO *Food Balance Sheets*[13]) and in many countries these provide the only means of dietary quantification. Although national food supplies do not represent what is actually

eaten, it is at this level that most international comparisons of diet (e.g. in relation to health) are made because so few comparable data exist at other levels.

The National Food Survey (NFS)

19. The NFS was started by the Ministry of Food in 1940 to assist Government when considering the measures necessary to mitigate the effects of wartime food shortages. Originally the survey covered only urban working-class households, because they were considered at greatest risk of food shortages, but after 1950 it became a truly national study.

20. The continuous NFS is one of the most comprehensive surveys of food purchases available anywhere in the world. Data are collected each year on domestic supplies of food in a representative sample of about 7,000 households throughout Britain (see Appendix III). Food composition data are applied to the information on the types and quantities of foods in order to produce data on average intakes of nutrients. Results are published not only for the national average household diet but also for households in different regions, income groups, of different household composition and according to other socio-economic descriptors. The most recently published annual report[14] is for 1986. Less detailed quarterly results are available more rapidly[15], the most recent being for the 4th quarter of 1987. A detailed analysis of the uses of this survey in nutritional epidemiology has been published[16].

The Total Diet Study

21. The Working Party is charged with overseeing MAFF's 'Total Diet Study'. The purpose of the study is to provide, as far as possible, estimates of the *average* intake of any food constituent of current concern in Britain. It began in the early 1960's when there was worldwide concern about the traces of pesticides that might remain in foods when they reached the consumer. It soon became necessary to supplement the data on selected foods (such as those that were important to vulnerable groups of the population) with estimates of the average or background exposure in the population as a whole[17].

22. The types and quantities of foods that make up this average British 'Total Diet' are largely based on those recorded in the National Food Survey and are outlined in Appendix IV, together with details of the study methodology. The major items in the national diet (119 categories of food) are combined into 20 groups of similar foods for analysis. Foods are grouped so that commodities known to be susceptible to contamination are kept separate as are commodities which are consumed in large quantities such as bread, potatoes, carcase meat and milk. Grouping foods in this way ensures that analysis of a comparatively small number of samples (and hence at a relatively low cost) gives a reliable estimate of average exposure. The Total Diet Study not only provides a cost effective means of monitoring the whole diet but also identifies which foods

or groups of foods are the major source of particular food constituents for subsequent study. This feature is especially useful in the study of food contaminants.

23. The continuous nature of this study allows trends over time to be established. Similar studies, e.g. the American 'Market Basket' surveys now exist in a number of countries around the world and, as in Britain, many have been expanded to monitor a wide range of other contaminants such as heavy metals. Total diet studies have also been applied to the measurement of nutrients, including selenium, manganese, iodine and fatty acids.

Special studies

24. The National Food Survey provides valuable information on the amount of food obtained by different categories of private households and trends in consumption. But the nature of the survey is such that it cannot provide information on the foods actually eaten by different individuals within households or by certain closely defined population groups such as pregnant women. Furthermore, the NFS does not include details of the types and quantities of foods eaten away from home or take account of different food preparation practices. Special studies are therefore undertaken by a number of Government departments including MAFF and DHSS, and the results are published. Those completed so far include studies on children, the elderly, and people in the Orkney Islands[2,18–21]. Information is needed on both average and extreme food consumption patterns to identify and anticipate inadequate or inappropriate food and nutrient intakes for the purposes of policy discussion and formulation.

RECENT AND CURRENT PROGRAMME OF WORK

Food Composition

25. Although information on the nutritional value of a wide range of foods available in the UK already exists in *McCance and Widdowson's The Composition of Foods*[7] it needs to be regularly updated because foods themselves are changing. Not only are new products constantly being developed and old ones being reformulated, but apparently traditional foods also change. Their composition may be influenced by a number of factors. For example, changes in breeds of animals, and in husbandry and butchering techniques, may result in changes in meat composition. Thus pig carcases have become considerably leaner over the last decade as a result of breeding, feeding and changes in age at slaughter (Table 2). Butchers are also trimming more fat from cuts of meat or increasingly using continental cuts which result in leaner meat[22].

26. Changes in food composition may also result from the introduction of new plant varieties, importation from different countries, altered storage practices, processing techniques, fortification practices and packaging. For example, over the last 20 years there have been a number of changes in the nutrients added

Table 2: Changes in pig carcase composition[22].
Estimates from the Meat and Livestock Commission.

	1975	1984
	mm	mm
Backfat thickness	17.0	13.5
	Percentage of carcase weight	
Lean	47.6	52.1
Subcutaneous fat	19.5	16.1
Inter-muscular fat	5.6	5.0

to a major brand of breakfast cereal (see Table 3). Changes in processing techniques and packaging have resulted in a wider choice of fruit juice (bottled, canned, frozen, long-life, pasteurised and commercially freshly squeezed) which need to be stored under different conditions and may have differing nutrient contents (see Table 4).

27. Because the composition of foods and their relative importance change, the Working Party *recommends* that the programme of monitoring of the individual foods that make up the UK diet should continue, to ensure that sound and sufficiently extensive data on the composition of all important foods become available.

28. The range and types of foods have steadily increased and there are now several thousand different foods available in the UK. More than 100 nutrients are found in food, although not all nutrients are present in every food. For example, most fresh fruit and vegetables contain only traces of fat while most meat and fish contain no vitamin C. Nutrient analysis programmes can be very costly. Samples are therefore selected carefully to ensure that resources are used as effectively as possible. To be of most value the samples of food selected need to be representative of those purchased by the general population, prepared according to normal domestic practice and analysed for relevant nutrients using a reliable and valid method. Attention is paid to all these points in the analyses that are commissioned.

Table 3: History of fortification of a major brand of breakfast cereal.

1960–69	Fortification to replace vitamins lost in manufacture – thiamin, riboflavin and niacin added to achieve one sixth of RDA.*
1969–78	Increasing importance of the cereal breakfast – fortification increased to at least one quarter average adult RDA, and at least one third child RDA.
1978–86	Fortification extended to include vitamins B_6, D, B_{12} to at least one quarter average adult RDA and at least one third child RDA. Iron also added at one sixth RDA.

*Recommended daily amounts of nutrients – see para. 47.

Table 4: Vitamin C content of different types of orange juice (mg/100g).

	Previously published values[7]	New analytical values*
Unsweetened, canned	35	35
Freshly squeezed	50	47
Commercially freshly squeezed	—	48
Bottled	—	37
UHT carton	—	34
Pasteurised carton	—	34
Frozen, reconstituted	—	38

*To be published.

29. Foods are biological materials and as such most show considerable variation in composition. The objective of the analyses is to obtain values that reflect the average or typical composition of foods. Analyses are not, therefore, based on a single sample of food which might be atypical. However, it is often not practical to analyse several samples separately. A more cost effective approach is to combine carefully selected samples to form composites of, say, 10 samples. This approach was adopted for the revision of *McCance and Widdowson's The Composition of Foods*[7] and for most subsequent analyses.

30. Since accepting responsibility for revision of UK food composition tables MAFF has conducted a major programme of food composition analyses, principally at the Laboratory of the Government Chemist and the AFRC Institute of Food Research. Several nutrients and a wide range of foods have been studied in detail (see Table 5).

31. A wide range of foods was analysed for the first time for selenium[24], manganese[25], copper and zinc[26] and iodine[27]. These studies were undertaken because of the limited amount of data available on the content of these nutrients in British food. The following foods were found to be useful sources: *selenium* – North American breadmaking flours, kidney, fatty fish and brazil nuts; *manganese* – tea, unrefined and partly refined cereals and some spices and herbs; *iodine* – fish, milk, eggs and cheese.

Effects of methods of analysis

32. The apparent nutrient content of a food may vary depending on the method of analysis. For example many spectrophotometric or electrochemical methods for measuring vitamin C cannot distinguish between ascorbic acid, dehydroascorbic acid and inactive compounds. Newer methods such as enzymatic procedures and high performance liquid chromatography (HPLC) are more specific. Improved methods of analysis of nutrients are being developed at an increasing pace. These enable scientists all over the world to generate better

Table 5: Recent and current analytical programme

	References
Individual nutrients in a wide range of foods	
Free sugars	23
Selenium	24
Manganese	25
Copper and zinc	26
Iodine	27
Vitamin A and D in battery and free range eggs	28
Fluoride	29
Vitamin A in foods of animal origin	30
Chromium	31
Dietary fibre fractions in cereal products	32
Fat and fatty acids in foods	in preparation
Individual sugars in foods	"
Foods analysed for a wide range of nutrients	
Cereals and cereal products (including flour, cakes, pastries, pasta and breads)	33, 34, 35
Butters (selected nutrients)	36
Potatoes	37
Milk and milk products (including bottled and cartoned milks, infant formulae, cheese, yoghurt and ice cream)	38, 39, 40
'Fast foods' and franchised foods	41
Carcase meat and meat products, offals, poultry and game	in preparation
Alcoholic drinks, soft drinks, tea and coffee	"
Fruit and fruit products (including fresh fruit, canned fruit and fruit juice)	"
Vegetables and vegetable products (including fresh, frozen and canned vegetables)	"
Fish and fish products	"
Commercially prepared infant foods	"

information about the nutrient composition of foods. Recent improvements in analytical methodology include automated microbial assays for B vitamins and HPLC analysis of fat soluble vitamins. HPLC can also now be applied to the determination of individual sugars in foods. Other developments include improved methods of fatty acid isomer analysis. Major efforts have been made in this area because of the widespread interest in the possible link between various fatty acids and cardiovascular disease. Gas liquid chromatography methods have been developed which enable separation of cis and trans geometrical isomers and also positional isomers such as n–3 and n–6 families of polyunsaturates. Implementation of formalised systems of analytical quality assurance has also improved the quality of nutritional data. The Working Party *recommends* that appropriate quality assurance procedures should be included in all programmes of nutrient analysis.

33. A thorough re-examination of the quantity and forms of vitamin A in selected foods of animal origin was undertaken using HPLC. The new analyses showed that measurable quantities of vitamin A-active compounds are present

in many meats, but that the previously calculated quantities for meat products containing offal (e.g. faggots, haggis, liver sausage) had been an over-estimate of the amounts present[30].

34. Dietary fibre fractions in a wide range of cereals and cereal products have been measured using a modification of the original procedure[32]. This resulted in slightly higher values being obtained. There are a number of analytical procedures available for measuring dietary fibre including the widely accepted Southgate and Englyst procedures[42,43]. These measure different dietary fibre fractions and result in different values. Multi-centre trials using standard foods have revealed extremely large inter-laboratory and methodological variations[44]. The Working Party has identified a need for more extensive data on the fibre content of foods but *recommends* that agreement should be reached on the definition of dietary fibre to be used in nutrition labelling before commencing further work.

Continuous programme of nutrient analysis

35. In addition to studies on selected nutrients there has been a 'rolling' programme revising and extending analyses on groups of food (see Table 5). An area of food composition that was not covered adequately in the 4th edition of *McCance and Widdowson's The Composition of Foods*[7] was food commonly eaten by the immigrant population in the UK. A review of the literature and a programme of analysis were therefore undertaken in the early 1980's. Special emphasis was placed on foods eaten by the most numerous groups of immigrants, namely those from the Indian sub-continent, the West Indies and Hong Kong. More than 20 nutrients were analysed in important foods where data were lacking. The emphasis was on those nutrients most likely to be of interest to people who deal with possible dietary problems in the immigrant communities in the UK. The new analytical data, together with data from other sources have been published as a supplement to the UK food tables[9].

36. As part of the programme of revision, groups of similar foods are considered. Priority is given to:

(i) Foods that make an important contribution to nutrient intake in the national diet or to specific groups within the population, either because they are consumed in large quantities or which, although eaten in smaller quantities, are likely to be particularly good sources of selected nutrients.
(ii) Foods which are likely to have undergone changes in composition.
(iii) New foods for which there are few data and which are foreseen to become important items in the national diet or the diet of specific groups within the population.

Major items in the diet are considered in more detail than the less important items. For example as part of the studies on cereal products, a wide variety of breads was analysed in considerable detail including an investigation of possible

regional differences in composition[34]. Milk and milk products have been considered in similar detail. Samples from dairies throughout the country over more than a year showed a number of differences from published data and also a marked seasonal variation, particularly for fat and fatty acids. Further studies demonstrated losses of vitamin C and riboflavin during delivery to the home and during storage in the domestic refrigerator[38,40]. As well as traditional milks and milk products a number of new products e.g. flavoured milk, goats milk, new cheeses such as Lymeswold and low fat Cheddar type have also been analysed.

National nutrient databank

37. Information on the composition of foods has traditionally been collated and published as books of food composition tables. However, computerised databanks are becoming increasingly important. MAFF Food Science Division has therefore commissioned the Royal Society of Chemistry (RSC) to produce a new national nutrient databank to make publicly available the extensive amount of new and more detailed data both in printed and computer readable form. Computer databanks have considerable advantages in allowing more frequent and more rapid updating and in allowing selected parts of the databank to be provided for special purposes. It is intended that the databank will be extended to include more detail on nutrients (e.g. individual components of dietary fibre) and many more foods. It may also include a range of values indicating for example, regional or varietal differences in nutrient content. With the increasing interest in diet in relation to health the databank will continue to provide a valuable and authoritative source of data not only for Government but also for dietitians, nutritionists, food scientists and others requiring data on the food we eat.

38. The MAFF/RSC databank will eventually replace *McCance and Widdowson's The Composition of Foods*. However development of the databank and revision of the data will take several years. Once revised, sub-sections of the data will be published both as books and in computer readable form.

39. The usefulness of any databank rests on the quality of data used to construct it. The Working Party *recommends* that new data are carefully evaluated before incorporation into the main databank and that a sub-group of the Working Party is set up to oversee revision of the data. The Working Party wishes to give every encouragement to these plans to make more extensive and more detailed data available more quickly to a wider range of users. We therefore *recommend* that appropriate resources are made available to implement these plans.

Dietary Studies

40. In addition to work relating to food composition, it is within the remit of the Working Party to propose and advise on the planning of dietary surveys.

41. A number of dietary survey techniques have been established and evaluated, and these include duplicate diet studies, recall methods and record keeping. These methods have been reviewed[45–47] but are also summarised here:

42. **Duplicate diet studies** provide information on the intake of components of foods by individuals. A duplicate diet is a replica of the whole or occasionally a particular part of a diet eaten by an individual. The technique has the advantage that the analyses are undertaken on an exact replicate of the foods eaten by an individual. However, the technique cannot readily be applied to unstable constituents of the diet. Furthermore it is only practical on a small scale. There are some uncertainties as to whether a duplicate diet is always as large as the diet actually eaten, since people may be reluctant to 'waste' good food[48]. There may also be a tendency to include the less choice items (e.g. meat fat) in the duplicate and eat the more choice items (e.g. lean meat).

43. **Recall methods.** In these methods individuals are asked to recall all the foods and drinks consumed over a defined time period, usually 24 hours. An obvious limitation is that the accuracy depends on the individual's memory. Recall methods are useful for indicating general dietary patterns but are of more limited value in providing information on the quantities of foods consumed. Food and nutrient intakes vary from day to day, so more reliable estimates of habitual intakes may well be obtained if several days are included. However it is difficult for most people to recall their diet accurately over a period greater than 24 hours.

44. A further technique aims to estimate the usual intake of selected foods of special interest, based on recall of the usual frequency of use of these foods. When coupled with estimates of portion size (using household measures, photographs or food models as a guide) the technique can provide a useful indicator of very high or low intakes of nutrients which could be followed up by more detailed studies. It can be useful for foods which are important sources of nutrients but which are eaten infrequently, such as liver.

45. **Record keeping.** A more accurate way of measuring foods consumed over a defined time period is by means of an actual record either of weights of food or estimates based on standard measures. The weighed record is widely taken to be the most accurate record of foods consumed. However, the technique can be onerous for the participants, especially if very detailed records are required and may lead to under-recording or simplification of the diet to exclude items which are complicated to weigh. Detailed weighed dietary surveys are also extremely costly.

46. In deciding the most appropriate methodology to apply the Working Party considers a number of factors, including:

(i) The group to be studied – different methods may be required, for example, for infants or the elderly.

(ii) The detail required to study the problem effectively.
(iii) Limitations of the scientific and financial resources available.

Evaluation of dietary studies

47. One way of evaluating nutritional surveys is by comparison of intakes with a recognised standard. A parallel exists with the use of 'acceptable daily intakes'* in evaluating surveys of additives. The usual standard for nutrients is the recommended daily amount (RDA). The DHSS currently provides tables of recommended daily amounts of 9 nutrients and of energy for different age and sex groups. The RDAs for nutrients are not minimum requirements. The nutrient RDAs are derived from estimates of nutrient requirement together with a considerable margin of safety. They are 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'[49]. RDAs cannot be used for assessing nutritional status. To do this, clinical, anthropometric and biochemical assessments would also be needed. They can, however, provide an indication of the risk of nutritional disorder and of the potential of diets to provide adequate levels of nutrients. If the nutrient intake of an individual is less than the RDA this does not necessarily indicate an inadequate intake. However, the greater the proportion of people with intakes below the RDA, the greater the possibility that some individuals may be undernourished. Where MAFF dietary surveys indicate that nutrient intakes may be compromised the results are passed to DHSS for medical advice. Many countries have established RDAs for a more extensive range of nutrients than the UK[50]. The Working Party *recommends* that UK RDAs are established for the wider range of nutrients known to be important for health.

Recent dietary studies

48. A number of dietary surveys have been undertaken by MAFF in recent years and are summarised in Table 6. These surveys have provided valuable information on the dietary habits and nutrient intakes of the groups studied. For example the diets of 15–25 year olds throughout Britain were found, on average, to meet the UK RDAs, with the exception that iron and energy intakes did not reach the levels recommended[20]. The percentage of energy from fat exceeded that recommended by the Committee on Medical Aspects of Food Policy (COMA)[1]. Women, and especially those 'on a diet' or 'watching their weight', generally had iron intakes well below the recommended daily amount. Reduced iron intake appeared to result from diets of reduced iron concentration as well as food restriction. The results have been passed to DHSS for consideration. The Working Party *recommends* that further research is carried out to establish whether health is compromised or whether the recommended daily amounts of energy and of nutrients are unnecessarily high.

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*The acceptable daily intake of a chemical is the daily intake which, during an entire lifetime, appears to be without appreciable risk on the basis of all known facts at the time.

Table 6: Summary of recently completed dietary studies.

Groups surveyed	Methods	Results in brief
Teenagers and young adults (15–25 year olds)[20]	Record keeping, measuring all food and drinks consumed over a 14 day period. 913 participants throughout Britain.	Diets as a whole met the RDAs, except for energy and iron. Iron intakes were particularly low in women and those 'dieting' or 'watching their weight'. The proportion of energy from fat exceeded COMA recommendations.
Orkney Islanders[20]	Record keeping, using weighings and household measures of foods consumed during two separate weeks by 118 people (78 women, 40 men) on the Orkney Islands of Westray and Rousay.	Consumption of potatoes, fish and beef was above the British average while consumption of fruit and vegetables (other than potatoes) was below the British average. Nutrient intakes were unremarkable.
Pregnant women[51]	Combined use of weighed record, measures and frequency of consumption during early and late pregnancy and postpartum in 260 women from Edinburgh and London.	Intakes of energy, calcium and (in Edinburgh) vitamin C were below the RDAs. Despite this there was no apparent adverse effect on mothers and infants. There is a need for re-evaluation of the energy and nutrient RDAs.
Study of survey methodology[52]	Comparison of 5 different survey techniques in civil servants. Development of modified methods suitable for general survey use, to be tested in groups that are traditionally difficult to survey (one parent families, low income households, the unemployed).	7 day weighed records and repeated 24 hour recalls provided comparable results. Correlation between these methods and food frequency interview, duplicate diet analysis or household food purchase record was less good. A method which incorporates elements of weighed record, 24 hour recall and food frequency interview is being tested further.
Average intake of selected trace elments[24–27,53]	Analysis of 'Total Diet' samples. Iron, copper, zinc and manganese are measured almost every year. Special studies have also been carried out on selenium, iodine, sodium, potassium, chromium and fluoride.	National averge intake of these nutrients are within acceptable limits.

Dietary study of adults

49. In the past, dietary surveys by Government Departments and by academic institutions have concentrated mainly on groups which might be at some risk of nutritional deficiency or who may be especially exposed or sensitive to food contaminants. The Working Party has identified the need for detailed information on the diet of individuals in the general population.

50. Precise information on the types and quantities of foods and nutrients consumed by individuals would provide an essential baseline against which to measure the impact of factors such as changes in agriculture, food and educational policies on dietary habits. It would provide information on which dietary advice could be formulated. The data would also act as a reference against which the significance of dietary surveys of specific groups of the population could be assessed, and should assist in the identification of vulnerable groups that warrant further study.

51. The Working Party recognises that the value of dietary surveys is enhanced by inclusion of objective measurements of nutritional status and indicators of health. They therefore recommended that MAFF and DHSS should collaborate in a dietary and nutritional survey of adults.

52. A detailed dietary and nutrition survey of 2,000 adults aged 16–64 throughout Great Britain has now been commissioned by MAFF and DHSS with the Office of Population Censuses and Surveys. Because of the precision and detail needed the weighed dietary survey technique has been chosen, with individuals keeping a weighed record of all foods and drinks consumed over a seven day period. Information on height, weight and blood pressure, together with samples of blood and urine, are collected for DHSS. Information from recent analytical surveys on the nutrient content of foods has been incorporated into a detailed database specially designed for this survey. The unemployed and shiftworkers, two groups considered by the Working Party to be potentially at risk, are being identified so that separate analyses can be performed. The first results from the survey are expected in 1989.

Other recent studies

53. The Working Party has also identified a need for information on regional differences in meat fat consumption, the diets of infants aged 6–12 months, the patterns of food consumption by vegetarians and further information on trace element intakes. Work has been commissioned in these areas (Table 7) and the results of the surveys will be published so that they can reach as many interested parties as possible.

FUTURE PRIORITIES

54. Following the publication of a report by the Advisory Council for Applied Research and Development (ACARD)[54] the Government announced the setting up of a Priorities Board to co-ordinate publicly funded agriculture and food

Table 7: Summary of current dietary studies.

Description	Reason for study
Dietary survey of adults Dietary survey of 2,000 adults aged 16–64 throughout Britain using the 7 day weighed dietary survey technique. The survey also includes measurement of height, weight, blood pressure and collection of blood and a 24 hour urine sample.	Detailed information is needed on the type and quantity of foods eaten by the general population to provide a baseline against which to measure the impact of factors such as changes in agriculture and in food and educational policies on dietary habits. It will also act as a reference against which the significance of dietary surveys of specific groups can be assessed.
Regional differences in meat fat consumption Preliminary study of fat content of meat and of meat preparation and cooking practices, plate wastage of fat and attitudes to fat in different regions throughout Great Britain.	Regional differences in heart disease are known to exist, but the NFS shows similar percentages of energy from fat in different regions. Meat is an important but variable source of fat. Different domestic practices which may reduce the amount of fat consumed are being assessed.
Food intake of infants aged 6–12 months Record of the type and quantity (using standard measures) of food eaten by a representative sample of approximately 500 infants over a 7 day period. Additional questions on initial feeding, weaning and use of sugar, salt and vitamin supplements are included.	A wide range of foods may be fed to infants including specially manufactured foods, modified family foods, and snack and convenience foods. Little quantitative information is available on infant feeding practices. The survey was requested by the Working Party on Pesticide Residues.
Food consumption by vegetarians Small scale survey of food consumption patterns and food preparation practices of lacto-ovo vegetarians, vegans and people avoiding red meat.	Information on groups of people with higher than average intake of selected foods such as vegetables are required by other Working Parties (e.g. the Working Party on Pesticide Residues.) Vegetarians potentially form such a group.
Trace elements in 'Total Diet' samples Survey of selected trace elements including selenium, iodine, molybdenum and vanadium in 'Total Diet' samples. The survey will assess national average intakes of these nutrients and identify which groups of foods make the major contributions.	There is little information on average intakes of a number of trace elements. Average intakes of selenium and iodine were measured in 'Total Diet' samples in the late 1970's, and the current survey will identify trends over time. No other reasonable means of determining national intakes of these nutrients or of molybdenum and vanadium exists.

research and development (R & D) and to advise on the allocation of their R & D budgets. In December 1985 the Priorities Board recommended that: 'the proportion of public sector R & D expenditure on nutrition should be increased. The emphasis should be on establishing nutrient content and bioavailability in foods and, in collaboration with medical researchers, exploring the relationship of diet (and individual foods) with health'[55]. Expenditure on nutrition has been increased by more than 33 per cent between 1985–86 and 1986–87, corresponding to an increase from 7.8 per cent to 9.4 per cent of the national programme of food R & D.

Criteria for Setting Priorities

55. A number of factors (Table 8) are considered by the Working Party in determining research priorities. Against these factors a number of areas have been identified that warrant further research (paras. 56–65).

Table 8: Criteria for assessing project priorities.

The following factors are considered when assessing the priority of proposed work:

General

(i) Is there reason to believe that a health or nutrition problem may exist or arise in some sector of the community which needs investigation by dietary or composition studies?
(ii) Is the study required to help other Government committees, to assist with formulation of recommendations or to monitor the effects of Government policy?
(iii) Is the study important for updating or extending currently available data? Priority is given to extension or updating where there is evidence of significant change or significant omissions.

Food Composition

(i) Are the foods important sources of nutrients in the diet of the population as a whole or specific nutritionally vulnerable groups within the population (e.g. children, pregnant women, the elderly, immigrants)?
(ii) Is nutrition research or a proper assessment of the diet impeded by lack of sound or sufficiently extensive data?
(iii) Is there evidence that altered agricultural, manufacturing, catering or domestic practices are causing nutritionally significant changes?
(iv) Is there other evidence that current data are inadequate or inappropriate e.g. is there new information on the bioavailability of different forms of nutrients, or have improved analytical methods become available?

Dietary Surveys

(i) Is the survey needed to assess the intake of foods and nutrients, or changes in the diet of the population e.g. in response to Government advice, such as the COMA Report on Diet and Cardiovascular Disease?
(ii) Is the survey needed to assess the intake of foods and nutrients by a specific nutritionally vulnerable group?
(iii) Is the survey required by other Working Parties or by other committees in MAFF or other Government Departments?

Food Composition

Nutritive values of food

56. Continued research is needed to determine the nutritive value of all foods with particular reference to those arising from emergent technologies in agriculture, the food industry, catering industry and the home. For example the Working Party *recommends* that information be obtained on the nutrient content and bioavailability* of nutrients in mechanically recovered meat. There is an apparent lack of published information concerning the effects of such alternative processing techniques as aseptic packaging and modified atmosphere packaging on the nutrient content of food. The Working Party *recommends* that these processes should be considered in future work.

Nutritional effects of food irradiation

57. The Advisory Committee on Irradiated and Novel Foods (ACINF), set up by DHSS and MAFF, referred the nutritional aspects of food irradiation to the Panel on Novel Foods of the Committee on Medical Aspects of Food Policy. Their conclusions are listed in Appendix V. ACINF concluded 'that the irradiation of foods at the appropriate dose up to an overall average dose of 10kGy will not have any special adverse effects on its nutritional content. However, we consider that, should the process be permitted in the United Kingdom, its usage and nutritional consequences in the light of consumption patterns should be monitored'[57]. The Working Party endorses the need for monitoring and *recommends* that the work outlined by the COMA Panel on Novel Foods should be undertaken.

Effects of new domestic practices

58. In addition to the data on the effect of commercial processing techniques more information is needed on the nutritional consequences of domestic practices, including 'boil in the bag', the effect of microwave thawing and cooking, use of slow cookers, and prolonged frozen food storage so that nutritional values of a wider range of foods 'as eaten' become available. Such programmes may need to be integrated with studies of the microbiological and organoleptic consequences of these practices. The Working Party *recommends* that these practices should be considered in future work.

Catering

59. Further research is needed on the nutritional values of foods purchased from catering establishments. In recent years there have been marked changes in patterns of eating out. These changes have in the past been measured by the British Survey of Eating Out[58]. This survey shows a decline in the number of

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*The proportion of the nutrient that can be digested, absorbed and utilised[56].

Table 9: Eating outside the home in Britain[59].

	School sector (11 years and over)	Place of work	Purely commercial	Total
Average number of meal occasions (millions/week)				
1975	9.4	34.3	41.5	85.2
1984	5.4	18.1	44.6	71.2*
Number of people eating out at least once a week (millions/week)				
1975	2.5	7.8	17.2	22.2†
1984	1.7	4.7	20.0	23.5†

*Includes other meals.
†The sum of individual sectors is greater than the total because individuals may eat out in more than one sector.

meals eaten out during the last decade (see Table 9). Within this there has been a marked decline in the number of meals at the place of work and school meals but a growth in the commercial sector. The number of people eating out at least once a week has increased over the same time period. Within the commercial sector 'fast food' outlets, take away shops, bakers' shops, cafés and snack bars have shown most growth.

60. The composition of foods purchased from catering establishments will often be different from the equivalent products prepared in the home. Furthermore many catering outlets use non-standard recipes so that the same dish prepared by different outlets may have a different nutrient content. The increased use of convenience products and the adoption by caterers of the methods of the food manufacturer, often without the same quality control procedures, requires monitoring. Priority in future work should be given to outlets using non-standard recipes and to those serving the most meals. In 1985 these were work and educational canteens, fish and chip shops, bakers' shops, cafés and snack bars, pubs and pub restaurants[58]. Cost-effective ways of gathering data on the composition of meals are being examined by the Working Party.

Methods of analysis

61. Whilst reliable methods of analysis are available for many nutrients there are others for which methods are less reliably established. The Working Party recognises the need for methods that are reproducible both within and between laboratories. Much of the work on method development is supported by the Chief Scientist's Group of MAFF. The Working Party *recommends* that improved methods of analysis for nutrients should be applied as soon as is practicable after validation, together with adequate quality control. For example spectrophotometric methods which fail to distinguish between carotenoids of varying pro-vitamin A activity should be replaced by HPLC methods which identify individual carotenoids.

Bioavailability

62. The availability to man of nutrients in foods is influenced by a number of factors including the form of the nutrient in the food, the presence of enhancing or inhibitory factors in the food or in other parts of the meal, and even the nutritional status and age of the individual. The Working Party endorses the view of the Priorities Board (para.54) and *recommends* that more work on bioavailability, particularly of vitamins and minerals such as vitamin A, tocopherols, iron and zinc, is needed. Future priorities will include applying data on bioavailability to nutrient analyses in food.

63. The current work on folates illustrates the type of research that may be undertaken in the future. Several different forms of folates exist in foods. Traditionally they were measured using microbial assays with *Lactobacillus casei*. However food folates with equal availability to *Lactobacillus casei* can have widely different bioavailability in man. Following a meeting in 1983 of an *ad hoc* COMA Working Group on Folic Acid, MAFF undertook to try to resolve the uncertainties in previous estimates of folates in foods. Work on bioavailability and method development was commissioned. As a result of this work several potentially useful techniques were developed. This work (and further studies of folate bioavailability) is now being extended. Various methods are being tested on common raw and cooked foods. This will enable the selection of a single method which can be applied more routinely to foods. It will also be valuable in determining recommended daily amounts for this important nutrient, for assessing dietary intake and providing a sound base for nutrition education campaigns.

FUTURE DIETARY STUDIES

64. There is a continuing need to know national average food intakes in the UK in order to determine usual intakes of nutrients and other food constituents (see para. 3). In addition special surveys of groups potentially at the extremes of the range of national intake are required. Evidence as to the nature of groups with potentially extreme intakes (either high or low) of energy, nutrients or toxic constituents is obtained from many sources including other Working Parties of the Steering Group on Food Surveillance, the DHSS, and medical and scientific research. Taking into account the data available in the literature and the recent and current programme of studies (see paras. 48–53) the Working Party *recommends* that the following groups warrant priority for study: shiftworkers, the unemployed, people on slimming diets, second generation immigrants and the elderly in institutions. This is not to say that separate studies need to be carried out on each group. Resources are limited so where practicable these groups may be identified within more general studies. For example dieters were identified and analysed separately in the recent MAFF survey of 15–25 year olds[20], and in the survey of women following pregnancy[51]. The unemployed and

shiftworkers are being identified as part of the national dietary and nutrition survey of adults.

65. Information is also needed on the nutritional importance of food obtained outside the home. Measurement of food consumed outside the home is extremely difficult and trends identified in different surveys vary. For example, the now discontinued British Survey of Eating Out[59] found a decline in the number of meals eaten outside the home between 1975 and 1984. The National Food Survey, however, indicated a small increase over the same period[10, 60]. The Working Party therefore *recommends* that a new comprehensive and continuous survey of food eaten outside the home, and of the nutrients obtained from these foods, should be undertaken. The Working Party recognises that there may be considerable practical difficulties both in obtaining adequate descriptions of the foods eaten and in quantification, particularly for outlets that use non-standard recipes and have variable portion control. Extensive developmental work may be necessary before such a survey can be established.

CONCLUSIONS AND SUMMARY OF RECOMMENDATIONS

66. Part of the work outlined in this report pre-dates the Working Party on Nutrients. Since its formation in 1984 the Working Party has recommended a programme of work which aims to ensure that up-to-date information on the composition of foods is available so that the nation's diet can be adequately monitored. The Working Party has also recommended dietary surveys which complement the work of other Government Departments and other workers in this field. The Working Party will continue to scrutinise the results of the surveys, to encourage publication of results and to recommend appropriate work. In particular we recommend that:

Food Composition

(i) The programme of monitoring the individual foods that make up the UK diet should continue so that sound and sufficiently extensive data on the composition of all important foods are available (para.27).

(ii) Appropriate quality assurance procedures should be included in all programmes of nutrient analysis (para.32).

(iii) Improved methods of analysis for nutrients should be applied as soon as practicable after validation (para.61).

(iv) Further work should be carried out on the dietary fibre content of foods but this work should not commence until agreement has been reached on the definition of dietary fibre to be used in nutrition labelling (para.34).

(v) More work on bioavailability, particularly of vitamins and minerals such as vitamin A, tocopherols, iron and zinc, should be undertaken (para.62).

(vi) Information should be obtained on the nutrient content and bioavailability of nutrients in mechanically recovered meat (para.56).

(vii) The effects of alternative processing techniques such as aseptic packaging and modified atmosphere packaging should be considered in future work (para.56).

(viii) Work on the nutritional consequences of food irradiation, as outlined by the COMA Panel on Novel Foods, should be undertaken (para.57).

(ix) The nutritional consequences of domestic practices, including 'boil in the bag', the effect of microwave thawing and cooking, use of slow cookers and prolonged frozen food storage should be considered in future work (para.58).

(x) Appropriate resources should be made available to enable development of a computerised nutrient databank so that more extensive and more detailed data can be made available more quickly to a wider range of users (para.39).

(xi) New data should be carefully evaluated before incorporation into the main databank and a sub-group of the Working Party should be set up to oversee revision of the data (para.39).

Dietary studies

(xii) UK recommended daily amounts of nutrients should be established for the wider range of nutrients known to be important for health (para.47).

(xiii) Further research should be carried out to establish whether health is compromised by intakes of iron below the RDAs or whether the RDAs are unnecessarily high (para.48).

(xiv) Shiftworkers, the unemployed, people on slimming diets, second generation immigrants and the elderly in institutions warrant priority for study (para. 64).

(xv) A new comprehensive and continuous survey of foods eaten outside the home, and of the nutrients obtained from these foods, should be undertaken (para.65).

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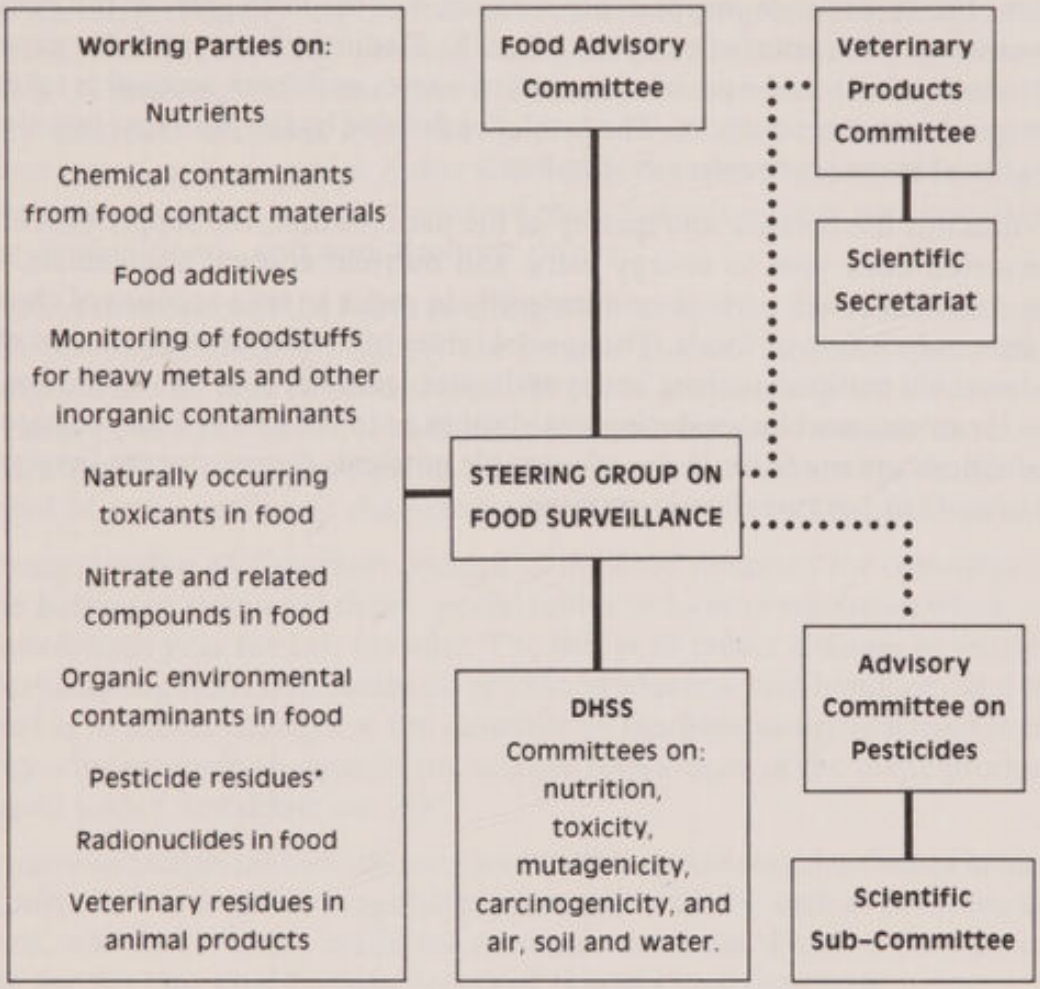
APPENDIX I COMMITTEE STRUCTURE OF THE STEERING GROUP AND ITS RELATIONSHIP TO OTHER COMMITTEES.



* This working party reports to both the Steering Group on Food Surveillance and the Advisory Committee on Pesticides.

APPENDIX II NATIONAL FOOD SUPPLIES—METHODOLOGY

This statistical series from the Ministry of Agriculture, Fisheries and Food represents, for each calendar year, supplies that moved into the human food distribution chain and thus became available for consumption by the UK population. For most foods, supplies are measured at the farm gate, at the point of processing or the point of entry into the UK. Deductions are made for exports, for non-food use and a certain amount of waste, and some account is taken of changes in measured stocks. The totals are divided by the mid-year population to give average 'consumption' per head.

To monitor the balance and quality of the nation's diet, the supply figures are converted each year to energy value and nutrient content equivalents. The nutrient factors are revised systematically in order to take account of changes in the composition of foods. The special tables of food composition used allow for inedible material such as bones and outer leaves or skin on vegetables, but not for subsequent losses during distribution or in the home. Furthermore, no deductions are made for losses of unstable nutrients during storage (except for vitamin C in potatoes) or in cooking.

APPENDIX III THE NATIONAL FOOD SURVEY

The National Food Survey is a continuous sampling enquiry into the domestic food consumption and expenditure of private households in Great Britain. Each household participates for one week only. The sole informant in each household is the person principally responsible for domestic arrangements (referred to as the 'housewife'). They keep a record, with guidance from a trained interviewer, of all food entering the home that is intended for human consumption; the survey therefore excludes meals out and pet food. Also excluded from the Survey are a few items which individual family members often buy for themselves without coming to the attention of the housewife—these are chocolates, sugar confectionery, soft and alcoholic drinks.

As well as details about the foods entering the households, the housewife notes which persons (including visitors) are present at each meal together with a description of the type of food served. Records are also kept of the number and nature (whether lunch, dinner etc.) of meals obtained outside the home by each member of the household. On a separate questionnaire, details are entered of socio-economic characteristics of the family and its members.

The energy value and nutrient content of the food obtained for consumption in the home are evaluated using special tables of food composition which are reviewed each year for two reasons. The first is to reflect changes in nutrient values resulting from new methods of food production and handling, and the second is to reflect changes in the structure of the food categories used in the survey—for example changes in the relative importance of the many products grouped under 'breakfast cereals'.

The nutrient factors make allowance for inedible material such as bones in meat and outer leaves or skin of vegetables; for certain foods, such as potatoes and carrots, allowance is also made for seasonal variations. Further allowance is made for the expected cooking losses of thiamin and vitamin C.

Results are published as annual reports[14], and less detailed quarterly reports[15] are also available from the National Food Survey Branch of the Ministry of Agriculture, Fisheries and Food, room 419, Whitehall Place (West), London SW1A 2HH (01 270 8562). In addition, more detailed analyses may be purchased.

APPENDIX IV THE TOTAL DIET STUDY

The quantities of foods that make up the 'Total Diet' are largely based on those determined in the National Food Survey. For several items not recorded in this survey, particularly soft drinks, chocolate and sugar confectionery, and herbs and spices, the values are based on total production in the UK or on imports and trade statistics. The type and quantities of foods in the 'Total Diet' are updated periodically to reflect changing eating habits in Britain.

A total of 119 categories of foods is specified for inclusion in the 'total diet'. These are combined into 20 groups of similar foods as indicated in Table 10. The relative proportion of each food in the group reflects the importance of the food within that section of the average household diet.

Food samples are bought from a wide variety of retail outlets at fortnightly intervals, on each occasion in a different area selected on a random basis, to be representative of Britain as a whole. The total quantities of foods are rigidly specified but, for items likely to be subject to regional or seasonal variations in availability, purchasers may buy certain items either fresh or frozen or select one item from a list of specified similar alternatives. The foods are rapidly transported to one centre where they are prepared and cooked (where necessary) according to normal domestic practice. After preparation the constituents of each food group are thoroughly homogenised, frozen, and then despatched for analysis.

To ensure that sufficient sample is available for analysis each group (except for beverages and eggs) is based on 500 g as purchased, but after preparation the actual quantities in some groups are substantially less because of losses of inedible material during preparation and further losses during cooking. The cereals group increases in weight due to uptake of water on boiling cereals such as rice and pasta. The beverage group substantially increases in weight because the tea leaves are infused with water. The contribution of the 20 food groups (in kg/person/day) to the average household diet as purchased is shown in Table 11 together with the gain or loss of weight in preparation and cooking.

Food groups are routinely analysed for a number of substances e.g. pesticide residues and heavy metals, and are also occasionally analysed for selected nutrients. Intakes of the food constituent from each food group is calculated by multiplying the concentration found in the analysed sample by the estimated weight of food eaten (Table 11).

Table 10: Groups of foods used in the preparation of 'Total Diet' samples in 1987, and proportions of each item as purchased.

Amounts based mainly on 3-year moving averages from National Food Survey reports for 1983–1985.

	Relative importance of individual foods within each group
Group 1—Bread	
White sliced	49.4
White unsliced	15.8
Brown	11.2
Wholemeal	10.4
Other	13.2
	100
Group 2—Other cereals	
Flour	19.8
Buns, pastries, cakes	15.8
Chocolate biscuits	6.0
Other biscuits	16.8
Breakfast cereals	17.8
Rice	4.1
Other cereal products	19.7
	100
Group 3—Carcase meat	
Beef	48.2
Lamb	26.2
Pork	25.6
	100
Group 4—Offals	
Lambs' liver	37.8
Pigs' liver	19.6
Other liver	13.4
Kidney	12.2
Other offals	17.0
	100
Group 5—Meat products	
Bacon and ham, uncooked	23.6
Bacon and ham, cooked	7.0
Corned meat	4.8
Other canned meats	8.0
Other cooked meat	3.5
Pork sausages	9.1
Beef sausages	10.4
Pies, sausage rolls	4.4
Frozen meat products	11.6
Other meat products	17.6
	100

	Relative importance of individual foods within each group
Group 6—Poultry	
Chicken	63.0
Other poultry	32.8
Cooked poultry	4.2
	100
Group 7—Fish	
White fish	37.5
Fat fish	7.6
Frozen fish products	23.4
Shellfish	2.8
Cooked fish	14.3
Canned salmon	4.6
Other canned fish	9.8
	100
Group 8—Oils and fats	
Soft margarine	40.4
Hard margarine	14.2
Vegetable oils	12.9
Lard	21.3
Other fats	11.2
	100
Group 9—Eggs	
Eggs	100
Group 10—Sugars and preserves	
Sugar	46.2
Jam, marmalade	8.0
Syrup, honey	2.0
Jelly	1.4
Chocolates	26.4
Sweets	16.0
	100
Group 11—Green vegetables	
Cabbage	26.8
Sprouts	12.8
Cauliflower	16.8
Leafy salads	10.6
Peas	14.2
Beans	11.2
Other fresh green vegetables	7.6
	100

	Relative importance of individual foods within each group
Group 12—Potatoes	
Fresh potatoes	91.2
Potato products	8.8
	100
Group 13—Other vegetables	
Onions, leeks	17.0
Carrots	18.6
Turnips, swedes	6.0
Miscellaneous vegetables	13.6
Mushrooms	3.6
Tomatoes	19.2
Cucumbers	5.2
Dried vegetables	1.6
Dried soups	0.8
Meat or yeast extract	0.8
Spreads, dressings	2.4
Pickles, sauces	11.0
Herbs, spices	0.2
	100
Group 14—Canned vegetables	
Canned soups	22.4
Canned tomatoes	12.2
Canned peas	18.8
Canned beans	36.8
Other canned vegetables	9.8
	100
Group 15—Fresh fruit	
Oranges	14.0
Other citrus fruit	9.6
Apples	36.4
Pears	5.4
Stone fruit	6.8
Bananas	15.0
Other fresh fruit	12.8
	100
Group 16—Fruit products	
Canned peaches, pears	10.0
Canned pineapple	4.0
Other canned or frozen fruit	13.4
Dried fruit	10.4
Fruit juices	62.2
	100

	Relative importance of individual foods within each group
Group 17—Beverages	
Tea	5.0
Instant coffee	1.0
Branded food drinks	0.5
Cocoa	0.5
Concentrated soft drinks	16.0
Ready-to-drink soft drinks	77.0
	100
Group 18—Milk	
Whole milk	88.6
Skimmed or semi-skimmed milk	11.4
	100
Group 19—Dairy products	
Condensed milk	4.4
Instant milk	2.4
Natural cheese	27.6
Processed cheese	1.8
Butter	22.4
Ice-cream, mousse	12.8
Yoghurt, other milk	18.0
Cream	4.0
Canned milk puddings	6.6
	100
Group 20—Nuts	
Desiccated coconut	10.8
Peanuts	31.6
Almonds	7.8
Chestnuts	1.6
Mixed nuts	10.4
Walnuts	3.6
Brazil nuts	2.2
Hazel nuts	1.6
Cashew nuts	2.2
Marzipan	9.4
Peanut butter	18.8
	100

Table 11: Weight factors used to calculate the amount of each 'Total Diet' food group eaten.

	Contribution to household diet as purchased (kg/person/d)	Loss/gain in preparation and cooking (%) (to nearest 5%)	Estimated weight of food group eaten (kg/person/d)
Bread	0.125	0	0.125
Other cereals	0.091	+15	0.105
Carcase meat	0.054	−40	0.032
Offals	0.003	−20	0.002
Meat products	0.064	−25	0.048
Poultry	0.029	−40	0.017
Fish	0.020	−20	0.016
Oils and fats	0.029	0	0.029
Eggs	0.029	−10	0.026
Sugar and preserves	0.080	0	0.080
Green vegetables	0.056	−25	0.042
Potatoes	0.179	−15	0.152
Other vegetables	0.079	−15	0.067
Canned vegetables	0.049	−15	0.042
Fresh fruit	0.077	−30	0.054
Fruit products	0.034	0	0.034
Beverages	0.147	+625	1.066
Milk	0.299	0	0.299
Dairy products	0.042	0	0.042
Nuts	0.002	0	0.002
Totals	1.488		2.280

APPENDIX V CONCLUSIONS FROM THE COMA PANEL ON NOVEL FOODS' REPORT ON NUTRITIONAL ASPECTS OF IRRADIATED FOODS

'The Panel has considered the evidence available on the effects of irradiation on nutrients.

Although much of the literature is incomplete and some reports appear to conflict, the general conclusions are that nutritional losses through irradiation are not considered to be significant in the diet as a whole.

Evidence from feeding animals over long periods of time and for several generations with diets sterilised by gamma-irradiation indicate no overall adverse nutritional effects except for those already noted in paragraph 77 and considered not relevant to human health.

The Panel supports the recommendation of the 1980 JECFI* that the irradiation of food up to an overall average dose of 10 kGy† introduces no special nutritional problems.

Special attention needs to be paid to foods that make a significant contribution to the intake of nutrients. For example, although reports in the literature are somewhat contradictory, there does appear to be evidence that there is some loss of vitamin C when potatoes are irradiated, and that there may be enhanced losses during subsequent storage. Since potatoes are a major contributor of vitamin C and of thiamin to the British diet this problem merits further investigation.

Attention has been drawn to the possible damage to vitamin E and to unsaturated fatty acids by irradiation in the presence of air. The effects of irradiation on foods which are important sources of polyunsaturated fatty acids should be kept under review.

Little is known about the effects of food processing including irradiation on folate. Since there are possible problems in the area of public health in relation to the intake of folate this needs further investigation.

Since food irradiation is a novel process there is a need for monitoring the extent of its use. Industry should assess the effects of irradiation on the nutrient content of the foods they propose to irradiate including carrying out simple analyses that are reliable. If there is any suspicion of nutrient damage then a dose-response relation should be determined. Government should monitor the nutrient content of irradiated foods under the existing arrangements for monitoring the nutrient content of all foods.'[57]

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*JECFI: The Joint FAO/IAEA/WHO Expert Committee on Food Irradiation. Now the Joint FAO/IAEA/WHO Expert Committee on the Wholesomeness of Irradiated Foods.

†kGy: The SI unit for radiation doses is the Gray (Gy). This is now used in place of the older unit, the rad (1Gy=100 rad). Doses used in food irradiation are usually quoted in kilograys (1 kilogray (kGy)=1000 Gy).

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