Department of Health and Social Security

Report on Health and Social Subjects

21

SUB-COMMITTEE ON NUTRITIONAL SURVEILLANCE: SECOND REPORT

Committee on Medical Aspects of Food Policy

London
Her Majesty's Stationery Office
£6.80 net

RHSS 21

COMMITTEE ON MEDICAL ASPECTS OF FOOD POLICY: SECOND REPORT

HMSO

Department of Health and Social Security

Report on Health and Social Subjects

21

SECOND REPORT BY THE SUB-COMMITTEE ON NUTRITIONAL SURVEILLANCE

Committee on Medical Aspects of Food Policy

London
Her Majesty's Stationery Office

First published 1981

ISBN 011 320751 4

Preface

In April 1971, the Government of the day announced changes in the provision of welfare milk for pregnant women and pre-schoolchildren, school milk and school meals. There was concern that these changes might have a detrimental effect on the nutritional status of children. Accordingly, the Committee on Medical Aspects of Food Policy was asked to consider the best method of assessing the changes and to make such recommendations as were deemed necessary.

A Sub-Committee of experts in the fields of paediatrics, nutrition, growth and epidemiology was set up and the results of its deliberations were published in 1973[1] by the Department of Health and Social Security as the First Report by the Sub-Committee on Nutritional Surveillance. In its report the Sub-Committee recommended that measurements of attained height and weight were the most reliable means of assessing nutritional status. Studies were designed to provide base-line information against which changes in growth rate could be compared. Because such changes, if any, were likely to be small, the Sub-Committee suggested that measurements should be made over a period of five years. Not all the studies started simultaneously and so the field work was not completed until July 1979.

This second report of the Sub-Committee is an account of the methods and findings of the various studies. Each study is reported separately by those from whom the work was commissioned. The final section gives the conclusions and recommendations of the Sub-Committee and has the approval and support of the Committee on Medical Aspects of Food Policy.

Thanks are due to the members of the Committee on Medical Aspects of Food Policy, and to the Chairman (Professor A M Thomson) and members of the Sub-Committee on Nutritional Surveillance. We are very grateful for the generous way in which they have given of their time and expertise.

HENRY YELLOWLEES
Chairman of the Committee on Medical Aspects of Food Policy

[1] Department of Health and Social Security, 1973.
Report on Health and Social Subjects, No. 6.
First Report by the Sub-Committee on Nutritional Surveillance London HMSO.

Sub-Committee on Nutritional Surveillance

Membership

Chairman:

Professor A M Thomson	MRC Reproduction and Growth Unit Princess Mary Maternity Hospital Newcastle-upon-Tyne

Members:

Professor J V G A Durnin	Institute of Physiology, University of Glasgow
Dr P C Elwood	MRC Epidemiology Unit, Cardiff
Professor H Goldstein	Department of Statistics and Computing Institute of Education University of London
Professor W W Holland	Department of Clinical Epidemiology and Social Medicine St Thomas's Hospital Medical School London
Professor R D G Milner	Department of Child Health University of Sheffield
Professor T E Oppé	Paediatric Unit St Mary's Hospital Medical School, London
Professor J M Tanner	Department of Growth and Development Institute of Child Health University of London
Professor J C Waterlow, CMG	Department of Human Nutrition London School of Hygiene and Tropical Medicine
Dr R G Whitehead	Dunn Nutritional Laboratory Milton Road, Cambridge

Secretariat

Scientific

Dr S J Darke	Department of Health and Social Security London

Administrative

Mr D K Smith	Department of Health and Social Security London

Assessors

Mr S Clayton Dr D H Buss	Ministry of Agriculture, Fisheries and Food London
Dr M A Heasman until 1975 Mr G Mitchell 1975–1979 Dr S Cole from 1979	Scottish Home and Health Department Edinburgh

Contents

1. Introduction

1.1 Terms of reference

These remained unchanged:—

1.1.1 To advise the Committee on Medical Aspects of Food Policy of the steps that should be taken to detect any effects upon the nutritional state of the community of changes which became effective from April 1971, in the arrangements for the provision of welfare milk, school milk and school meals, at a time when any harmful effects of the changes are likely to be mild and reversible.

1.1.2 To consider the long-term arrangements that would be required for the prediction and assessment of any nutritional effects of changes in relevant Government policy, whether social, economic or other.

1.2 Summary of relevant changes in the provision of school meals and milk and of welfare milk.

1.2.1 *School meals*

1.2.1.1 The charge for the school meal and the arrangement for remitting the charge on grounds of hardship are laid down by regulation. The charge, which was a standard one for all schools other than special schools, was increased from 1s 9d (9p) in April 1970 to 12p from April 1971 under proposals made in the White Paper *New Policies for Public Spending* of October 1970. The White Paper also announced the intention to increase the charge further to 14p in April 1973, and ultimately to make it cover the running cost of the meal. In fact, a further increase to 15p was not made until April 1975. Subsequent increases were to 25p in August 1977, 30p as from the beginning of the autumn term 1979 and to 35p in February 1980.

1.2.1.2 Parents who receive Supplementary Benefit have for some years been eligible for the provision of free school meals for their children without further enquiry, and a similar concession was applied to recipients of Family Income Supplement when this benefit was introduced in the autumn of 1971. The parents' income below which a child could have the benefit of free school meals has been suitably adjusted whenever there was an increase in the charge for school meals or when the Supplementary Benefit rates have been increased. Intensive and apparently successful publicity campaigns have been made in the schools concerning the availability of free school meals. Censuses are made in October of each year and Table 1.1 shows the number of pupils who received free

Table 1.1: *The number of schoolmeals provided free of charge in England and Wales*

Year (October)	Pupils receiving free meals (000's)	Percentage of pupils present	Percentage of all meals	Remarks
1970	627	8·3	12·2	School meals charge 9p.
1971	805	10·3	17·3	School meals charge 12p from summer term 1971. SB rates raised from Sept. 1971. Remission arrangements improved from September 1971.
1972	850	10·7	16·7	SB rates raised from October 1972. Remission arrangements improved from September 1972.
1973	795	9·7	14·7	SB rates raised from October 1973. Remission arrangements improved from September 1973.
1974	750	9·1	13·0	SB rates raised from July 1974. Remission arrangements improved from August 1974.
1975	784	9·3	13·3	School meals charge 15p from April 1975. SB rates raised from April 1975. Remission arrangements improved from April 1975.
1976	839	9·9	14·4	SB rates raised from Nov. 1975. Remission arrangements improved from November 1975.
1977	997	11·9	19·3	SB rates raised from Nov. 1976. Remission arrangements improved from November 1976. School meals charge 25p from August 1977 Remission arrangements further improved by a substantial amount as from August 1977.
1978	1,159	14·1	21·4	SB rates raised from Nov. 1977.
1979[1]	899	11·9	18·5	SB rates raised from Nov. 1978.

[1] Figures for England only.

Table 1.1: (cntd.) *The number of school meals provided free of charge in Scotland*

Year	Pupils receiving free meals (000's)	Percentage of Pupils present	Percentage of all meals
1970	96	11·3	25·61
1971	97	11·1	26·96
1972	144	16·6	29·71
1973	137	15·3	34·91
1974	130	14·0	30·35
1975	122	13·1	26·09
1976	1170	12·8	25·14
1977	118	12·7	24·75
1978	156	17·1	36·52
1979	143	15·9	33·25

Figures are taken from the Annual January Census.

The remarks in the right hand column of Table 1.1 apply also to the provision of school meals in Scotland.

school meals from 1970 until 1979 when 899,000 children received the meal free (11·9% of all children present at school and 18·5% of those taking the school meal). In accordance with previous custom, the free school meal remission benefit took account of the last increase in Supplementary Benefit rate in November 1979 but no account was taken of the increased cost of the meal at the beginning of the autumn term in 1979 and again in February 1980.

1.2.1.3 Proposed legislation which is contained in the Education (No 2) Bill (1980) has removed from Local Education Authorities their statutory duty to provide for every pupil, at a maintained school and on every school day, a mid-day meal suitable in all respects as the main meal of the day. Instead, Authorities will have discretion over the charges to be made and over what meals and refreshments they provide for pupils. Under the new Act, Authorities will be required to have regard to the needs of pupils from families in receipt of Supplementary Benefit or of Family Income Supplement, to ensure that any necessary provision is made for them in the middle of the day and to make the provision free of charge. Authorities will also have the power to remit the whole or part of any charge that would otherwise be made to any other pupils.

1.2.2 *School milk*

1.2.2.1 The White Paper of October 1970 announced the Government's intention, from September 1971, to discontinue the supply of free milk to pupils after the end of the summer term following their seventh birthday, except for children under 12 years of age with a certified medical entitlement. Younger pupils in nursery and primary schools and pupils in special schools were not to be affected.

1.2.2.2 These proposals were given effect in the Education (Milk) Act (1971) which, as amended by the Education Act of 1976, also authorized the making of regulations so that Local Education Authorities were empowered to provide milk on payment to any pupil at any school maintained by them, secondary as well as primary.

1.2.2.3 Under the provisions of the Education (No 2) Act (1980), Local Education Authorities will no longer be under a statutory obligation to provide free school milk, and the provision of milk and any charge to be made for it, will be at the discretion of individual Authorities.

1.2.3 *Welfare milk*

1.2.3.1 From 1940 onwards, under the Welfare Foods Scheme, all pregnant women and children up to the age of 5 years could receive one pint of liquid milk at not more than about one half the market price, with special arrangements for low income families to receive these supplements free. Since April 1971 the supply of half-price milk has been discontinued, although entitlement to free milk has been on a more generous scale (Welfare Food Order, 1971). The present position with regard to welfare milk is set out in Table 1.2.

Table 1.2: *Free Welfare Food Service—February 1980*

Beneficiaries	What They Receive	
	Milk	Vitamins
1. Expectant mothers and all children* under school age in families receiving SB, FIS, or who are in need because of low income.	7 pints liquid milk per week *or* *for infants under one year old* 2 packs per week of a proprietary brand of modified baby milk.	2 containers of 45 vit A D and C tablets every 13 weeks for expectant mothers and 5 containers in all for nursing mothers. 2 bottles of vitamin drops A, D, and C every 13 weeks for children under school age.
2. Handicapped children aged 5 to 16 who are not registered pupils at a school or special school	7 pints liquid milk per week	None
3. Children attending an approved day nursery or playgroup with an approved childminder	1/3 pint milk for each day they attend. (If attendance is by half-days then milk may be claimed for each child attending for each $\frac{1}{2}$ day).	As in 1

* Includes foster children under school age.

National Dried Milk

Before 1977, welfare milk tokens could be exchanged either for 7 pints of liquid milk per week or 1 pack of National Dried Milk. National Dried Milk was discontinued in February 1977 and proprietary brands of modified dried milk have since been offered to babies under one year old. Lactating mothers receive the liquid milk entitlement instead.

Change in categories of entitlement to welfare foods.

In December 1979, entitlement to free milk and vitamins was withdrawn from large young families (ie expectant mothers with two children under school age, and families with three or more children under school age) not receiving Supplementary Benefit, Family Income Supplement or in need because of low income.

Number of beneficiaries

In November 1978, in Great Britain, 422,500 estimated beneficiaries were receiving free welfare food tokens. This figure includes 63,400 beneficiaries in 'large young families' some of whom still qualify because of low income.

1.3 The general background

1.3.1 It is not easy to provide a definition of 'the nutritional state of the community' which distinguishes that concept from the general state of health, of

which nutritional status forms a part. Nutritional status may be taken to comprise those aspects of general health which can be causally related to the types and amounts of food consumed by members of the community, and which can be affected for better or worse by changes in diet.

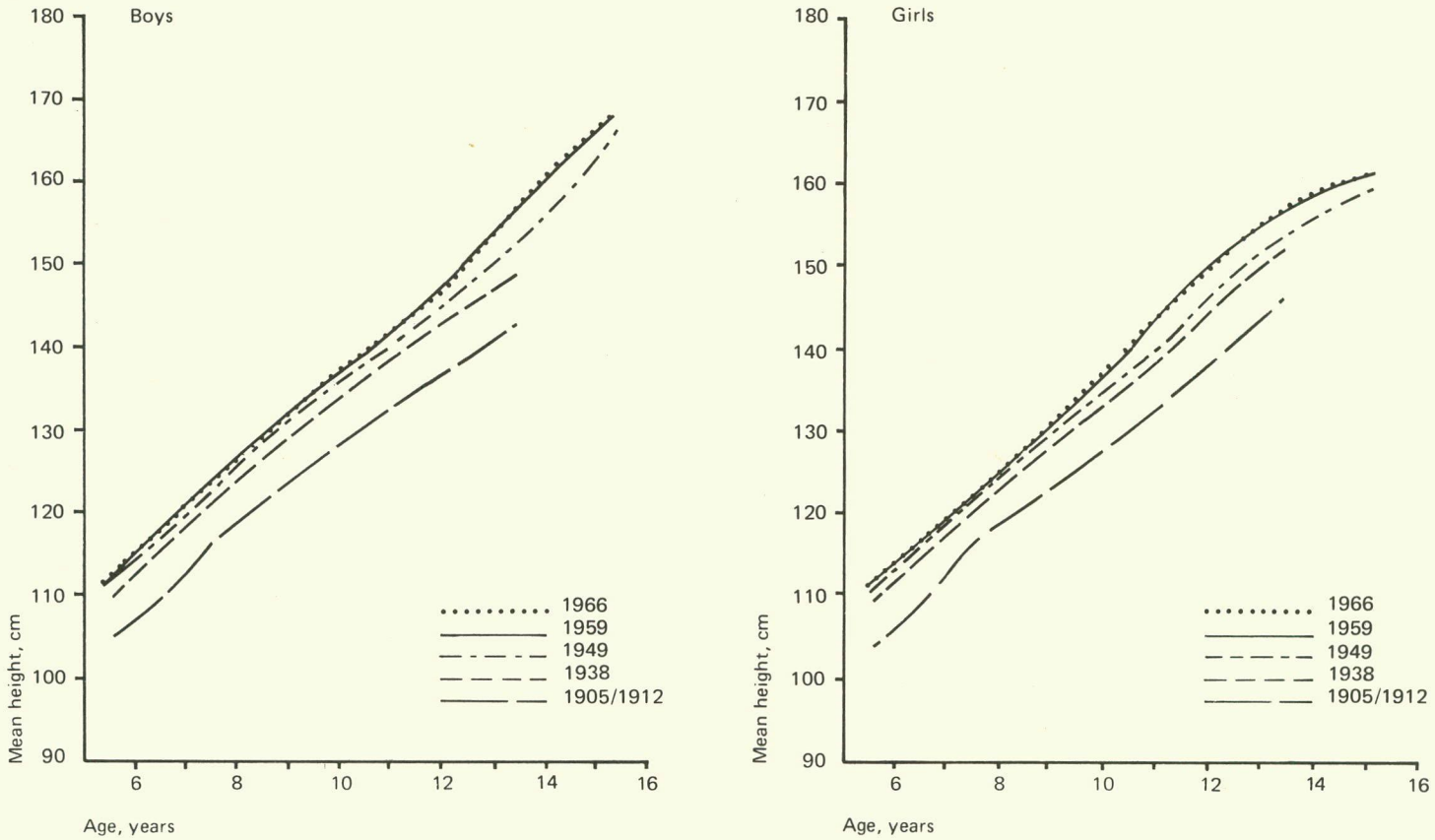
1.3.2 The First Report of the Sub-Committee described the uses and limitations of the available methods of nutritional surveillance under the conditions prevailing in Britain. These comprise dietary surveys, feeding experiments, measurements of growth in children, the diagnosis of clinical and biochemical signs of malnutrition, and the scrutiny of vital statistics directly or indirectly related to nutrition. Studies involving all these methods of approach, with the exception of clinical and biochemical surveys, have been used and the findings are described in the following sections of this report.

1.3.3 The relevance of dietary surveys and feeding trials is direct and obvious, but the diets consumed by population groups, families and individuals are difficult and expensive to measure accurately, and the measurements are even more difficult to interpret in terms of nutritional adequacy. Furthermore, the amounts and types of food consumed are influenced by a host of factors, such as the supplies available, habits and preferences, marketing methods and advertising, resources for the purchase of foods and for their preparation and consumption, physical activity, pathological conditions which may affect appetite and metabolism, and a multitude of other social and environmental influences which determine the behaviour of people living their ordinary lives. It should be noted, also, that the Sub-Committee was asked, in the first place, to consider the effects, if any, of changes in legislation affecting the supply of school milk and meals and of welfare milk, and that such supply formed only a small part of the overall diet of the women and children involved.

1.3.4 Growth, whether assessed directly in relation to diet by means of combined dietary and clinical surveys or by feeding trials, or assessed indirectly in relation to socio-economic status, has been considered by the Sub-Committee to be the most useful general index of nutritional status. Growth is determined mainly by genetics and is influenced by many factors other than diet, but attained height and weight can be measured fairly easily and accurately without causing much inconvenience or discomfort to the individual. There is also no doubt that poorly nourished children grow more slowly on average, and probably become smaller adults, than those who are well-nourished.

1.3.5 Age for age, the children of today are much taller and heavier than those of previous generations. Figure 1.1 shows the increase in average height of London schoolboys over the half century 1905 to 1959 (London County Council, 1955, 1961) and Table 1.3 shows the increase in height and weight of Glasgow schoolchildren over the same period. The remarkable improvement in growth during recent decades could scarcely have taken place without improving supplies and consumption of the body-building materials derived from food, even though it must be conceded that better growth has also been a consequence

Figure 1.1: *Mean heights of London schoolchildren between 1905/1912 and 1966*



SOURCE: Cameron, N. 1979.

Table 1.3: *Average height (inches) and weight (pounds) of Glasgow schoolchildren aged 5 and 13 years between 1910 and 1969*

Period	Boys				Girls			
	5 yrs		13 yrs		5 yrs		13 yrs	
	Ht.	Wt.	Ht.	Wt.	Ht.	Wt.	Ht.	Wt.
1910–1919	40·4	38·5	55·2	74·5	39·7	37·7	55·5	76·8
1930–1939	41·3	39·7	56·8	81·6	41·0	38·3	57·7	85·9
1960–1969	42·6	42·4	60·0	96·6	42·3	41·3	60·2	101·8

Source: Morris, J.N., 1975.

of better housing, more exercise and enormously reduced rates of infectious disease.

1.3.6 However, bigger is not necessarily better. There are grounds for believing that obesity has become more common among children as well as adults, and obsesity is associated with increased morbidity (Department of Health and Social Security, Medical Research Council, 1976). Increasing average weights in children and adults may therefore represent a deterioration of nutritional status rather than an improvement. There is, however, no reason to believe that this applies equally to increased linear growth, of which the main measurement is increase in stature. In the absence of pathological factors, such as endocrinological disease, increasing height can reasonably be assumed to represent better, ie more healthy, growth. Since milk is the main source of calcium, which is essential for skeletal growth, the measurement of height has been considered to be a relevant and useful approach to the ascertainment of nutritional status in the present context.

1.3.7 The Sub-Committee has therefore tried to find out whether changes in supplies of school milk and welfare milk have been associated with any significant changes in growth rate, especially in terms of height, among pre-school and primary school children. Measurements of height (in practice, of length) among newborn babies are not available, but an indication of fetal growth rates can be obtained from birth weights and the incidence of babies of low birth weight, both of which are routinely recorded.

1.3.8 The condition of infants and children in Britain has, in general, been remarkably satisfactory at least since the end of World War II, partly as a result of the special measures taken by successive Governments to protect their nutritional status. It was not anticipated that the legislative changes in 1971 would cause any dramatic deterioration in health, at least in the short term. Nevertheless, human growth continues for some 15–20 years, and even small and apparently insignificant changes may have important long-term consequences. For this reason, the measurement of growth should be regarded as an important basis for an approach to long-term surveillance.

1.3.9 The work of the Sub-Committee has so far been restricted to observations on fetal growth (para 1.3.7) and the growth of children who were directly affected by the 1971 legislative changes. But in the wider context of long-term nutritional surveillance, it is important that adults of all ages and both sexes should be covered. Obesity is considered 'to constitute one of the most important medical and public health problems of our time, whether we judge importance by a shorter expectation of life, increased morbidity or cost to the community in terms of both money and anxiety' (DHSS/MRC Group, 1976). This conclusion is, at present, based largely on the general impression that the problem of obesity is large and has been increasing. But we cannot know, unless we make systematic measurements, whether British adults are becoming taller and fatter, or whether economic stringency is leading to deterioration of adult physique. It may be complacent to assume that the only problems of adult nutrition are now those related to affluence and dietary excess.

1.3.10 Although the implications were not formally discussed, the deliberations of the Sub-Committee prior to the First Report took place at a time when the national economic climate in Britain was deteriorating with the consequence that public expenditure began to be restricted. There is, however, little evidence of much, or indeed any, decrease in the purchasing power of the ordinary citizen, although the rise in unemployment allows no room for complacency. Several members of the Sub-Committee are aware that, during their own professional lifetimes, a clear relationship was demonstrated in Britain between food, health and income (Boyd Orr, 1936). This became a major political issue during the 1930s and, indeed, led to the general institution of measures to improve the nutritional status of children and of pregnant and nursing women. These measures began one of the great success stories of public health in Britain, but times are changing and comfort should not be derived from the fact, described later in this report, that the 1971 changes in welfare food legislation had trivial and possibly unimportant consequences for health.

1.3.11 For the reasons given above, the Sub-Committee concentrated on the surveillance of milk consumption and on growth rates among children. But it also remained alert to evidence from vital statistics of morbidity and mortality. Reliable evidence on morbidity is scanty and what there is has not given rise to concern, except perhaps in relation to immigrant communities and those in the more impoverished areas of large cities. Statistics of perinatal and infant mortality and of low birth weight are summarized in a later section of this report.

1.3.12 Information from records prior to the establishment of the Sub-Committee was summarized in the First Report. During the course of the work of the Sub-Committee, several other problems relevant to nutritional status were examined by other sub-groups of the Committee on Medical Aspects of Food Policy, and a short summary of this parallel work helps to complete the background picture.

1.4 Other studies relevant to nutritional surveillance

1.4.1 The reappearance of vitamin D deficiency disease among adults (osteomalacia) and children (rickets) in Britain in the 1960s and 1970s was a matter of concern. Rickets was found to occur chiefly in young Asian children and Asian adolescents. Osteomalacia was found in Asian women of child-bearing age, especially when they became pregant, so that cases of fetal and neonatal rickets were reported. The disease also occurs among elderly people of all races when, for one reason or another, they become housebound. A Working Party was set up by the Committee on Medical Aspects of Food Policy to investigate the situation and to make recommendations about the fortification of foods with vitamin D. The Working Party advised that no fortification of additional foods such as flour or milk with vitamin D was necessary but that margarine, infant formulae and other foods should continue to be fortified as at present and that the provision of supplements of vitamin D under the Welfare Foods Scheme should also continue. The Working Party agreed that the problems of vitamin D deficiency could best be resolved by local Area Health Authorities giving priority to the education of all health professionals and of the Asians themselves about the importance of sunlight in the synthesis of vitamin D, and of the need for dietary supplements (Department of Health and Social Security, 1980).

1.4.2 Obesity in infancy and an increasing incidence of hypernatraemic dehydration in young infants were found to be associated with the early introduction of solid foods and the use of artificial feeds derived from dried cows' milk supplemented with vitamins A, C and D and with iron. The feeds were often made up inaccurately and were more concentrated than when manufacturer's instructions on the label were obeyed. The Committee on Medical Aspects of Food Policy reported in 1974 and recommended that breast-feeding, even for a few weeks and preferably for a few months, is best for the young infant but that when artificial feeding is preferred by the mother, or is necessary, only low-solute feeds should be given (Department of Health and Social Security, 1974). These feeds resemble human milk more closely than the high-solute unmodified cows' milk foods. As a result National Dried Milk (NDM) and the proprietary artificial milks of a similar formulation were taken off the market and arrangements were made for mothers who qualified for free NDM to have a more suitable modified milk free of charge (Table 1.2).

1.4.3 In 1975 a study of infant feeding practice in England and Wales was commissioned from the Office of Population Censuses and Surveys (Martin, 1978). The study revealed that only 51% of the mothers wanted to breast-feed and, by the time they left hospital, a third had given up the attempt and were bottle-feeding. The study indicated a need for more information to be given about infant feeding in the ante-natal period and for some changes in hospital practice in order to help others to establish lactation successfully. A second study to be made in 1980 has been commissioned and will be reported.

1.4.4 The surveillance of elderly people living in their own homes or with friends or relatives began in 1967/68. A sample of 1,000 elderly people aged 65

years or more was studied and 879 provided socio-economic information, a weighed dietary record for 7 consecutive days, blood for biochemical and haematological measurements, and radiographs of both hands. The sample was biassed in that there were equal numbers of men and women, and was not nationally representative. The survivors of the original sample were studied again in 1972/73 and in 1978 and the results of this 10 year longitudinal survey are being analysed. The cross-sectional findings in 1967/68 and in 1972/73 showed that, although mean daily intakes were smaller, the foods eaten and the dietary pattern were no different from what is known about the diet of younger adults. Malnutrition, when diagnosed, was found to be in association with debilitating clinical disease and, as might be expected in older people, the diagnosis was made more frequently in 1972/73 than in 1967/68 (Department of Health and Social Security 1972, 1979). A larger and nationally representative sample of elderly people was studied in 1973/4. When the analyses of these longitudinal and cross-sectional studies of elderly people are complete, an assessment of the relative merits of these types of study for surveillance will be possible and a base-line for the simplification of surveillance will have been achieved.

1.4.5 The Sub-Committee was aware that although surveillance programmes had been set up for pre-school and schoolchildren, and for the elderly, there was no information as to possible long-term trends in the stature of British adults. Obesity in adults is of importance for health and is possibly an increasing problem (Department of Health and Social Security, Medical Research Council, 1976). Plans have therefore been made to undertake a study of height and weight in a nationally representative sample of adults aged 16 to 65 years. This study has been commissioned by the Department of Health and Social Security from the Social Surveys Division of the Office of Population Censuses and Surveys.

References

Boyd Orr, J., 1936.
Food, health and income.
London, Macmillan.

Cameron, N., 1979.
Growth of London Schoolchildren, 1904–1966.
Annals of Human Biology, **6,** 505–525.

Department of Health and Social Security, 1972.
A nutrition survey of the elderly.
Reports on Health and Medical Subjects, No. 3.
London, HMSO.

Department of Health and Social Security, 1974.
Present day practice in infant feeding.
Report on Health and Social Subjects, No. 9.
London, HMSO.

Department of Health and Social Security, 1979.
Nutrition and health in old age.
Report on Health and Social Subjects, Nos. 16.
London, HMSO.

Department of Health and Social Security, 1980.
Rickets and osteomalacia.
Report on Health and Social Subjects, No. 19.
London, HMSO.

Department of Health and Social Security, Medical Research Council, 1976.
Research on obesity. A Report of the DHSS/MRC Group.
London, HMSO.

Education (Milk) Act, 1971.
Chapter 74.
London, HMSO.

Education Act, 1980.
Chapter 20.
London, HMSO.

London County Council, 1961.
Report on the heights and weights of school pupils in the County of London in 1959.
London, London County Council.

Martin, J., Office of Population Censuses and Surveys, 1978.
Infant feeding 1975: attitudes and practice in England and Wales.
London, HMSO.

Morris, J. N., 1975.
Uses of Epidemiology, 3rd edition.
London, Churchill Livingstone.

New Policies for Public Spending, 1970.
Cmnd. 4515
London, HMSO.

Thomson, A. M., 1978.
Fourth Boyd Orr Memorial Lecture. Problems and politics in nutritional surveillance.
Proceedings of the Nutritional Society, **37**, 317–332.

Welfare Food Order, 1971.
Statutory Instruments No. 457.
London, HMSO.

2. National Food Survey Special Study: Estimates of quantities of milk consumed in the home by individual members of households containing children, 1971–1978.

2.1 Summary

2.1.1 Data obtained from the National Food Survey between 1971 and 1978 provided no evidence of any significant lasting changes in milk consumption *in the home* resulting from the changes made in 1971 to the arrangements for welfare and school milk. This conclusion applies to all age groups, and milk consumption continued to vary inversely with age.

2.2 The Study

2.2.1 Following the announcement in October 1970 that the supply of welfare milk at a reduced price to young children and expectant mothers was to be discontinued in April 1971, and that the supply of free milk in schools to most children over seven years of age was to be discontinued in September of the same year, arrangements were made to produce special analyses of National Food Survey data which would highlight any changes which might take place in milk consumption in various types of families containing children under 10 years of age or an expectant mother. Two categories of analyses were planned. The first of these entailed tabulation of the quantities of milk obtained for consumption in the home by the household as a whole, plus quantities of milk obtained at school. The second category of analyses entailed tabulation of quantities of milk consumed in the home by various categories of *person*. With this second purpose in mind, special questions were introduced into the National Food Survey in mid-February 1971—the earliest date that this could be done. These questions required the housewife to record the quantities of milk drunk or consumed in beverages each day by each member of her family and also the quantities used in cooking or served to visitors.

2.2.2 For both categories of analyses, three broad groups of households were distinguished, namely:

Group I: housholds containing one or more children aged 0–4 years and/or an

expectant mother, but no child aged 7–9 years. This group includes all households which would have been entitled to welfare milk under the regulations applicable before April 1971, but excludes most (though not all) households containing a child who would have been eligible for free school milk under the old regulations but not under the new regulations. Sacrificing strict accuracy to brevity, this group is referred to below as "households affected by the change in arrangements for welfare milk but not by that for school milk".

Group II: households containing one or more children aged 7–9 years, but no expectant mother and no child aged 0–4 years. Virtually all the households in this group would contain at least one child whose entitlement to free school milk was removed by the new regulations, but virtually none of the households who were affected by the changes in regulations for welfare milk, although a very small quantity of welfare milk was recorded by this group owing to the presence of visitors in households in this group. For convenience, this group is referred to below as "households affected by the change in arrangements for school milk but not by that for welfare milk".

Group III: households containing at least one child aged 0–4 years and/or an expectant mother, and at least one child aged 7–9 years. For convenience, this group is referred to below as "households affected by the changes in arrangements for both welfare milk and school milk".

The system of coding and processing National Food Survey data which was in use at the time these groups were defined did not make it possible to match them more closely with households which were affected by the changes in the regulations for school milk (effectively, those households with children aged 7–10 years in junior schools). The matching could only be attempted in terms of distinguishing households containing children in either the age range 7 to 12 (ie under 13) years, or that from 10 to 12 years, or that from 7 to 9 years, the latter being the one which was adopted.

2.2.4 Results for these three groups are shown in Tables 2.1 to 2.4 for the period from 1971 to 1976, and the corresponding sample sizes are shown in Tables 2.5 to 2.7. Throughout this period, the three broad groups of households were further sub-divided into families in higher income groups and those in lower income groups. The income groups are defined in terms of the gross weekly income of the head of the household. Because of the continuing rise in money incomes, the point of sub-division between the higher and lower income groups is changed each year: it was £27 in 1971, £30 in 1972, £34 in 1973, £41 in 1974, £49 in 1975, £57 in 1976, £70 in 1977, and £80 in 1978.

2.2.5 A further (alternative) sub-division distinguished between families with only one or two children aged *under 10 years* and those with three or more such children. Subsequent to 1976 the analyses were extended to include all households with children under 18 years of age, but separate results for each of groups I, II and III have not be tabulated; however, the analyses do distinguish

Table 2.1: *Milk acquired by households containing children under 10 years of age or an expectant mother, and milk consumed by individuals therein, 1971–1976 (pints per person per week)*

	1971				1972	1973	1974	1975	1976
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec					
I Households affected by the change in arrangements for welfare milk but not by that for school milk.									
(i) Milk acquired:									
Full price milk	2·48	4·21	4·29	4·40	4·34	4·61	4·61	4·64	4·56
Welfare milk	2·38	0·26	0·14	0·20	0·18	0·11	0·09	0·08	0·05
School milk	0·10	0·06	0·04	0·07	0·07	0·08	0·08	0·09	0·09
Total	4·93	4·53	4·47	4·67	4·58	4·81	4·78	4·81	4·70
(ii) Consumption in the home by:									
individuals aged 0–4	4·6	4·6	4·7	5·1	4·7	4·7	4·8	4·7	4·5
individuals aged 5–6	4·5	4·3	4·0	4·6	4·4	4·3	4·4	4·5	4·3
individuals aged 7–9	—	—	—	—	—	—	—	—	—
individuals aged 10–14	3·6	4·2	3·4	3·5	3·7	4·3	4·6	4·3	4·1
individuals aged 15–17	3·2	3·1	2·7	2·8	3·9	3·9	4·1	3·4	3·8
males aged 18 or over	3·7	3·4	3·5	3·4	3·7	3·7	3·7	3·9	3·8
females aged 18 or over	4·0	3·3	3·5	3·3	3·5	3·6	3·5	3·7	3·7
pregnant females	5·2	5·2	5·0	4·4	4·6	5·2	5·4	5·3	5·1
All above	4·2	3·9	3·9	4·0	4·0	4·1	4·1	4·2	4·1
Visitors and cooking	0·7	0·6	0·5	0·6	0·5	0·6	0·5	0·6	0·5
Total	4·9	4·5	4·4	4·6	4·5	4·7	4·6	4·7	4·6

	1971				1972	1973	1974	1975	1976
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec					
II Households affected by the change in arrangements for school milk but not by that for welfare milk.									
(i) Milk acquired:									
Full price milk	4·38	4·35	4·42	4·51	4·21	4·47	4·38	4·43	4·35
Welfare milk	0·01	—	—	—	...	—	...	—	...
School milk	0·44	0·20	0·09	0·12	0·10	0·11	0·11	0·12	0·12
Total	4·83	4·55	4·51	4·63	4·32	4·58	4·48	4·55	4·47
(ii) Consumption in the home by:									
individuals aged 0–4	—	—	—	—	—	—	—	—	—
individuals aged 5–6	3·6	4·2	4·5	4·6	4·4	4·4	4·6	4·1	4·5
individuals aged 7–9	4·2	4·4	4·5	4·8	4·6	4·7	4·5	4·5	4·4
individuals aged 10–14	3·9	4·2	4·1	4·2	4·2	4·3	4·2	4·3	4·3
individuals aged 15–17	4·3	3·7	3·3	4·4	3·6	3·9	3·8	4·0	3·9
males aged 18 or over	3·8	3·4	3·3	3·5	3·3	3·6	3·4	3·6	3·6
females aged 18 or over	3·3	3·1	3·3	3·2	3·0	3·3	3·3	3·3	3·2
pregnant females	—	—	—	—	—	—	—	—	—
All above	3·8	3·8	3·8	4·0	3·8	4·0	3·9	3·9	3·9
Visitors and cooking	0·6	0·6	0·6	0·5	0·5	0·5	0·5	0·5	0·5
Total	4·5	4·3	4·4	4·5	4·3	4·4	4·4	4·5	4·4

	1971				1972	1973	1974	1975	1976
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec					
III Households affected by the changes in arrangements for both welfare and school milk.									
(i) Milk acquired:									
Full price milk	3·13	3·81	3·99	4·17	4·01	4·17	4·26	4·42	4·38
Welfare milk	1·32	0·23	0·08	0·16	0·17	0·09	0·09	0·03	0·05
School milk	0·38	0·21	0·12	0·15	0·14	0·14	0·16	0·18	0·15
Total	4·83	4·25	4·19	4·48	4·32	4·40	4·51	4·63	4·57
(ii) Consumption in the home by:									
individuals aged 0–4	5·2	4·4	4·5	4·3	4·6	4·7	4·7	4·7	4·5
individuals aged 5–6	4·0	4·3	3·6	3·8	4·0	4·1	4·1	4·2	4·2
individuals aged 7–9	4·5	4·0	3·9	3·9	4·0	4·2	4·2	4·2	4·2
individuals aged 10–14	4·4	3·2	3·7	3·8	3·8	3·7	4·0	4·3	4·0
individuals aged 15–17	2·8	2·8	4·1	3·2	3·6	3·0	2·9	3·9	3·0
males aged 18 or over	3·1	3·3	2·9	3·4	3·3	3·4	3·5	3·6	3·6
females aged 18 or over	3·6	2·9	2·7	3·1	3·0	3·2	3·2	3·5	3·5
pregnant females	—	—	*	*	4·6	4·0	5.3	5·6	3·9
All above	4·1	3·7	3·6	3·7	3·8	3·9	4·0	4·1	4·0
Visitors and cooking	0·6	0·6	0·4	0·5	0·4	0·4	0.4	0·5	0·5
Total	4·8	4·3	4·0	4·2	4·2	4·2	4·4	4·6	4·4

(a) Except that the averages of *consumption* relate to the period from mid-February to end March 1971.
* Fewer than 3 persons.
— No milk recorded.
. . . An average of less than 0·01 pint/person/week recorded.

Table 2.2: *Milk acquired by households containing children under 10 years of age or an expectant mother and milk consumed by individuals therein, 1971–1976 (pints per person per week)*

I. Households affected by the change in arrangements for welfare milk but not by that for school milk

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
A. Households in higher income groups									
(i) Milk acquired:									
Full price milk	2·56	4·45	4·66	4·78	4·71	4·74	4·77	4·75	4·62
Welfare milk	2·37	0·21	0·04	0·03	0·05	0·04	0·04	0·04	0·03
School milk	0·10	0·07	0·03	0·07	0·07	0·09	0·09	0·09	0·09
Total	5·03	4·73	4·73	4·88	4·83	4·88	4·89	4·88	4·73
(ii) Consumption in the home by:									
individuals aged 0–4	4·7	4·6	4·8	5·0	4·9	4·7	4·7	4·7	4·4
individuals aged 5–6	4·6	4·4	4·3	4·4	4.5	4·4	4·5	4·5	4·3
individuals aged 7–9	—	—	—	—	—	—	—	—	—
individuals aged 10–14	3·5	4·4	3·5	4·4	4·1	4·4	4·6	4·8	3·8
individuals aged 15–17	*	4·8	2·8	3·1	3·6	4·1	4·6	3·4	3·6
males aged 18 or over	4·0	3·6	3·6	3·4	3·8	3·8	3·8	3·8	3·8
females aged 18 or over	3·6	3·5	3·6	3·5	3·6	3·8	3·6	3·7	3·7
pregnant females	6·2	5·2	5·9	4·5	4·8	5·3	5·5	5·3	5·3
All above	4·2	4·0	4·1	4·1	4·2	4·2	4·2	4·2	4·1
Visitors and cooking	0·8	0·7	0·5	0·6	0·6	0·6	0·6	0·6	0·6
Total	5·0	4·7	4·6	4·7	4·7	4·7	4·8	4·7	4·6

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
B. Households in lower income groups									
(i) Milk acquired:									
Full price milk	2·37	3·94	3·76	3·88	3·86	4·30	4·39	4·47	4·47
Welfare milk	2·32	0·31	0·27	0·43	0·34	0·26	0·17	0·16	0·12
School milk	0·10	0·06	0·06	0·08	0·07	0·07	0·07	0·08	0·08
Total	4·79	4·31	4·09	4·39	4·27	4·62	4·63	4·70	4·66
(ii) Consumption in the home by:									
individuals aged 0–4	4·7	4·7	4·6	5·2	4·4	4·8	4·8	4·7	4·6
individuals aged 5–6	4·2	4·3	3·8	4·9	4·3	4·1	4·6	4.6	4·2
individuals aged 7–9	—	—	—	—	—	—	—	—	—
individuals aged 10–14	3·6	4·0	3·2	2·8	3·3	3·9	4·2	3·6	4·7
individuals aged 15–17	3·5	2·0	2·5	2·7	4·2	3·9	3·7	3·2	4·4
males aged 18 or over	3·6	3·2	3·4	3·4	3·5	3·6	3·6	4·1	3·9
females aged 18 or over	4·4	3·2	3·3	2·9	3·3	3·5	3·3	3·6	3·7
pregnant females	*	*	4·0	4·2	4·4	5·5	5·2	5·4	4·6
All above	4·2	3·8	3·8	3·9	3·8	4·0	4·0	4·2	4·2
Visitors and cooking	0·6	0·5	0·4	0·5	0·4	0·5	0·5	0·5	0·5
Total	4·8	4·3	4·1	4·4	4.2	4·5	4·5	4·7	4·6

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
C. Households containing 1 or 2 children under 10 years of age									
(i) Milk acquired:									
Full price milk	2·51	4·20	4·42	4·54	4·49	4·71	4·70	4·78	4·62
Welfare milk	2·42	0·27	0·08	0·12	0·11	0·08	0·06	0·06	0·04
School milk	0·06	0·06	0·04	0·07	0·05	0·06	0·07	0·07	0·07
Total	4·99	4·53	4·54	4·73	4·65	4·85	4·83	4·91	4·73
(ii) Consumption in the home by:									
individuals aged 0–4	4·7	4·6	4·7	5·1	4·7	4·8	4·8	4·6	4·5
individuals aged 5–6	4·4	4·4	4·1	4·8	4·5	4·5	4·5	4·6	4·4
individuals aged 7–9	—	—	—	—	—	—	—	—	—
individuals aged 10–14	4·0	4·0	4·3	3·7	4·5	5·0	4·5	5·2	5·1
individuals aged 15–17	3·2	3·4	2·9	2·8	4·2	4·2	3·9	3·4	4·1
males aged 18 or over	3·9	3·4	3·7	3·4	3·8	3·8	3·8	4·0	3·8
females aged 18 or over	4·2	3·4	3·6	3·4	3·5	3·7	3·6	3·7	3·8
pregnant females	5·2	5·2	5·0	4·4	4·7	5·2	5·4	5·4	5·0
All above	4·3	3·9	4·0	4·1	4·1	4.2	4·1	4·2	4·1
Visitors and cooking	0·7	0·6	0·5	0·6	0·5	0·6	0·6	0·6	0·6
Total	5·0	4.5	4·5	4·7	4·6	4·7	4·7	4·8	4·7

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
D. Households containing 3 or more children under 10 years of age									
(i) Milk acquired:									
Full price milk	2·38	4·26	3·86	3·91	3·78	4·23	4·19	4·01	4·23
Welfare milk	2·05	0·19	0·33	0·47	0·41	0·24	0·23	0·20	0·14
School milk	0·28	0·11	0·06	0·07	0·10	0·17	0·13	0·14	0·16
Total	4·71	4·56	4·25	4·45	4·29	4·63	4·54	4·34	4·52
(ii) Consumption in the home by:									
individuals aged 0–4	4·4	4·6	5·1	5·0	4·6	4·5	4·6	4·7	4·3
individuals aged 5–6	4·6	4·2	4·0	4·3	4·2	4·0	4·4	4·4	4·0
individuals aged 7–9	—	—	—	—	—	—	—	—	—
individuals aged 10–14	3·4	4·3	3·0	3·5	3·4	3·9	4·6	3·8	3·6
individuals aged 15–17	—	*	2·0	2·9	3·3	3·3	4·2	3·2	3·2
males aged 18 or over	3·4	3·7	2·4	3·2	3·2	3·4	3·5	3·2	3·7
females aged 18 or over	2·5	3·1	2·7	2·9	3·0	3·5	3.1	3·1	3·3
pregnant females	—	—	*	—	3.8	6·1	*	*	*
All above	3·7	4·0	3·6	3·9	3·8	3·9	4·1	3·9	3·8
Visitors and cooking	0·6	0·6	0·3	0·4	0·4	0·5	0·5	0·4	0·5
Total	4·3	4·6	3·9	4·3	4·2	4·4	4·5	4·3	4·2

(a) Except that the averages of *consumption* relate to the period from mid-February to end March 1971

* Fewer than 3 persons

— No milk recorded

Table 2.3: *Milk acquired by households containing children under 10 years of age or an expectant mother and milk consumed by individuals therein, 1971–1976 (pints per person per week)*

II. *Households affected by the change in arrangements for school milk but not by that for welfare milk*

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
A. Households in higher income groups									
(i) Milk acquired:									
Full price milk	4·63	4·55	4·61	4·72	4·43	4·60	4·54	4·49	4·37
Welfare milk	0·02	—	—	—	...	—	...	—	—
School milk	0·47	0·20	0·10	0·12	0·11	0·11	0·11	0·13	0·13
Total	5·12	4·75	4·71	4·84	4·54	4·71	4·65	4·62	4·50
(ii) Consumption in the home by									
individuals aged 0–4	—	—	—	—	—	—	—	—	—
individuals aged 5–6	3·8	4·0	4·9	4·8	4·4	4·5	4·9	4·0	4·7
individuals aged 7–9	4·1	4·3	4·6	5·1	4·8	4·8	4.6	4·6	4·5
individuals aged 10–14	4·2	4·4	4·5	4·5	4·5	4·4	4·3	4·4	4·4
individuals aged 15–17	3·7	4·0	3·1	5·4	3·6	4·0	4·0	4·1	4·1
males aged 18 or over	4·0	3·5	3·6	3·5	3·4	3·6	3·4	3·6	3·6
females aged 18 or over	3·4	3·3	3·5	3·3	3·2	3·5	3·4	3·4	3·2
pregnant females	—	—	—	—	—	—	—	—	—
All above	3·9	3·8	4·0	4·2	3·9	4·1	4·0	4·0	3·9
Visitors and cooking	0·8	0·6	0·6	0·6	0·6	0·5	0·6	0·5	0·5
Total	4·7	4·5	4·6	4·8	4·5	4·6	4·5	4·5	4·4

	1971								
	Jan-Mar[a]	Apr-June	July-Sep	Oct-Dec	1972	1973	1974	1975	1976
B. Households in lower income groups									
(i) Milk acquired:									
Full price milk	4·12	4·07	4·15	4·12	3·92	4·20	4·09	4·30	4·27
Welfare milk	—	—	—	—	—	—	—	—	—
School milk	0·41	0·20	0·08	0·13	0·10	0·09	0·11	0·12	0·10
Total	4·53	4·27	4·23	4·25	4·02	4·28	4·20	4·42	4·37
(ii) Consumption in the home by:									
individuals aged 0–4	—	—	—	—	—	—	—	—	—
individuals aged 5–6	3·5	4·7	4·0	4·3	4·2	4·2	4·3	4·1	4·2
individuals aged 7–9	4·4	4·6	4·3	4·3	4·3	4·4	4·3	4·4	4·3
individuals aged 10–14	3·4	3·8	3·6	3·6	3·8	4·0	4·1	4·3	4·0
individuals aged 15–17	4·8	3·2	3·5	3·3	3·6	3·8	3·5	3·9	3·6
males aged 18 or over	3·6	3·1	2·8	3·6	3·1	3·4	3·3	3·7	3·6
females aged 18 or over	3·1	2·9	3·0	3·1	2·8	3·0	3·1	3·2	3·2
pregnant females	—	—	—	—	—	—	—	—	—
All above	3·7	3·7	3·5	3·7	3·5	3·7	3·7	3·9	3·8
Visitors and cooking	0·4	0·5	0·5	0·4	0·4	0·4	0·4	0·5	0·5
Total	4·2	4·1	4·0	4·1	4·0	4·1	4·1	4·4	4·3

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
C. Households containing 1 or 2 children under 10 years of age									
(i) Milk acquired:									
Full price milk	4·59	4·38	4·60	4·55	4·43	4·66	4·49	4·53	4·39
Welfare milk	0·01	—	—	—	—	—	—	—	—
School milk	0·38	0·18	0·08	0·10	0·10	0·10	0·11	0·12	0·12
Total	4·98	4·56	4·68	4·65	4·53	4·76	4·60	4·65	4·51
(ii) Consumption in the home by:									
individuals aged 0–4	—	—	—	—	—	—	—	—	—
individuals aged 5–6	3·8	4·5	4·4	4·8	4·5	4·7	4·8	4·1	4·6
individuals aged 7–9	4·3	4·4	4·6	5·0	4·8	4·9	4·6	4·6	4·5
individuals aged 10–14	4·0	4·4	4·2	4·4	4·5	4·6	4·4	4.5	4·5
individuals aged 15–17	4·3	3·6	3·2	3·9	3·8	4·5	4·0	4·1	3·8
males aged 18 or over	3·7	3·5	3·3	3·6	3·4	3·7	3·4	3·7	3·6
females aged 18 or over	3·2	3·2	3·5	3·2	3·1	3·4	3·4	3·4	3·2
pregnant females	—	—	—	—	—	—	—	—	—
All above	3·8	3·8	3·8	4·0	3.9	4·1	3·9	4·0	3·9
Visitors and cooking	0·7	0·6	0·6	0·6	0·6	0·5	0·5	0·6	0.6
Total	4·5	4·4	4·4	4·6	4·4	4·6	4·4	4·5	4·4

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
D. Households containing 3 or more children under 10 years of age									
(i) Milk acquired									
Full price milk	4·05	4·29	4·12	4·44	3·81	4·14	4·18	4·21	4·24
Welfare milk	—	—	—	—	—	—	—	—	—
School milk	0·54	0·24	0·10	0·16	0·12	0·12	0·11	0·13	0·12
Total	4·59	4·53	4·22	4·60	3·93	4·26	4·29	4·34	4·35
(ii) Consumption in the home by:									
individuals aged 0–4	—	—	—	—	—	—	—	—	—
individuals aged 5–6	3·4	4·1	4·7	4·3	4·2	4.2	4·5	4·0	4·4
individuals aged 7–9	4·0	4·4	4·2	4·5	4·1	4·3	4·5	4·3	4·3
individuals aged 10–14	3·8	4·0	4·0	4·0	3·8	4·0	4·2	4·3	4·2
individuals aged 15–17	4·3	3·7	3·5	5·1	3·2	3·1	3·5	3·5	3·9
males aged 18 or over	4·2	3·0	3·4	3·2	3·0	3·3	3·3	3·4	3·6
females aged 18 or over	3·3	2·8	2·9	3.2	2·9	3·0	3·2	3·2	3·2
pregnant females	—	—	—	—	—	—	—	—	—
All above	3·8	3·7	3·8	4·0	3·5	3·7	3·9	3·9	3·9
Visitors and cooking	0·5	0·5	0·5	0·4	0·4	0·4	0·5	0·4	0·4
Total	4·3	4·2	4·3	4·4	3·9	4·1	4·3	4·3	4·3

(a) Except that the averages of *consumption* relate to the period from mid-February to end March 1971.
— No milk recorded
. . . An average of less than 0·01 pint/person/week recorded

Table 2.4: *Milk acquired by households containing children under 10 years of age or an expectant mother, and milk consumed by individuals therein, 1971–1976 (pints per person per week)*

III *Households affected by the changes in arrangements for both welfare milk and school milk*

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
A. Households in higher income groups									
(i) Milk acquired:									
Full price milk	3·98	4·24	4·36	4·72	4·43	4·47	4·51	4·63	4·50
Welfare milk	1·29	0·20	—	—	0·01	0·02	0·01	0·01	0·01
School milk	0·41	0·20	0·09	0·18	0·15	0·13	0·16	0·18	0·14
Total	5·68	4·64	4·45	4·90	4·59	4·62	4·68	4·81	4·65
(ii) Consumption in the home by:									
individuals aged 0–4	5·6	4·3	4·6	4·2	4·8	4·8	4·5	4·9	4·5
individuals aged 5–6	5·7	4·3	4·0	3·8	4·2	4·3	4·2	4.3	4·5
individuals aged 7–9	5·4	4·2	4·3	4·1	4·2	4·4	4·3	4·4	4·3
individuals aged 10–14	6·3	3·4	4·2	4·0	4·2	4·2	4·1	4·3	3·9
individuals aged 15–17	*	*	4·6	*	4·3	2·9	2·9	4·1	3·2
males aged 18 or over	3·9	3·6	2·9	3·6	3·4	3·5	3·4	3·5	3·7
females aged 18 or over	4·6	3·1	3·0	3·5	3·2	3·3	3·3	3·6	3·6
pregnant females	—	—	*	*	5·3	4·4	4·7	*	4·1
All above	5·1	3·8	3·9	3·9	4·0	4·0	4·0	4·2	4·1
Visitors and cooking	0·8	0·6	0·4	0·6	0·4	0·5	0·5	0·5	0·6
Total	5·9	4·4	4·3	4·6	4·5	4·5	4·5	4·7	4·6

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
B. Households in lower income groups									
(i) Milk acquired:									
Full price milk	2·41	3·45	3·56	3·74	3·56	3·68	3·97	4·12	4·08
Welfare milk	1·33	0·26	0·18	0·28	0·31	0·20	0·21	0·06	0·12
School milk	0·35	0·27	0·14	0·13	0·14	0·15	0·15	0·18	0·16
Total	4·09	3·93	3·88	4·15	4·02	4·03	4·33	4·36	4·37
(ii) Consumption in the home by:									
individuals aged 0–4	4·9	4·5	4·4	4·4	4·4	4·5	5.0	4·2	4·6
individuals aged 5–6	2·8	4·4	3·2	3·8	3·6	3·5	3·9	4·3	3·7
individuals aged 7–9	3·6	3·8	3·5	3·8	3·8	3·8	4·0	4·0	4·1
individuals aged 10–14	3·0	3·0	3·0	3·7	3·4	3·8	3·9	4·2	3·9
individuals aged 15–17	2·5	3·4	2·8	2·7	3·2	2·9	3·0	3·2	2·6
males ages 18 or over	2·4	3·1	2·9	3·2	3·1	3·2	3·7	3·7	3·5
females aged 18 or over	2·6	2·6	2·3	2·6	2·8	2·9	3·1	3·3	3·2
pregant females	—	—	—	—	2·0	5·0	7·7	*	5·0
All above	3·3	3·6	3·3	3·6	3·5	3·5	3·9	3·9	3·9
Visitors and cooking	0·6	0·6	0·4	0·4	0·3	0·3	0·3	0·5	0·4
Total	3·8	4·2	3·6	4·0	3·9	3·8	4·2	4·3	4·2

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
C. Households containing 1 or 2 children under 10 years of age.									
(i) Milk acquired:									
Full price milk	3·01	4·35	4·58	4·66	4·65	4·54	4·56	4·57	4·43
Welfare milk	1·51	0·19	0·06	—	0·02	0·04	0·03	0·03	0·02
School milk	0·29	0·16	0·11	0·12	0·07	0·11	0·14	0·13	0·13
Total	4·81	4·70	4·75	4·78	4·74	4·69	4·73	4·73	4·58
(ii) Consumption in the home by:									
individuals aged 0–4	4·1	4·8	4·7	4·5	4·8	4·9	4·5	4·6	4·3
individuals aged 5–6	—	—	—	—	*	*	*	—	*
individuals aged 7–9	4·8	4·6	5·0	4·4	4·5	4·6	4·4	4·4	4·2
individuals aged 10–14	—	—	—	*	*	*	*	*	*
individuals aged 15–17	—	*	*	*	*	3·0	3·7	4·1	3·2
males aged 18 or over	3·1	3·0	3·5	3·6	3·4	3·4	3·8	3·7	3·7
females aged 18 or over	3·5	3·1	3·2	2·8	3·4	3·1	3·5	3·8	3·7
pregnant females	—	—	*	*	4·0	5·0	5·6	4·9	4·4
All above	3·8	3·8	4·1	3·8	4·0	4·0	4.1	4·1	4·0
Visitors and cooking	0·7	0·5	0·4	0·7	0·5	0.5	0·5	0·6	0·5
Total	4·5	4·3	4·5	4·4	4·6	4·5	4·6	4·7	4·4

	1971								
	Jan-Mar[a]	Apr-June	July-Sept	Oct-Dec	1972	1973	1974	1975	1976
D. Households containing 3 or more children under 10 years of age.									
(i) Milk acquired:									
Full price milk	3·15	3·72	3·86	4·07	3·89	4·05	4·19	4·40	4·35
Welfare milk	1·28	0·24	0·09	0·19	0·20	0·11	0·11	0·03	0·05
School milk	0·39	0·22	0·12	0·16	0·16	0·16	0·11	0·19	0·15
Total	4·82	4·18	4·07	4·42	4·25	4·31	4·46	4·62	4·55
(ii) Consumption in the home by:									
individuals aged 0–4	5·5	4·3	4·5	4·2	4·6	4·6	4·8	4·7	4·6
individuals aged 5–6	4·0	4·3	3·6	3·8	4·0	4·1	4.1	4·2	4·3
individuals aged 7–9	4·5	3·8	3·7	3·8	3·9	4·0	4·2	4·2	4·3
individuals aged 10–14	4·4	3·2	3·7	3·8	3·7	3·7	3·9	4·3	4·0
individuals aged 15–17	2·8	3·2	4·2	3·8	3·7	3·2	2·6	3·9	3·0
males aged 18 or over	3·1	3·4	2·7	3·4	3·2	3·3	3·4	3·5	3·6
females aged 18 or over	3·6	2·8	2·5	3·1	2·8	3·1	3·1	3·4	3·5
pregnant females	—	—	*	*	4·6	3·8	5.3	*	*
All above	4·2	3·6	3·5	3·7	3·8	3·8	3·9	4.1	4·0
Visitors and cooking	0·6	0·6	0·4	0·5	0·4	0.4	0·4	0·5	0·5
Total	4·8	4·2	3·9	4·2	4·2	4·2	4·3	4·5	4·5

(a) Except that the averages of *consumption* relate to the period from mid-February to end March 1971.

* Fewer than 3 persons.

Table 2.5: *Numbers of persons and of households recording quantities of milk consumed*

I. *Households affected by the change in arrangements for welfare milk but not that for school milk.*

	1971								
	Feb–Mar	Apr–June	July–Sept	Oct–Dec	1972	1973	1974	1975	1976
A. Households in higher income groups									
No of households	76	140	146	169	632	798	535	624	669
No of individuals aged 0–4	106	187	182	215	802	1042	671	803	842
No of individuals aged 5–6	23	29	31	37	152	221	140	165	182
No of individuals aged 7–9	—	—	—	—	—	—	—	—	—
No of individuals aged 10–14	11	18	25	19	84	114	88	76	75
No. of individuals aged 15–17	2	4	11	6	33	36	16	28	33
No of males aged 18 or over	81	137	145	170	661	837	559	664	697
No of females aged 18 or over	77	141	150	160	624	776	530	621	649
No of pregnant females	4	6	7	15	60	77	38	43	59
Total no of persons	304	522	551	622	2416	3103	2042	2400	2537
B. Households in lower income groups									
No of households	56	122	91	92	461	335	388	367	329
No of individuals aged 0–4	74	166	116	131	620	446	493	454	414
No of individuals aged 5–6	9	27	34	28	96	82	84	86	81
No of individuals aged 7–9	—	—	—	—	—	—	—	—	—
No of individuals aged 10–14	10	18	13	25	78	37	36	65	60
No of individuals aged 15–17	4	6	8	12	35	20	20	23	13
No of males aged 18 or over	60	125	91	88	474	344	398	381	330
No of females aged 18 or over	60	133	94	98	460	349	398	369	349
No of pregnant females	2	1	6	6	41	21	29	29	23
Total no of persons	219	476	362	388	1804	1299	1458	1407	1270

	1971								
	Feb–Mar	Apr–June	July–Sept	Oct–Dec	1972	1973	1974	1975	1976
C. Households containing 1 or 2 children under 10 years of age.									
No of households	114	233	204	221	943	986	811	878	896
No of individuals aged 0–4	151	306	244	270	1133	1216	976	1063	1093
No of individuals aged 5–6	19	38	38	43	166	192	144	174	183
No of individuals aged 7–9	—	—	—	—	—	—	—	—	—
No of individuals aged 10–14	4	8	11	8	46	52	36	47	44
No of individuals aged 15–17	6	8	14	11	41	44	19	42	34
No of males aged 18 or over	122	233	201	220	978	1025	836	920	921
No of females aged 18 or over	118	243	210	215	932	969	808	866	885
No of pregnant females	6	7	12	21	94	94	66	70	80
Total no of persons	426	843	730	788	3390	3592	2885	3182	3240
D. Households containing 3 or more children under 10 years of age.									
No of households	18	29	33	40	150	147	112	113	102
No of individuals aged 0–4	29	47	54	76	289	272	188	194	163
No of individuals aged 5–6	13	18	27	22	82	111	80	77	80
No of individuals aged 7–9	—	—	—	—	—	—	—	—	—
No of individuals aged 10–14	17	28	27	36	116	99	88	94	91
No of individuals aged 15–17	—	2	5	7	27	12	17	9	12
No of males aged 18 or over	19	29	35	38	157	156	121	125	106
No of females ages 18 or over	19	31	34	43	152	156	120	124	113
No of pregnant females	—	—	1	—	7	4	1	2	2
Total no of persons	97	155	183	222	830	810	615	625	567

	1971								
	Feb–Mar	Apr–June	July–Sept	Oct–Dec	1972	1973	1974	1975	1976
E. All households*									
No of households	132	262	237	261	1093	1133	923	991	998
No of individuals aged 0–4	180	353	298	346	1422	1488	1164	1257	1256
No of individuals aged 5–6	32	56	65	65	248	303	224	251	263
No of individuals aged 7–9	—	—	—	—	—	—	—	—	—
No of individuals aged 10–14	21	36	38	44	162	151	124	141	135
No of individuals aged 15–17	6	10	19	18	68	56	36	51	46
No of males aged 18 or over	141	262	236	258	1135	1181	957	1045	1027
No of females aged 18 or over	137	274	244	258	1084	1125	928	990	998
No of pregnant females	6	7	13	21	101	98	67	72	82
Total no of persons	523	998	913	1010	4220	4402	3500	3807	3807

* N.B. numbers of persons and of households in A plus those in B=those in C plus those in D=those in E.

Table 2.6: *Numbers of person and of households recording quantities of milk consumed*

II *Households affected by the change in arrangement for school milk but not by that for welfare milk*

	1971								
	Feb–Mar	Apr–June	July–Sept	Oct–Dec	1972	1973	1974	1975	1976
A. Households in higher income groups									
No of households	44	106	90	78	357	460	360	423	439
No of persons aged 0–4	—	—	—	—	—	—	—	—	—
No of persons aged 5–6	10	30	22	27	115	150	91	119	120
No of persons aged 7–9	51	121	103	94	399	519	414	479	506
No of persons aged 10–14	28	64	63	50	222	316	276	297	279
No of persons aged 15–17	8	27	11	12	80	82	74	71	66
No of males aged 18 or over	46	117	98	80	384	486	391	464	466
No of females aged 18 or over	44	117	102	82	386	501	384	443	469
No of pregnant females	—	—	—	—	—	—	—	—	—
Total no of persons	187	476	399	345	1586	2054	1630	1873	1960
B. Households in lower income groups									
No of households	29	72	59	45	251	203	206	221	209
No of persons aged 0–4	—	—	—	—	—	—	—	—	—
No of persons aged 5–6	10	20	14	17	69	54	53	73	54
No of persons aged 7–9	33	89	67	52	281	239	237	255	243
No of persons aged 10–14	23	46	53	32	221	176	165	133	170
No of persons aged 15–17	10	19	14	10	80	51	53	50	51
No of males aged 18 or over	26	69	59	44	277	195	200	220	194
No of females aged 18 or over	33	83	64	49	276	222	232	243	231
No of pregnant females	—	—	—	—	—	—	—	—	—
Total no of persons	135	326	271	204	1204	937	940	974	943

	1971								
	Feb–Mar	Apr–June	July–Sept	Oct–Dec	1972	1973	1974	1975	1976
C. Households containing 1 or 2 children under 10 years of age									
No of households	54	105	110	91	457	480	403	484	490
No of persons aged 0–4	—	—	—	—	—	—	—	—	—
No of persons aged 5–6	12	20	18	29	112	105	80	116	105
No of persons aged 7–9	57	142	119	101	487	518	439	530	543
No of persons aged 10–14	19	49	49	30	192	201	167	181	199
No of persons aged 15–17	14	29	16	12	110	84	84	90	76
No of males aged 18 or over	54	138	119	95	492	495	425	514	511
No of females aged 18 or over	58	149	123	99	499	522	440	517	534
No of pregnant females	—	—	—	—	—	—	—	—	—
Total no of persons	214	527	444	366	1892	1925	1635	1948	1968

	1971								
	Feb–Mar	Apr–June	July–Sept	Oct–Dec	1972	1973	1974	1975	1976
D. Households containing 3 or more children under 10 years of age									
No of households	19	48	39	32	151	183	163	160	158
No of persons aged 0–4	—	—	—	—	—	—	—	—	—
No of persons aged 5–6	8	30	18	15	72	99	64	76	69
No of persons aged 7–9	27	68	51	45	193	240	212	204	206
No of persons aged 10–14	32	61	67	52	251	291	274	249	250
No of persons aged 15–17	4	17	9	10	50	49	43	31	41
No of males aged 18 or over	18	48	38	29	169	186	166	170	149
No of females aged 18 or over	19	51	43	32	163	201	176	169	166
No of pregant females	—	—	—	—	—	—	—	—	—
Total no. of persons	108	275	226	183	898	1066	935	899	881
E. All households*									
No of households	73	178	149	123	608	663	566	644	648
No of persons aged 0–4	—	—	—	—	—	—	—	—	—
No of persons aged 5–6	20	50	36	44	184	204	144	192	174
No of persons aged 7–9	84	210	170	146	680	758	651	734	749
No of persons aged 10–14	51	110	116	82	443	492	441	430	449
No of persons aged 15–17	18	46	25	22	160	133	127	121	117
No of males aged 18 or over	72	186	157	124	661	681	591	684	660
No of females aged 18 or over	77	200	166	131	662	723	616	686	700
No of pregnant females	—	—	—	—	—	—	—	—	—
Total no. of persons	322	802	670	549	2790	2991	2570	2847	2849

* A+B=C+D=E (see footnote to Table 2.5).

Table 2.7: *Numbers of persons and of households recording quantities of milk consumed*

III *Households affected by the changes in arrangements for both welfare milk and school milk*

	1971								
	Feb–Mar	Apr–June	July–Sept	Oct–Dec	1972	1973	1974	1975	1976
A. Households in higher income groups									
No of households	20	32	61	43	182	205	188	170	177
No of persons aged 0–4	24	37	71	47	210	220	210	182	187
No of persons aged 5–6	7	11	24	11	73	71	70	42	51
No of persons aged 7–9	24	37	74	49	227	233	212	195	198
No of persons aged 10–14	11	14	36	19	77	94	71	80	65
No of persons aged 15–17	1	2	11	2	12	7	17	17	15
No of males aged 18 or over	18	31	64	44	192	212	195	174	187
No of females aged 18 or over	21	35	63	45	188	208	186	183	187
No of pregnant females	—	—	2	2	8	9	9	2	5
Total no of persons	106	167	345	219	987	1054	970	875	895
B. Households in lower income groups									
No of households	21	36	45	43	173	102	122	110	81
No of persons aged 0–4	24	49	53	50	215	116	146	127	97
No of persons aged 5–6	10	11	23	20	70	32	45	38	26
No of persons aged 7–9	24	44	60	53	213	114	148	126	98
No of persons aged 10–14	14	18	21	24	108	65	70	57	38
No of persons aged 15–17	5	3	4	8	20	13	19	8	12
No of males aged 18 or over	21	33	45	42	172	95	121	107	86
No of females aged 18 or over	22	40	46	44	186	107	125	112	78
No of pregnant females	—	—	—	—	3	4	3	2	6
Total no of persons	120	198	252	241	987	546	677	577	441

	1971								
	Feb–Mar	Apr–June	July–Sept	Oct–Dec	1972	1973	1974	1975	1976
C. Households containing 1 or 2 children under 10 years of age									
No of households	9	18	27	21	87	101	82	90	93
No of persons aged 0–4	9	18	26	20	71	96	77	88	87
No of persons aged 5–6	—	—	—	—	1	2	1	—	2
No of persons aged 7–9	9	18	27	21	77	101	82	90	93
No of persons aged 10–14	—	—	—	1	1	2	2	1	1
No of persons aged 15–17	—	1	1	2	1	5	9	7	3
No of males aged 18 or over	10	16	27	23	84	104	83	92	94
No of females aged 18 or over	9	20	27	23	78	107	78	101	89
No of pregnant females	—	—	1	1	4	6	5	3	9
Total no of persons	37	73	109	91	317	423	337	382	378
D. Households containing 3 or more children under 10 years of age.									
No of households	32	50	79	65	268	206	228	190	165
No of persons aged 0–4	39	68	98	77	313	240	279	221	197
No of persons aged 5–6	17	22	47	31	131	101	114	80	75
No of persons aged 7–9	39	63	107	81	316	246	278	231	203
No of persons aged 10–14	25	32	57	42	171	157	139	136	102
No of persons aged 15–17	6	4	14	8	29	15	27	18	24
No of males aged 18 or over	29	48	82	63	244	203	233	189	179
No of females aged 18 or over	34	55	82	66	261	208	233	204	176
No of pregnant females	—	—	1	1	6	7	7	1	2
Total no of persons	189	292	488	369	1471	1177	1310	1080	958

	1971								
	Feb–Mar	Apr–June	July–Sept	Oct–Dec	1972	1973	1974	1975	1976
E. All households*									
No of households	41	68	106	86	355	307	310	280	258
No of persons aged 0–4	48	86	124	97	425	336	356	309	284
No of persons aged 5–6	17	22	47	31	143	103	115	80	77
No of persons aged 7–9	48	81	134	102	440	347	360	321	296
No of persons aged 10–14	25	32	57	43	185	159	141	137	103
No of persons aged 15–17	6	5	15	10	32	20	36	25	27
No of males aged 18 or over	39	64	109	86	364	307	316	281	273
No of females aged 18 or over	43	75	109	89	374	315	311	295	265
No of pregnant females	—	—	2	2	11	13	12	4	11
Total no of persons	226	365	597	460	1974	1600	1647	1452	1336

* A+B=C+D=E (See footnote to Table 2.5).

between families in higher and lower income groups and (alternatively) between those with 1 or 2 children *under 18 years* of age and those with 3 or more such children. These results are shown in Tables 2.8 and 2.10, and the sample sizes are given in Table 2.9. The inclusion of the additional households in the analyses in 1977 and 1978 increased the sample size sufficiently to justify tabulation of separate results for larger families (those with 3 or more children under 18 years of age) in the lower income group.

2.3 Results for 1971–1976

2.3.1 Table 2.1 shows national results for households in each of Groups I, II and III; corresponding results for these households further subdivided into high or low income and large or small families are given in Tables 2.2 to 2.4. The numbers of households and persons in the sample from each group are shown in Tables 2.5 to 2.7. Small differences between the average quantities of milk obtained and the average quantities consumed are due to the latter excluding all milk which was wasted, fed to pets or added to household stocks. The data for the first quarter of 1971, and especially those relating to individuals' consumption, are based on samples which are really too small to provide accurate base-line for the levels of consumption before the changes in arrangements for welfare and school milk.

2.3.2 The data suggest that households affected by the change in arrangements for welfare milk, but not by that for school milk (Group I), on the whole replaced nearly all their reduced price welfare milk by increased purchases at the full retail price after April 1971. Within Group I households, average consumption by children aged 0–4 years (ie those whose entitlement to welfare milk was affected by the change in arrangements) was maintained after April 1971 except that children of this age in families in the lower income groups *temporarily* recorded (in 1972) a rather lower average level of consumption than previously. There were no significant lasting changes in consumption by other categories of persons.

2.3.3 The households affected by the change in arrangements for school milk, but not by that for welfare milk (Group II), appear not to have increased their purchases of full price milk to compensate for the loss of school milk. Indeed, average consumption *in the home* by all children of school age did not change significantly; in particular, average consumption in the home by children aged 7–9 (ie those whose entitlement to free school milk was withdrawn) although at least fully maintained, even in lower income groups and in larger families, did not rise sufficiently to offset fully the loss of school milk.

2.3.4 Households affected by the changes in arrangements for both welfare milk and school milk (Group III) appear to have increased their average purchases of full price milk in April 1971 and again in October 1971, but not sufficiently to compensate fully for the loss in welfare and school milk. The averages for this group are derived from information provided by a very small

Table 2.8: *Average quantities (pints) of milk consumed in the home per week by different categories of person in families with children aged under 18 years, 1977 and 1978**

	Income groups		Families with		Families with 3 or more children in lower income groups	All families with children
	Higher	Lower	1 or 2 children	3 or more children		
1977						
Consumption in the home by:						
individuals aged 1–4	4·61 (0·07)	4·58 (0·08)	4·58 (0·06)	4·63 (0·11)	4·62 (0·18)	4·59 (0·05)
individuals aged 5–6	4·21 (0·08)	3·85 (0·10)	4·18 (0·08)	3·90 (0·09)	3·66 (0·14)	4·07 (0·06)
individuals aged 7–9	4·18 (0·07)	3·96 (0·08)	4·07 (0·07)	4·11 (0·08)	3·98 (0·12)	4·09 (0·05)
individuals aged 10–14	4·33 (0·06)	4·14 (0·06)	4·39 (0·06)	4·08 (0·06)	3·99 (0·09)	4·24 (0·04)
individuals aged 15–17	4·51 (0·10)	4·04 (0·10)	4·49 (0·09)	3·96 (0·10)	3·63 (0·15)	4·29 (0·07)
males aged 18 or over	3·48 (0·04)	3·42 (0·04)	3·47 (0·03)	3·36 (0·06)	3·29 (0·10)	3·45 (0·03)
females aged 18 or over and expectant mothers	3·33 (0·04)	3·21 (0·04)	3·32 (0·03)	3·12 (0·05)	3·06 (0·09)	3·27 (0·02)
All above plus individuals aged under 1 year	3·83	3·68	3·77	3·76	3·64	3·76
Visitors and cooking	0·56	0·51	0·57	0·47	0·47	0·54
Total**	4·39	4·20	4·34	4·23	4·12	4·31

Table 2.8: *Average quantities (pints) of milk consumed in the home per week by different categories of person in families with children aged under 18 years, 1977 and 1978**

	Income groups		Families with		Families with 3 or more children in lower income groups	All families with children
	Higher	Lower	1 or 2 children	3 or more children		
1978						
Consumption in the home by:						
individuals aged 1–4	4·46	4·58	4·54	4·43	4·27	4·51
	(0·08)	(0·09)	(0·07)	(0·12)	(0·21)	(0·06)
individuals aged 5–6	3·91	4·11	3·97	4·03	4·05	4·00
	(0·08)	(0·10)	(0·08)	(0·10)	(0·15)	(0·06)
individuals aged 7–9	4·12	4·16	4·20	4·08	3·92	4·14
	(0·07)	(0·08)	(0·07)	(0·08)	(0·11)	(0·05)
individuals aged 10–14	4·26	4·13	4·44	3·91	3·78	4·20
	(0·06)	(0·06)	(0·06)	(0·06)	(0·08)	(0·04)
individuals aged 15–17	4·39	4·04	4·30	4·04	3·85	4·21
	(0·10)	(0·08)	(0·08)	(0·10)	(0·12)	(0·06)
males aged 18 or over	3·50	3·53	3·55	3·36	3·27	3·51
	(0·04)	(0·05)	(0·03)	(0·07)	(0·10)	(0·03)
females aged 18 or over and expectant mothers	3·23	3·20	3·26	3·07	2·90	3·21
	(0·03)	(0·04)	(0·03)	(0·05)	(0·07)	(0·02)
All above plus individuals aged under 1 year	3·75	3·74	3·76	3·71	3·60	3·75
Visitors and cooking	0·51	0·42	0·50	0·38	0·32	0·47
Total**	4·27	4·17	4·27	4·09	3·91	4·22

* Figures in parentheses are standard errors of the averages.
** Including liquid milk consumed by infants under one year of age.

Table 2.9: *Numbers of persons and of households recording quantities of milk consumed, 1977 and 1978*

	Income groups		Families with		Families with 3 or more children in lower income groups	All families with children
	Higher	Lower	1 or 2 children	3 or more children		
1977						
No of households	1843	1419	2559	703	293	3262
No of individuals aged under 1	134	110	201	43	12	244
No of individuals aged 1–4	747	543	960	330	125	1290
No of individuals aged 5–6	433	272	431	274	104	705
No of individuals aged 7–9	667	459	643	483	192	1126
No of individuals aged 10–14	1078	843	1046	875	394	1921
No of individuals aged 15–17	544	461	639	366	173	1005
No of males aged 18 or over	2038	1492	2785	745	304	3530
No of females aged 18 or over and expectant mothers	2060	1608	2900	768	320	3668
Total no of persons	7701	5788	9605	3884	1624	13489
1978						
No of households	1695	1540	2543	692	331	3235
No of individuals aged under 1	136	122	204	54	22	258
No of individuals aged 1–4	631	584	927	288	136	1215
No of individuals aged 5–6	374	334	419	289	140	708
No of individuals aged 7–9	611	502	633	480	228	1113
No of individuals aged 10–14	1014	884	1040	858	416	1898
No of individuals aged 15–17	497	531	665	363	205	1028
No of males aged 18 or over	1896	1672	2828	740	353	3568
No of females aged 18 or over and expectant mothers	1866	1723	2835	754	371	3589
Total no of persons	7025	6352	9551	3826	1871	13377

Table 2.10: *Percentage frequency distribution of persons in families with children aged under 18 years classified according to level of milk consumption in the home. 1977/1978*

Age groups	Sex	Pints per person per week											Total persons	
		0–	1–	2–	3–	4–	5–	6–	7–	8–	9–	10 and over	%	No
1–4	M	3	9	9	27	13	14	17	4	2	1	2	100	1316
	F	2	10	12	29	13	13	15	2	2	1	2	100	1189
5–6	M	2	12	13	32	13	14	12	2	1	0	...	100	739
	F	2	12	15	33	15	11	10	1	1	...	1	100	674
7–9	M	3	9	13	27	15	14	14	2	1	1	1	100	1137
	F	3	13	15	35	14	11	8	2	1	...	...	100	1102
10–14	M	2	8	11	28	13	15	14	4	2	1	2	100	1982
	F	3	15	14	33	11	11	9	2	1	...	1	100	1837
15–17	M	2	11	10	25	11	14	15	5	2	1	3	100	1026
	F	6	16	14	32	11	9	9	2	1	...	1	100	1007
18 and over	M	5	22	17	29	9	8	6	1	1	...	1	100	7098
	F	6	24	17	30	9	6	4	1	1	...	...	100	7257
Total, all ages	M	4	16	14	28	11	11	10	2	1	1	1	100	12098
	F	5	19	16	31	11	8	7	1	1	...	1	100	13066

... greater than zero but less than 0·5%

number of households and are subject to a degree of sampling error which is so great as to mask any real changes that may have occurred in the levels of consumption of milk in the home by the various categories of persons.

2.3.5 On the whole, the data obtained from this special study between 1971 and 1976 provide no evidence of any significant lasting change in milk consumption *in the home* by any age group which resulted from changes in arrangements for welfare and school milk. The differences between the age groups remained virtually unchanged, with consumption varying inversely with age. As nutritional status depends on the diet as a whole rather than on any single component, no nutritional assessment may be made solely on the basis of these data.

2.4 Results for 1977 and 1978

2.4.1 Details of average milk consumption in the home in 1977 and 1978 for each category of person in various types of family are shown in Table 2.8 together with (in parentheses) their standard errors; corresponding sample sizes are given in Table 2.9. In these analyses, children under 1 year of age have been excluded from the lowest age group since many of them were breast fed or fed on dried milk, but to conform with normal National Food Survey practice they have been included in the overall averages. Separate averages of quantities of milk obtained are not shown because of their close similarity to the overall average quantities consumed.

2.4.2 In the two years, the average quantities of milk drunk in the home by children aged 1–4 years and those aged 7–9 years in lower income families did not differ significantly from those in higher income families, nor did those in larger families (even larger families in the lower income groups) differ significantly from those in smaller families. For children aged 5–6 years the results are somewhat inconclusive in that they show a significantly higher level of consumption in 1977 by those in higher income groups or smaller families than by those in lower income groups or larger families respectively, but results for 1978 show the opposite (though in that year the differences were not statistically significant). In contrast, there was a generally significant tendency for average milk consumption in the home by older children (10–14 and 15–17 years) to vary directly with income and inversely with size of family. Although average consumption by adult males did not vary significantly in different income or family size groups, that by adult females was significantly greater in smaller families than in larger families (especially larger families in lower income groups).

2.5 Frequency distributions

It is possible to present the data obtained from this study not only as group averages but also in the form of frequency distributions of persons classified according to the quantity of milk consumed in the home during the week they participated in the Survey. Examples of such distributions are shown in

percentage form in Table 2.10 for persons of each sex within each age group in the combined samples for 1977/78. Separate distributions for the higher and the lower income groups and for larger and smaller families are not shown because they are broadly similar to the overall distributions. Although some of the distributions appear to be bimodal this is largely due to quantities having been recorded by individuals to the nearest quarter of a pint, thus giving a clustering of weekly totals at multiples of $7 \times \frac{1}{4}$ pints, ie $1\frac{3}{4}$, $3\frac{1}{2}$, and $5\frac{1}{4}$ pints. Despite this limitation, the distributions for boys aged under seven are almost identical with those for girls of similar ages. However, those for girls move to the left as their ages increase and are in contrast with those for boys, thereby suggesting a reluctance on the part of older girls to drink relatively large quantities of milk in the home. The distributions for all ages of juvenile males show little variation with age, but the distribution for the much wider age group containing all adult males shows an abrupt cut back in average consumption in the home, the distribution moving to the left to coincide almost exactly with that for all adult females.

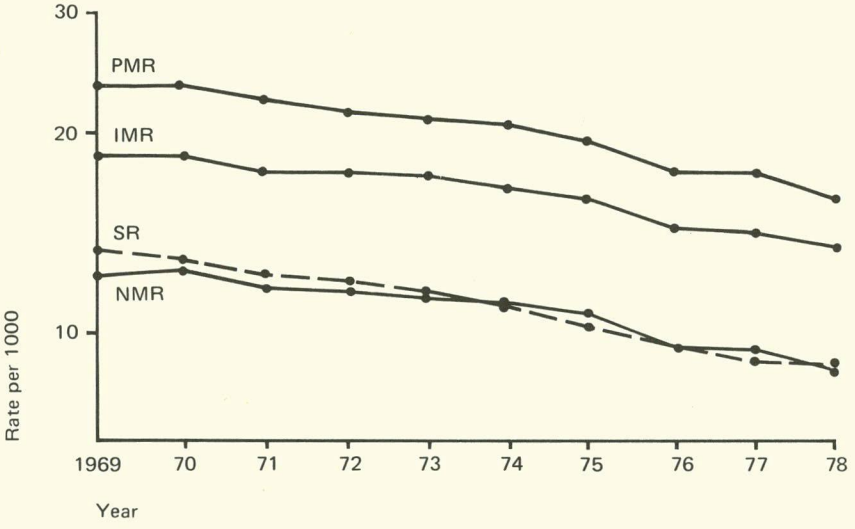
3. Vital Statistics

3.1 Death rates among toddlers and schoolchildren are now so low (less than 1 per 1000) that there is little point in expecting the trends to show evidence of any possible effect of changes in legislation affecting welfare and school milk. It is sufficient to note that these rates have tended to fall fairly steadily during the past decade.

3.2 Figure 3.1 shows trends in rates for stillbirths and perinatal deaths (per 1000 live and stillbirths) in Great Britain from 1969 to 1978. The rates are plotted on a logarithmic scale, so that similar proportionate falls at any level occupy the same space on the vertical scale. It is clear that all the rates have fallen steadily during the period shown, with perhaps a slightly accelerated fall since 1976.

3.3 It might be argued that, even if death rates are satisfactory, any adverse effect on the nutritional status of pregnant women would result in a decrease in fetal growth rate and hence in lower birth weights. Evidence as to birth weights in

Figure 3.1: *Vital statistics for Great Britain from 1969 to 1978*



Mortality rates for infant mortality (IMR) and neonatal mortality (NMR) are per 1000 live births
Stillbirth (SR) and perinatal mortality rates (PMR) are per 1000 live and stillbirths

Source: Population Trends, Nos. 1, 12 and 18 (1975, 1978 and 1979)

general is not readily available, but birth weights of 2500 g or less are notified routinely and presented in the Annual Reports of the Chief Medical Officer. The incidence of live born low birth weight babies, per 1000 live births, has remained remarkably steady throughout the past decade: it was, for example 6·5% in 1967 and 6·5% in 1977.

3.4 There is, therefore, no evidence from vital statistics that the 1971 changes in welfare and school milk legislation had any adverse effect on mortality or on fetal growth.

Reference

Office of Population and Censuses and Surveys, 1975, 1978 and 1979. *Populations Trends*, Nos. 1, 12 and 18.
London HMSO.

4. Randomized Controlled Trial of the Effect of Entitlement to a Milk Supplement in Pregnant Mothers and their Children

P C Elwood, P M Sweetnam, T J L Haley, S J Hughes
M. R. C. Epidemiology Unit, South Wales.

O P Gray, D P Davies,*
Department of Child Health, Welsh National School of Medicine.

4.1 Summary

4.1.1 A consecutive series of 1251 pregnant women were contacted: 1163 infants were born to these women, and 951 infants were followed to age 5 years. Measurements of growth were made throughout the five years. Throughout the whole study half the families, selected at random, were supplied with milk tokens, entitling the mother, while pregnant, and all children under 5 years of age, to one pint of milk per day at half the current price.

4.1.2 Entitlement to the milk supplement led to a small increase in milk purchases by the families and to a small increase in milk drunk by the children. No effect was detected on any of the growth measurements.

4.2 Introduction

4.2.1 In 1940, as part of the war time food policy, tokens were issued to all pregnant women and children up to the age of 5 years entitling them to a pint of milk (20 fluid oz or 568 ml), or the equivalent as dried milk, at half price. Those in the most severe economic need received the supplement free (Welfare Food Act, 1940). This measure continued with little change until April 1971 when benefit was restricted to those in need and to these the benefit became a free pint of milk. At the same time the socio-economic limits for defining families in need were altered so that the number of families entitled to free milk was increased.

4.2.2 Early in 1972 a randomized controlled trial was set up to investigate the

* Present address: Department of Child Health,
Royal Infirmary,
Leicester

effect of entitlement to a daily supplement of milk comparable to that which had been available to all pregnant women under the Welfare Food Act, 1940.

4.3 Method

4.3.1 The study was based on two small towns in South Wales, each of about 45,000 total population. One is a seaside, industrial and residential town, with a social class distribution almost identical to that of England and Wales: the other town is largely industrial and has a rather higher proportion of subjects in the lower social classes.

4.3.2 In each town contact was made through general practitioners with a consecutive series of just over 700 newly pregnant women. The women were visited at the time of first reporting their pregnancy and at about the 36th week of pregnancy. The infants born to them were visited by specially trained nurses at 10 days, at six weeks, at three, six, nine and twelve months and thereafter at six month intervals until their fifth birthday.

4.3.3 Immediately following the initial visit to the mother, an independent observer randomly allocated women into a 'supplemented' and a 'control' group. Women in the supplemented group were supplied, throughout their pregnancy and during any subsequent pregnancy, with milk 'tokens'. On delivery, each was given tokens for her child until he or she reached the age of 5 years. Each mother was also given tokens for all other children under 5 years of age for whose care she was responsible.

4.3.4 The milk tokens were similar in appearance and in use to those which had been used under the Welfare Food Act (1940). Each token was equivalent to the price of half a pint of milk, and arrangements for their acceptance were made with local milk delivery men.

4.3.5 Measurements of growth were made throughout the trial but only those at birth and at 5 years of age are reported here. In each town birth measurements were made by a specially trained nurse, who was blind with regard to group. At five years all measurements were made by two trained observers who were also blind with regard to group. The methods used throughout were those described in Tanner et al. (1969).

Weight—weight at delivery was obtained from hospital records, subsequently it was measured on a portable beam balance.

Length—crown heel length was measured on a modified infant stadiometer (Davies and Holding, 1972). To give time for caputs to resolve, length was measured at 10 days, but for some infants this was exceeded, though seldom by more than a few days. Height at 5 years was measured on a stadiometer with stretching.

Head circumference—the maximum occipito-frontal measurement was taken with a disposable paper tape on the tenth day, or within a few days of this, and again at 5 years.

Skinfold thickness—mid triceps skinfold was measured with Harpenden calipers, at about 10 days and again at 5 years.

4.36 Great efforts were made to ensure comparability between all the observers who made measurements in this study. The nurses were trained by one of us (D.P.D.) and their performance was monitored throughout. At monthly intervals during the first two years, and subsequently at regular, though less frequent intervals, the two nurses worked together and both measured a number of infants, separately, and in random order. Except for skinfold, the results were always very close indeed, but to improve comparability even further, the results of these sessions were later discussed with the nurses.

4.3.7 A large amount of information was collected during the trial but is not reported here. Items presented relate to the mother (age, smoking habit, whether or not working at the time of the 5 year measurements, etc.), to the child (rank in the family) or to both (family size, social class etc.). All these data were obtained by questionnaires administered by the nurses.

4.3.8 Growth differences between mothers and children, who were given or not given tokens, are presented first for the total groups. These represent the total community, and consequently contain subgroups of families, which, for economic or other reasons, may be at greater than average risk of nutritional deprivation. We have attempted to identify and present results for one such 'vulnerable' group. This group is defined in terms of family size and expenditure on food, and comprises all families which, when the trial child was aged 5 years, had an expenditure on food of under £20 per week, and 3 or more children, or an expenditure on food of under £25 and 4 or more children, or five or more children irrespective of money spent on food.

4.3.9 In addition to measurements of the growth of the children, several other 'outcome' measurements were made. Those presented here are limited to the amount of milk drunk in a typical day by the child when aged four and a half years, obtained from the mother by questionnaire, and the amount of milk purchased during a typical week by the family during the child's fourth year. This last was obtained, in confidence, from milk delivery men and it makes the assumption, which we believe to be reasonable, that almost all milk purchases are made from delivery roundsmen.

4.3.10 In what follows, data for the two towns have been amalgamated because detailed examination of the results indicated that the two population samples were closely comparable in every way. Two groups are therefore described, those who received tokens (referred to in tables simply as 'Tokens') and those who did not (referred to throughout as 'controls'). Means with standard deviations (S.D.) are presented and differences between the groups have been assessed usually by the use of Students "t" test with significance at $P < 0{\cdot}05$.

4.4 Results

4.4.1 *The pregnant women*

4.4.1.1 Table 4.1 shows the numbers of women referred to us by general practitioners at the start of the trial, and losses to this group at various stages.

4.4.1.2 Table 4.2 compares a variety of factors on entry to the trial in the women and their families who were allotted to milk tokens, and in those who received no tokens. In order to facilitate the interpretation of later tables these results are derived from only the women who later had infants admitted to the

Table 4.1: *Numbers of women contacted and the numbers lost at various stages to the trial in pregnant women*

Total number referred by G.P.s		*1479*
Not suitable for the trial (found not to be pregnant: miscarriage before seen: moved away: already receiving Welfare milk etc.)	191	
Total eligible for trial		*1288*
Refused to co-operate	37	
Total admitted to the trial		*1251*
Failed to complete the trial (miscarriage after entry: malformed infant: twins: death of child: moved away etc.)	88	
Total who completed the trial		*1163*

Table 4.2: *Comparability of pregnant women on entry to the trial. Means shown with (S.D.) below.*

Measurement	Tokens	Controls
Numbers of women	595	568
Age in yrs.	25·1 (4·7)	24·4 (4·4)
Women who smoked	36%	44%
Parity	1·2	1·1
Height in cm.	160·1 (5·7)	160·0 (6·0)
Weight in Kg.	62·0 (10·1)	62·1 (10·1)
Systolic B.P. in mm Hg.	121·0 (10·5)	120·7 (9·3)
Diastolic B.P. in mm Hg.	71·7 (9·3)	71·2 (9·2)

For no item is information missing for more than 13 of all the 1163 women.

trial. There is no evidence of any important difference between the groups, other than for smoking. Because of the relevance of maternal smoking to an infant's birth weight, we examined this point in some detail. Smoking habit had been obtained by questionnaire at first interview and at 36 weeks gestation and had been recorded as the numbers of cigarettes smoked per day, grouped zero, 1–4, 5–14, 15–24, 25+. Means were estimated from these grouped data and are shown in Table 4.3. This suggests that the difference between women on tokens and those who were not, amounted to only about $1\frac{1}{2}$ cigarettes per day on average.

Table 4.3: *Numbers of women entered into the trial by cigarette consumption.*

Cigarettes per day	Tokens	Controls
0	379	313
1–4	19	23
5–14	86	100
15–24	94	96
25+	14	27
No. of women	592*	559*
Estimated mean** (cigs./woman/day)	5·4	6·8

* In this, and in subsequent tables where the numbers of subjects differs from those shown in tables 1 and 2, the differences are due to missing information for some subjects.

** Assuming mid points for the groups:— 0, 3, 10, 20 and 30.

4.4.1.3 Table 4.4 shows the stage of the pregnancy at which each woman was first seen. The milk tokens were given to the women by an independent field worker a few days after they had been first seen by the nurse. This means that the women given tokens probably received them for about 20 weeks on average, that is, half the duration of their pregnancies.

Table 4.4: *The stage of gestation at which women were admitted to the trial. Derived from mothers information*

Duration of gestation in wks.	Tokens	Controls
<12	52	56
12–19	225	213
20–27	201	190
28–35	59	64
36+	2	2
No. of women	539	525
Mean (S.D.)	19·6 (6·2)	19·6 (6·2)

Table 4.5: *Outcome of trial in pregnant women. Means (S.D.) of birth measurements.*

Measurement	Males		Females	
	Tokens	Controls	Tokens	Controls
No. of subjects	324	301	271	267
Weight* in Kg.	3·44 (0·51)	3·40 (0·51)	3·29 (0·53)	3·23 (0·47)
Length* in cm.	52·3 (2·1)	52·2 (2·1)	51·3 (2·1)	51·2 (2·1)
Head circum.* in cm.	36·4 (1·3)	36·4 (1·2)	35·4 (1·3)	35·3 (1·2)
Skinfold* in mm.	5·4 (1·1)	5·2 (1·0)	5·4 (1·0)	5·3 (1·1)

* In this, and in all subsequent tables which give birth measurements, weight is birth weight but length, head circumference and skinfold were measured at 10 days.

For the 1163 children, information is missing for the following: weight 0; height 58; head circumference 58; skinfold 93.

4.4.1.4 Table 4.5 shows the birth (or 10 day) measurements, which can be regarded as outcome variables in the trial in pregnant women. All the differences are small and none achieves statistical significance at $P < 0{\cdot}05$.

4.4.2 *The children*

4.4.2.1 In order to have ensured a balanced trial in the children born to the women just described, the infants should have been randomized to milk tokens or not at birth. It was thought that such a procedure would not have been acceptable to the families and so the children were maintained in the groups to which their mothers had been randomized.

4.4.2.2. There were losses in the five years during which the infants were surveyed (Table 4.6). Most of the losses were due to removal out of the area, a few children died, a few were adopted, and the mothers of some refused to co-operate to the end of the trial. It was expected that losses would be higher from the controls than from those receiving the tokens.

4.4.2.3. The possibility that bias was introduced into the trial by the loss of selected children between 0 and 5 years is examined in Table 4.7. The data displayed do suggest that those who remained in the area and were seen at age 5

Table 4.6: *Numbers of children in the trial and losses between birth and 5 years.*

	Tokens	Controls
Infants born	595	568
Children measured at 5 years	510	441
Lost to the trial	85	127
(%)	(14%)	(22%)

Table 4.7: *Comparability of two groups of children—those who completed the trial and were measured at age 5 years, and those who were lost to the trial between birth and age 5 years. Based on data collected during the pregnancies of the mothers, and on the children at birth.*

Measurement	Seen at 5 yrs.	Lost to Trial
No. of children	951	212
Age of mother in yrs.	25·0	23·7
Mothers who smoked	40%	40%
No. of children in family	2·0	1·7
Birth weight in Kg.	3·36	3·29
Length in cm.	51·8	51·6
Head circum. in cm.	35·9	35·7
Skinfold in mm.	5·3	5·3

For the 1163 children, information is missing for the following: birth weight 0; length 58; head circumference 58; skinfold 93.

yrs. were very slightly heavier, longer and had larger head circumference, but none of these differences achieve statistical significance (at $P<0{\cdot}05$). The children seen at 5 years however came from slightly larger families and had slightly older mothers and both these differences are statistically significant at $P<0{\cdot}05$. The loss of information and possible bias introduced by selective losses during the trial is therefore very small and the children who were seen at the end of the trial, and on whom conclusions are based can probably safely be accepted to be representative of the total group of children born into the trial.

4.4.2.4. Table 4.8 examines the children who completed the five years in the trial and their families. Those who had received tokens were very similar to the controls. Again the one difference which might be of importance is maternal cigarette smoking but when this difference was examined in detail it was found to be equivalent to an excess consumption in the control mothers of only about $1\frac{1}{2}$ cigarettes per day.

Table 4.8: *Comparability of the two groups of children examined at 5 years of age.*

	Males		Females	
	Tokens	Controls	Tokens	Controls
Number of subjects	276	237	234	204
Age of mother in yrs.	29·8	29·9	30·7	29·6
Mothers who smoked during pregnancy	39%	44%	30%	43%
No. of children in family	2·4	2·4	2·5	2·4
Rank of study child	1·9	2·0	2·0	1·9
Social class:—				
I+II	23%	20%	18%	19%
III	57%	63%	61%	58%
IV+V	21%	17%	20%	22%

For no item is information missing for more than 6 of all the 951 children except for social class which is unknown or unclassifiable for 136.

Table 4.9: *Comparability at birth of the children seen at 5 yrs. Means (S.D.) of birth measurements.*

Measurement	Males		Females	
	Tokens	Controls	Tokens	Controls
No. of subjects	276	237	234	204
Weight in Kg.	3·46 (0·49)	3·39 (0·50)	3·32 (0·50)	3·24 (0·47)
Length in cm.	52·4 (2·1)	52·3 (2·1)	51·3 (2·0)	51·2 (2·1)
Head circum. in cm.	36·5 (1·3)	36·4 (1·2)	35·4 (1·2)	35·4 (1·3)
Skinfold in mm.	5·4 (1·1)	5·2 (1·0)	5·4 (1·0)	5·3 (1·1)

For the 951 children, information is missing for the following: birth weight 0; length 40; head circumference 41; skinfold 67.

4.4.2.5. Table 4.9 examines the birth measurements in the children who completed the trial, and shows that there were only trivial differences between the groups at birth.

4.4.2.6. As related in an earlier section, it had always been our intention to examine the effect of entitlement to milk by the issue of tokens, at three levels. Data on the first of these are displayed in Table 4.10. The number of milk delivery firms involved was very large and the records of some were very poor. It was therefore possible to get information for only about half the families. The available data show that the families which received milk tokens spent more on milk throughout the trial. The difference was equivalent to about 2 pints (1,136 ml.) per week. The tokens were each of a value equivalent to half a pint of milk daily or $3\frac{1}{2}$ pints per week, but as tokens were issued for all children under 5 years of age, and as the mean number of children under 5 years was 1·4 per family, the excess purchases of milk by the families receiving tokens should have been rather higher than this (almost 5 pints on average) had the full allowance provided by the tokens been spent on milk.

4.4.2.7. Information on the amount of milk drunk by the children was obtained from the mothers and every effort was made to reduce bias in these data. Thus questions about milk were only a small part of a long questionnaire and this was applied by nurses who had never been involved in the distribution of tokens to the families and who did not know whether or not a family was in recipt of tokens. The differences shown in Table 4.11 suggest that the children on tokens drank about $2\frac{1}{2}$ fluid oz (71 ml) of milk per day more than the control children. While this estimate is very crude, it is considerably less than the 10 oz of milk which each token acutally represented.

4.4.2.8. Evidence on the effect the receipt of tokens had on growth is summarized in Table 4.12. Differences between the two groups, tokens and

Table 4.10: *Milk purchases by households during the trial based on one week during November each year.*

	1973		1975		1976		1977	
	Tokens	Controls	Tokens	Controls	Tokens	Controls	Tokens	Controls
No. of households	208	187	318	280	286	257	215	192
Age range of study children	0–2 yrs		1–3 yrs		2–4 yrs		3–5 yrs	
Milk purchases (P/week/household)	84P	75P	114P	107P	167P	140P	194P	174P
Equivalent to:— (pints/wk/household)	15·3	13·6	13·4	12·6	17·6	14·7	16·9	15·1
Excess per household receiving tokens:—	1·7 pints/week		0·8 pints/week		2·9 pints/week		1·8 pints/week	

Table 4.11: *Mean (S.D.) milk consumption by the children when aged 4½ yrs: based on answers by mothers to a general questionnaire on food consumption.*

	Males		Females	
	Tokens	Controls	Tokens	Controls
No. of subjects	273	232	230	199
Milk Consumption in fluid oz./day	20·0 (8·1)	17·3 (8·2)	17·8 (7·9)	16·0 (7·1)

Note: one fluid oz. = 28·4 ml.

Table 4.12: *Outcome of trial in children at 5 yrs. Mean (S.D.) of growth measurements.*

	Males		Females	
Measurement	Tokens	Controls	Tokens	Controls
No. of subjects	276	237	234	204
Weight in Kg.	19·0 (2·4)	19·0 (2·6)	18·7 (2·4)	18·2 (2·4)
Height in cm.	108·5 (4·1)	108·9 (4·6)	108·2 (4·5)	107·7 (4·4)
Head circum. in cm.	52·2 (1·4)	52·4 (1·4)	51·3 (1·4)	51·2 (1·4)
Skinfold in mm.	7·1 (2·2)	7·2 (2·4)	7·6 (2·3)	7·6 (2·4

For the 951 children, information is missing for the following: weight 16; height 6; head circumference 43; skinfold 74.

Table 4.13: *Definition of a 'vulnerable group' in terms of money spent on food and number of children in the families. The 155 children in the top right part of the table are the subjects for the tables which follow.*

Money spent on food (£ per week)	No. of Children:—					
	1	2	3	4	5+	TOTALS
<15	22	63	20	5	0	110
15	42	185	55	19	5	307
20	18	146	70	24	9	268
25	9	92	65	23	18	208
N.K.	13	36	4	5	0	58
TOTALS	104	522	214	76	32	951

Number of children NK for 3 families.

Table 4.14: *Differences between the 'vulnerable group' of children (shown as 'V') and all the other children (shown as 'others') at age 4½ yrs.*

Variable		Males V	Males Others	Females V	Females Others
No. of subjects		78	435	77	361
Mothers age in yrs.		31·7	29·5	31·9	29·9
Mothers who had smoked during pregnancy		51%	40%	47%	34%
No. of children in family		3·9	2·1	3·8	2·1
Rank of study child		3·3	1·7	3·1	1·7
No. in family	<5 yrs	1·4	1·3	1·5	1·4
	5–9 yrs	1·2	0·6	1·1	0·5
	10–14 yrs	0·8	0·1	0·6	0·2
	15–19 yrs	0·2	0·1	0·2	0·0
	20+ yrs	1·9	2·0	1·9	2·0
Father's Social Class	I+II	19%	22%	16%	19%
	III	52%	61%	53%	61%
	IV+V	30%	17%	31%	19%

For no item is information missing for more than 8 subjects in any subgroup, except for social class which is unknown or unclassifiable for 13–18%.

Table 4.15: *Comparability at birth of children on tokens and controls within the 'Vulnerable group'*

Measurement	Males Tokens	Males Controls	Females Tokens	Females Controls
No. of subjects	43	35	45	32
Weight in Kg.	3·38 (0·54)	3·39 (0·47)	3·38 (0·52)	3·18 (0·51)
Length in cm.	51·7 (2·0)	52·3 (1·9)	51·3 (2·0)	50·9 (1·8)
Head circum. in cm.	36·0 (1·3)	36·1 (1·4)	35·4 (1·3)	35·6 (1·1)
Skinfold in mm.	5·3 (0·9)	5·0 (1·1)	5·5 (1·0)	5·5 (1·1)

For the 155 children, information is missing for the following: weight 0; length 11; head circumference 12; skinfold 11.

Table 4.16: *Milk consumption at 4½ years by children in the vulnerable group, based on answers by mothers to a general questionnaire on food consumption.*

	Males Tokens	Males Controls	Females Tokens	Females Controls
No. of subjects	43	35	45	31
Milk consumed in fluid oz./day	19·5 (7·2)	15·7 (8·2)	17·8 (8·1)	17·2 (8·5)

Note: one fluid oz.=28·4 ml.

controls, are quite trivial for both sexes, and no difference is statistically significant (at $P < 0{\cdot}05$).

4.4.2.9. As explained earlier, an attempt was made to identify a subgroup of children who might have benefited from the tokens to a greater extent than the whole study population. Table 4.13 indicates the 'vulnerable group' selected, and Table 4.14 shows how these compared with the other children. For every factor examined, the 'vulnerable group' was worse off, often markedly so. Within the 'vulnerable group' the children who had received tokens had had birth measurements which were very similar to the controls (Table 4.15). Table 4.16 indicates that milk consumption was higher in the children entitled to the supplement, but again by only about two and a half ozs. (71 ml) per day.

4.4.2.10 Table 4.17 gives no consistent evidence that even within this vulnerable group, receipt of tokens conferred benefit in terms of growth during the first five years.

Table 4.17: *Outcome in children in the 'vulnerable group'. Mean (S.D.) of growth measurements.*

Measurement	Males		Females	
	Tokens	Controls	Tokens	Controls
No. of children	43	35	45	32
Weight in Kg.	18·2 (2·3)	18·6 (2·5)	18·6 (2·4)	17·8 (2·3)
Height in cm.	107·2 (4·0)	108·2 (4·2)	108·0 (4·7)	106·6 (3·4)
Head circum. in cm.	51·7 (1·2)	51·9 (1·6)	51·4 (1·5)	51·1 (1·0)
Skinfold in mm.	6·8 (2·2)	7·1 (2·3)	7·6 (2·8)	7·4 (2·0)

For the 115 children, information is missing for the following: weight 2; height 0; head circumference 11; skinfold 13.

4.5 Discussion

4.5.1 A beneficial effect of milk on growth was demonstrated in early studies by Auden (1923), McCollum (1924) and by Corry Mann (1926). While under-nutrition in children is undoubtedly very much less common now than when these studies were done, and hence the room for improvement is very much smaller, yet a very recent randomized controlled trial detected a beneficial effect on growth from under 200 ml. milk given each school day to children aged 7 and 8 years (Baker et al., 1978 and section 7 of this report).

4.5.2 However the trial described in this report represents an evaluation of entitlement to a milk supplement. It was not a test of a milk supplement itself.

This is important and the effect of the entitlement must be considered at each of three levels, namely, an effect on milk purchases by the families, on milk drunk by the child of interest, and an effect on growth. While these are clearly interdependent, they are not synonymous. Indeed it would be possible for the issue of tokens to have no effect on either milk purchases or milk drunk, and yet for the children in the families given tokens to grow more than the controls. Such an outcome could arise if women used the tokens to save money on milk purchases, and then used that money for the purchase of, say, other dairy produce, or meat, or some other foodstuff.

4.5.3 The first level of effect to be considered is on milk purchases. While there was an increase, this was only about two-fifths of what the tokens provided. This in itself is an important finding of the trial, and is of relevance to any procedure similar to the issue of tokens, whether adopted as part of the national food policy, or on a smaller scale.

4.5.4 The second level of effect of the tokens is on the amount of milk consumed. The tokens each represented half a pint (10 fluid oz) of milk and it was never anticipated that children under 5 years of age would consume all this amount of extra milk. However our finding, that about $2\frac{1}{2}$ fluid oz (71 ml) extra per day was drunk when the children were aged $4\frac{1}{2}$ years, was rather less than we had anticipated. A cupful of milk is about 4 to 6 fluid oz and we had hoped that about this amount extra would have been taken daily by most of the children towards the end of the trial.

4.5.5 Whatever the effects on the other two levels, the absence of an effect on growth is of course the most important outcome of the trial. The trial in the pregnant women can be criticised in that the women only received the tokens, on average, for about half the duration of their pregnancy. Yet it is a fact that most women do not consult a doctor until pregnancy is well established, and so any nutritional provision, however it is made available, will suffer this limitation. In any case it is doubtful if the milk drinking habits of adult women will be appreciably affected by the mere issue of tokens. The trial in the children was perhaps rather more realistic in both these aspects, in that the supplement was made available from birth, and their milk drinking pattern should have been more easily influenced.

4.5.6 The criteria by which we defined a 'vulnerable group' within our total population of children are of course open to question. There is no limit to the number of sub-groups which could have been examined and the one we eventually decided on was chosen after very careful consideration. However it is important to remember, that, since the receipt of milk tokens had virtually no effect on growth in the total group of children, there just cannot be a subgroup of any size in which there was an appreciable beneficial effect, unless of course this was balanced by a deleterious effect of milk in another subgroup.

4.5.7 One aspect of this work which is of very great importance, is the sensitivity of the trial, that is, the size of the differences in each outcome variate

Table 4.18: *Least significant differences at* $P \leqslant 0{\cdot}05$ for the outcome growth measurements (based on male children only)

Measurement	At birth	All children at 5 years	'Vulnerable group' at 5 years
Weight in kg.	0·08 (2·3%)	0·4 (2·3%)	1·1 (5·8%)
Height in cm.	0·33 (0·6%)	0·8 (0·7%)	1·8 (1·7%)
Head circum. in cm.	0·20 (0·5%)	0·2 (0·5%)	0·6 (1·2%)
Skinfold in mm.	0·17 (0·3%)	0·4 (5·6%)	1·0 (14·2%)

Estimates given are $t_{0{\cdot}05} \times SE_{difference}$. The figures in parentheses indicate the proportion each estimate is of the mean measurement in the control children.

which would have been detected as statistically significant had they occurred. Table 4.18 displays estimates of differences in growth measurements from which the sensitivity of the trial can be judged. These data indicate that the trial was reasonably sensitive, that is, had the issue of tokens led to an increase in mean birth weight of just over 2%, statistical significance (at $P < 0{\cdot}05$) would have been achieved in the trial in pregnant women. Similarly, in the trial of children an excess mean weight gain during the five years of 3% in all the children, or 6% in the 'vulnerable group' would have achieved statistical significance. Other estimates given in Table 4.18 indicate that the trial was very much more sensitive with respect to length and head circumference, and rather less sensitive for skinfold. In fact these estimates underestimate the probable sensitivity of the trial because they are based on one sex alone. If it is assumed that, had there been an effect, it would have been equal in the two sexes and conclusions could therefore be based on all children combined, then the trial can be considered to have been about 40% more sensitive than Table 4.18 suggests, and the data given in Table 4.18 could each be divided by about 1.4.

4.5.8 The overall conclusion of this work must therefore be that the trial, which was of reasonable sensitivity, gave no evidence consistent with a beneficial effect from the receipt of tokens entitling pregnant women and children under five years of age, to a pint of milk at half price each day.

Acknowledgements

A very large number of persons were involved in this work and we wish to record our sincere gratitude to all of them. In addition to the families involved, officers of the Area Health Authorities, milk delivery men and members of both our Units gave constant support and encouragement. Above all, the nurses involved in the field work, Carole Hopkinson, Daphne Williams and Sylvia Roberts, and Mrs. Marion Jones who was involved in very many ways, deserve our very special thanks.

References

Auden, G. A., 1923.
An experiment in the nutritive value of an extra milk ration.
Journal of Royal Sanitary Institute, **44**, 236–247.

Baker, I. A., Elwood, P. C., Hughes, J., Jones, M., Sweetnam, P., 1978.
School milk and growth in primary school children.
Lancet, **2**, 575.

Corry Mann, H. C., 1926.
Diets for boys during the school age.
Special Report Series No. 105, Medical Research Council.
London H.M.S.O.

Davies, D. P. and Holding, R. E. 1972.
Neonatometer: a new infant length measurer.
Archives of Disease in Childhood. **47**: 938–940.

McCollum, E. V., 1924.
The Nutritional Value of Milk,
Proceedings of World Dairy Congress **1**: 421.

Tanner, J. M., Hiernaux, J. and Jarman, S., 1969.
Growth and physique studies. In: *Human Biology: a guide to field methods.* Ed. J. S. Weiner and J. A. Lourie.
Blackwell Scientific Publications, Oxford.

5. Pre-School Child Survey

P T Fox, M D Elston, J C Waterlow
Department of Human Nutrition
London School of Hygiene and Tropical Medicine

5.1 Summary

5.1.1 Cross-sectional and longitudinal measurements were made on children aged two, three and four years in four regions of England. The social class structure of the sample was reasonably representative of that of the country as a whole. The results provide a baseline for future cross-sectional surveillance.

5.1.2 No important differences were found in the pattern of growth in the four areas and there was no evidence of a north-south gradation.

5.1.3 Groups of children were identified in whom height was significantly below the average. Although much of this variation in height was accounted for by parental size, there were differences in birth weight and in growth which are functions of social, economic and environmental factors. These differences were not related to breast-feeding or to the availability of milk. They were well defined at two years, and were no stronger at four years.

5.1.4 The changes in welfare legislation and in the price of milk did not appear to have affected the amount of milk consumed by pre-school children.

5.1.5 The evidence suggests that the more limited distribution of benefit since 1971 has in fact reached those who need it most.

5.1.6 Comparison between children born before the changes in the provision of welfare milk suggests that there were no adverse effects on growth.

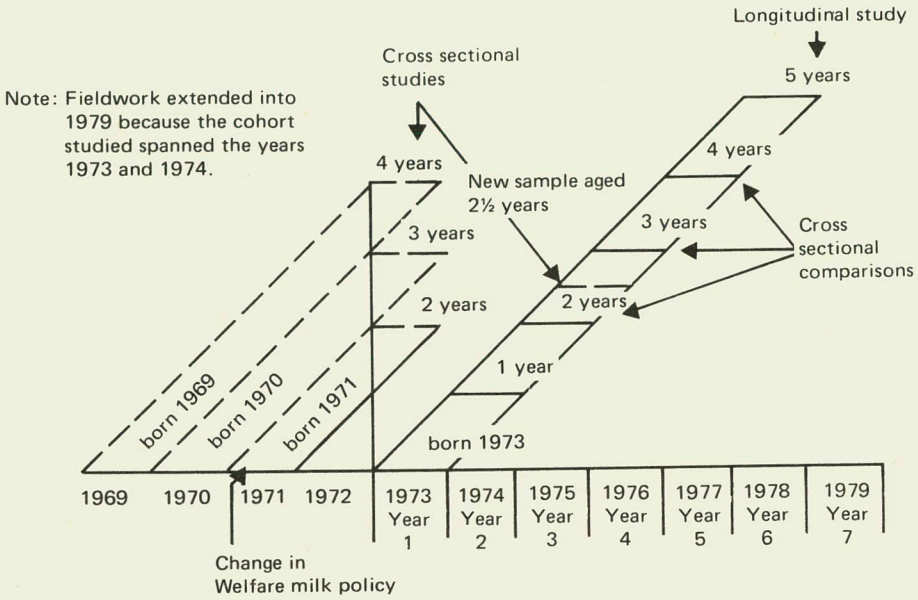
5.1.7 Although anthropometric differences were identified which are statistically significant, their significance for health remains uncertain. Perhaps the most that can be said is that a deficit in height may still, as in the past, be regarded as an indicator of social disadvantage.

5.2 Design

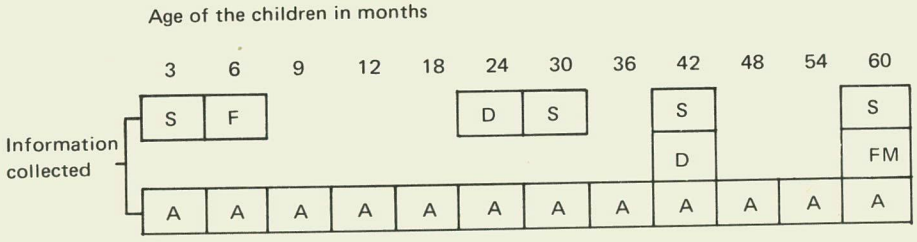
5.2.1 *General design.* The changes in the distribution of welfare milk were

introduced in April 1971. The planning and organization of the survey and the recruitment of staff took more than 18 months, so that field-work, other than a pilot study, did not begin until early in 1973. The final design, which is illustrated diagrammatically in Figure 5.1, had to take account of this delay. Particular importance was attached to attained height as a measure of satisfactory growth and nutrition, and therefore special attention is given to it in this report.

Figure 5.1: *Diagram showing the growth study of pre-school children conducted between 1973 and 1979.*



The information collected about the subjects involved in the longitudinal pre-school child growth survey (1973–79)



A — Anthropometric measurements — Height/length, weight, arm circumference, head circumference, biceps, triceps, subscapular, suprailiac skinfolds, illnesses.
F — Feeding information — breast feeding, introduction of solids, dietary pattern at 6 months.
FM — Anthropometric measurements of 'natural' members of each subject's family.
D — Developmental questions and assessment used in the British Births Study (1970).
S — Socioeconomic information — occupation, education, income of the parents, family structure, receipt of welfare benefits, health and care of the study child.

5.2.2 As the figure shows, the survey contained two components, cross-sectional and longitudinal. In the cross-sectional study measurements were made in 1973 of children who were aged 2, 3 and 4 years. The 3- and 4-year olds were born in 1969 and 1970, before the changes in welfare milk; the 2-year olds were mainly born after the change, but their mothers would have been entitled to subsidized milk during pregnancy.

5.2.3 For the longitudinal sample a cohort of children was selected who were born in 1973 and who were measured at intervals until they were 5 years old. This part of the study has two objectives: to compare children who were born before and after the 1971 changes (see Figure 1), and to provide a base-line for future surveillance. Longitudinal studies are desirable for this purpose, since they enable growth velocities to be determined, as well as attained heights and weights.

5.2.4 During the first year of the longitudinal study there was a noticeable amount of migration by the families of survey subjects. This diminished progressively over the first two and a half years and was insignificant thereafter. As it appeared to have a possible socioeconomic bias, concern was expressed that this might invalidate the anthropometric comparison of a local birth cohort—the longitudinal study population—and a mixed cohort—the cross-sectional study population.

5.2.5 As a check on the legitimacy of comparing the longitudinal results with the cross-sectional ones obtained several years earlier, a further cross-sectional sample was studied in 1976 of children who were then aged $2\frac{1}{2}$ years. As Figure 1 shows, this enables comparisons to be made both with the 1973 cross-sectional sample and with the longitudinal cohort.

5.2.6 The results and conclusions presented in this report are, therefore, all based on cross-sectional analyses, since the primary objective is to compare the growth of children born before and after the 1971 changes in legislation. The findings on the velocity of growth in the longitudinal study could form part of a baseline for future monitoring, and will be published elsewhere.

5.2.7 *Sampling frame.* The sampling frame used in both studies was the birth notification register. For the cross-sectional study its updated form, the immunization register, was more appropriate because it included children who had moved into the area and excluded those who had died or moved away. The use of such a register is only feasible when the data are stored on a computer.

5.2.8 *Choice of areas.* The criteria used in selecting the areas were:—

i. The existence of an accurate sampling frame. In the early 1970s most authorities did not maintain computerized registers, and this was one factor limiting the choice of areas.
ii. A population where births were in excess of 2,000 per year. This was necessary for the conduct of a longitudinal survey.

iii. A co-operative local authority, because the study requires some assistance from health visitors and the use of local authority clinics.
iv. A social structure providing an adequate sample of children whose families were described as: social class III M (manual) with 2–3 children. It was considered that such families would be on the borderline for receiving the new benefit, and would therefore be an important indicator group.

5.2.9 Six areas were initially selected: Northampton, Southampton, Stoke, Co Durham, Haringey and Dyfed. Haringey was later excluded because of the mobility of the population and Dyfed because the population was very scattered. The remaining four areas were considered to be reasonably representative of urban England. This was confirmed by comparison of the social class distribution of the samples with that of England and Wales as a whole.

5.2.10. *The size of the sample.* The number of children to be included in each sex/family size/social class group will depend on at least three factors: the magnitude of the smallest difference in any measurement which is meaningful in relation to health; the standard deviation of the measurement; and the degree of statistical confidence desired in detecting a meaningful difference. At present, however, we do not know how large a difference should be to have meaning as an index of nutritional status and in practice, therefore the choice of sample size must be a matter of judgement, in which the financial and administrative drawbacks of very large samples are balanced against their possible desirability in theory. On the basis of the available evidence it was concluded that about 150 children should be included in each 'cell' (according to age, sex, socio-economic group and family size), and that a sample of 3,000 children of each age would produce adequate numbers in the critical group—families of social class III manual with 2 or 3 children.

5.2.11 This calculation, which takes no account of possible geographical differences, determined the scope of the survey and the resources needed for it. In the four areas as a whole some 10,000 children were selected for study, 6000 in the cross-sectional and 4,000 in the longitudinal study. In the former, the sample represented children born over 6 calendar months and in the latter, children born over one year.*

5.3 Methods of interview and measurement

5.3.1 Four field workers, operating in pairs, were employed in each area. The work was supervised and the results analysed by the staff of the Human Nutrition Studies Group in London. No formal qualifications were required of the field workers, but initial training was given by the central team.

* *Footnote:* The Northampton sample was taken from children born from February to July (inclusive) in 1969, 70, and 71. The Southampton and Stoke samples were taken from children born from May to October and the Durham sample from children born from June to November of the same 3 years.

5.3.2 Interviews were conducted either in local authority clinics or in the home, according to the preference of the parents. Overall, 40% of children were seen in their homes. This is probably inevitable in any study of pre-school children, and it is for this reason that such studies require relatively large numbers of field staff.

5.3.3 Where there was no response to an introductory letter the field staff made home visits and the assistance of local authority staff was sought to trace missing members of the samples.

5.3.4 Weight was measured with beam-balance scales weighing to 20 g. Height or length was measured to 1 mm with a Holtain portable stadiometer or a modified Holtain infantometer. Triceps skinfold thickness was determined with Tanner/Whitehouse calipers reading to 0·2 mm, and arm and head circumferences with metal tapes reading 1 mm. Up to the age of 2 years the length of the child was measured, and thereafter height. Tanner, Whitehouse and Takaishi (1965) gave a mean difference of 10 mm of length over height at 2 years. In the present study the mean difference was 9·3 mm, independent of sex and age between 2 and 4 years.

5.3.5 In the cross-sectional study 46% of interviews were conducted within two weeks of the correct date, and in the longitudinal study 86%. Weights and heights were corrected for the expected growth during any delay by prediction from the standards of Tanner, Whitehouse and Takaishi (1965).

5.3.6 Quality control was maintained by periodic exercises in which all field workers were requested to make duplicate measurements on the same group of children. In addition, examination of the monthly work logs of each field worker made it possible to assess their consistency.

5.3.7 Additional information was collected by questionnaires administered by the field staff. In the cross-sectional study a single document was used for all age groups, whereas in the longitudinal study a series of documents was constructed, designed to trace changes in the circumstances of each family over the study period. Developmental status was also assessed with the questionnaires designed for the British Births Study (1970 cohort) (Chamberlain and Davey, 1976).

5.3.8 Socio-economic information was obtained from questionnaires administered at 3 months, $2\frac{1}{2}$ and 5 years. The results for the longitudinal sample discussed in this report use that information drawn from the questionnaire at $2\frac{1}{2}$ years, and therefore enable comparisons to be made between conditions in 1976 and 1973.

5.3.9 Some of the questions dealt with sensitive issues, such as family finance and the marital status of the parents, which might have caused them to withdraw from the study. However, since the purpose was to monitor those sections of the community most likely to be at risk, such questions could not be avoided. To assess bias from non-responders certain pieces of non-controversial information

were sought even when parents would not participate. These were: father's or mother's occupation, to indicate social class; family size and child's height or length. In many cases, even when a parent had refused to take part, the first two items of information was obtained. It was recognized that the wishes of non-responders must be respected, and this procedure seemed to be a reasonable approach to the problem of bias created by non-response.

5.3.10 All the methods were tested in a pilot survey carried out in Northampton in the autumn of 1972, before the main field work began early in 1973.

5.4 Response rates

5.4.1 *The cross-sectional study.* Of the 5,856 children originally selected, 520 were excluded from the sample because they had removed from the area or died, giving an effective sample of 5,366. Of this number, measurements and completed questionnaires were obtained for 4,045 (76%), the response rate being highest in Southampton (86%) and lowest in Stoke (69%). The non-reponders (24%) were made up of 6% who refused and 18% who could not be traced.

5.4.2 *The longitudinal study.* In a longitudinal study the size of the effective sample progressively decreased because of non-responders and by loss of children who moved out of the area or died. In the present study 4,206 children were originally selected from the registers in the four areas. The progress of this sample over four years is shown in Table 5.1. The proportion of non-responders at the various stages was about 10%. At age 4 questionnaires were completed and measurements made on 3,202 children, representing 76% of the initially selected sample.

5.4.3 In the sections which follow, the word 'sample' indicates a group of

Table 5.1: *Response Rate in the Longitudinal Study*

Age-point	Effective[1] sample	Seen[2]	%
0	Initial cohort selected 4206		
3 m	3936	3449	87·6
6 m	3884	3416	88·0
9 m	3846	3362	87·4
1 yr	3805	3352	88·1
2 yr	3734	3295	88·2
$2\frac{1}{2}$ yr	3704	3304	89·2
3 yr	3652	3224	88·3
4 yr	3628	3202	88·3

(1) In this column the difference between each successive entry represents the net loss of children through death or moving out of the area. Thus 270 of the initial cohort were lost in this way.
(2) The difference between the number seen and the effective sample represents non-responders (353, or 9% of the effective sample at 3 months) and children who could not be traced (134, or 3% of the sample at 3 months). This number remained fairly constant throughout the study.

children who were actually measured, and not the sample as originally drawn. For brevity, samples from the cross-sectional and longitudinal studies will be referred to as CS and LS samples.

5.5 Characteristics of the samples

5.5.1 *Sex distribution.* In both samples the sex distribution was approximately equal in all areas and at all ages.

5.5.2 *Social class and economic status.* Table 5.2 (A and B) shows the social class distribution based on the criteria of the Office of Population Censuses and Surveys Classification of Occupations (1970). There are some obvious and expected differences between areas.

5.5.3 Table 5.2C shows the social class distribution in England and Wales as a whole, as recorded in 1971 (United Kingdom Census, 1971). It seems that the study samples were slightly weighted towards the lower social classes compared with the national average. The reason may be that the samples in the survey were necessarily derived from families with young children. This represents a bias in the right direction for the purposes of the survey.

5.5.4 The main difference between the CS and LS samples was that the latter contained a larger proportion of children from social class V (6%, compared with 3·8% in the CS sample). This probably represents a real difference in the composition of the samples, rather than a deterioration between 1973 and 1976, because when the LS sample was drawn in 1973 the proportion in social class V was 5·4% The LS sample in 1976 also showed a small increase over the CS sample in the proportion of families where the father was chronically unemployed (2% compared with 1·4%) and of families with no father figure (4% compared with 3·1%).

Table 5.2: *Social Class Distribution*

	A		B				C
Social class	CS		LS	(3/12)	LS	(30/12)	reference
I	174	4·3%	158	4·5%	126	3·8%	4·8%
II	504	12·5%	434	12·2%	413	12·5%	17·3%
III NM	331	8·2%	272	7·7%	260	7·9%	11·4%
III M	2027	50·1%	1698	47·9%	1561	47·2%	36·4%
IV	657	16·2%	651	18·4%	514	15·6%	17·0%
V	154	3·8%	193	5·4%	204	6·2%	8·0%
Other†	198	4·9%	140	3·9%	226	6·8%	5·1%
	4045		3546		3304		100·0%

* Social class of males from the 1971 UK census (from Table 30, p. 184, UK Census 1971, 10% Sample of Economic Activity, Part IV)
† Children not classifiable by father's occupation

Table 5.3: *Family Size distribution*

A: cross-sectional samples

sibs	Age 2 Born 1971		Age 3 Born 1970		Age 4 Born 1969	
0	393	28·3%	242	17·9%	167	12·8%
1	559	40·3%	624	46·2%	626	47·9%
2	243	17·5%	274	20·3%	293	22·4%
3+	193	13·9%	211	15·6%	220	16·8%
	1388		1351		1306	

B: longitudinal sample

sibs	Age $2\frac{1}{2}$ Born 1973–4	
0	964	29·2%
1	1509	45·7%
2	529	16·0%
3+	302	9·1%
	3304	

5.5.5 *Family size.* The distribution of family size in the two samples is shown in Tables 5.3 (A and B). This comparison has to be made for children at similar ages, since families are larger when the children are older. The results for the LS sample were obtained at $2\frac{1}{2}$ years, which is as close as possible to the average age of the CS sample. The LS sample contained a higher proportion of families with one or two children and a much smaller proportion of families with four or more children (9%, compared with 14% for the CS 2-year olds). This mirrors the national trend towards smaller families which was particularly evident in the mid-seventies.

5.5.6 *Special groups.* In order to reduce the heterogeneity of the samples for analysis of the anthropometric data, a small number of children belonging to special groups were excluded from further analysis: non-European races, children born of multiple pregnancies and handicapped children. These together amounted to 6·4% of the CS sample and 5·9% of the LS sample. The highest proportion of non-white children was found in Southampton (6% in the cross-sectional study, compared with 2·1% in the CS sample as a whole).

5.6 Anthropometric findings

5.6.1 In both samples comparisons for each age and sex group of the results from the four different regions showed very few differences which are statistically significant, and no pattern emerged of any consistent geographical trends. We therefore considered it legitimate to pool the data from the four areas for analysis. These pooled results provide provisional standards for pre-school children, based on larger sample than any previously studied in the UK.

5.6.2 As was pointed out in chapter 1, height/length was considered to be the

most important of the anthropometric measurements because it reflects the child's growth history from birth or even earlier. Weight, on the other hand, reflects the food intake over a more recent period. For this reason priority was given to analysis of the data for height. (For brevity, the word 'height' is used to cover measurements of both height and length.)

5.6.3 Differences between groups will only be mentioned if they are statistically significant at the level of $P=0{\cdot}05$ or less.

5.6.4 *Height.* Mean heights for each sex are given in Table 5.4 (A and B) and centiles for weight in Figures 5.2 and 5.3 for children aged 2, 3 and 4 years. At all ages the centiles, particularly the lower ones, are above those recorded by Tanner, Whitehouse and Takaishi (1965). The only significant difference between the CS and LS samples is that in the former 3 and 4-year old boys were approximately 0·5 cm taller, but there was no difference in the heights of the girls.

Table 5.4: *Mean Height (cm) by Age and Sex*

Year of birth	age	boys mean	boys sd	boys n	girls mean	girls sd	girls n
		A: cross-sectional samples					
1971	2	87·15	3·22	597	85·76	3·06	606
1970	3	94·94	3·59	609	93·67	3·78	559
1969	4	102·07	3·81	584	100·83	4·23	589
		B: longitudinal sample					
1973–1974	2	87·00	3·19	1488	85·78	3·21	1463
	3	94·56	3·65	1238	93·59	3·58	1236
	4	101·55	3·95	1477	100·70	4·02	1454

5.6.5 *Weight.* Mean weights are shown in Table 5.5 (A and B) and observed centiles at each age in Figures 5.4 and 5.5. The centiles are consistently below those found by Tanner, Whitehouse and Takaishi (1965) by about 0·25 kg, and sometimes by as much as 0·5 kg. The only significant difference in weight between the two samples was in the 3-year old boys, who were 0·2 kg lighter in 1976 than in 1973.

5.6.6 *Other measurements.* The overall means for skinfold thickness, arm circumference and head circumference are shown in Table 5.6 (A and B). These results and the inter-relationships between the different anthropometric variables will be described in more detail elsewhere. Their main value at present is to provide a standard of comparison for those who may be making studies of special groups.

Figure 5.2: *Centiles for height (calculated) – cross-sectional samples 1973*

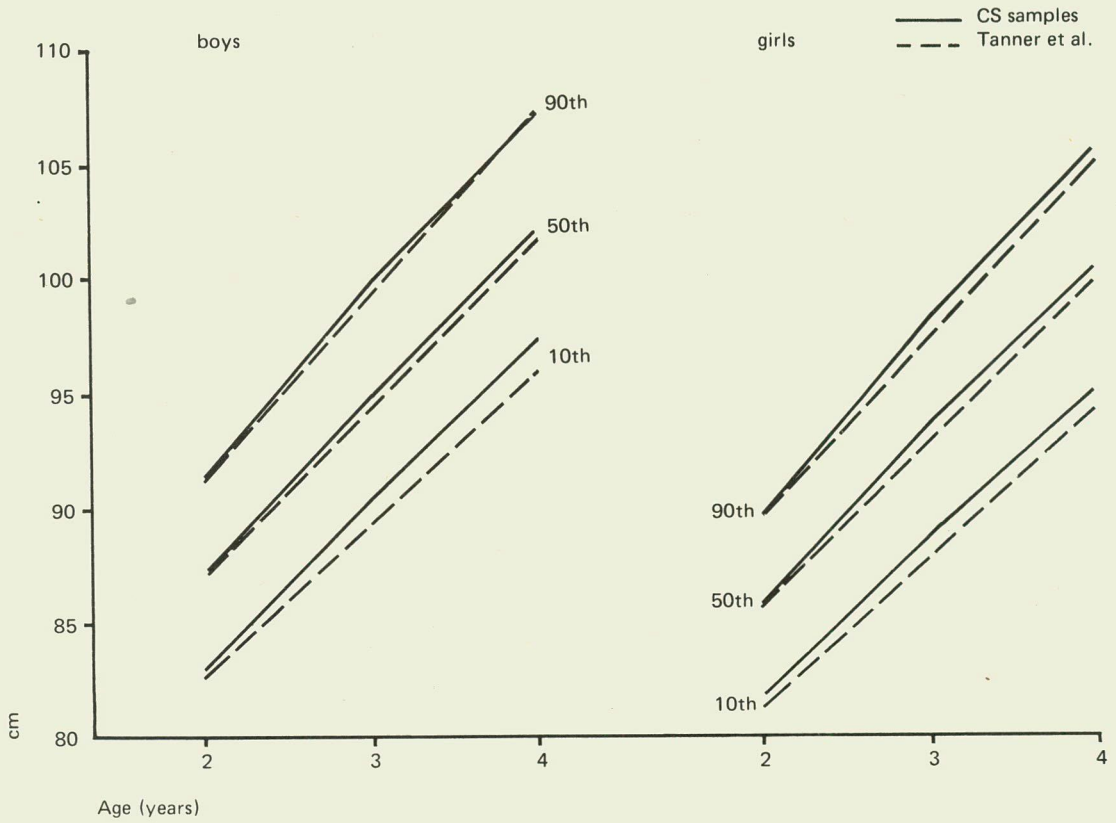


Figure 5.3: *Centiles for height (calculated) — longitudinal sample 1975–7*

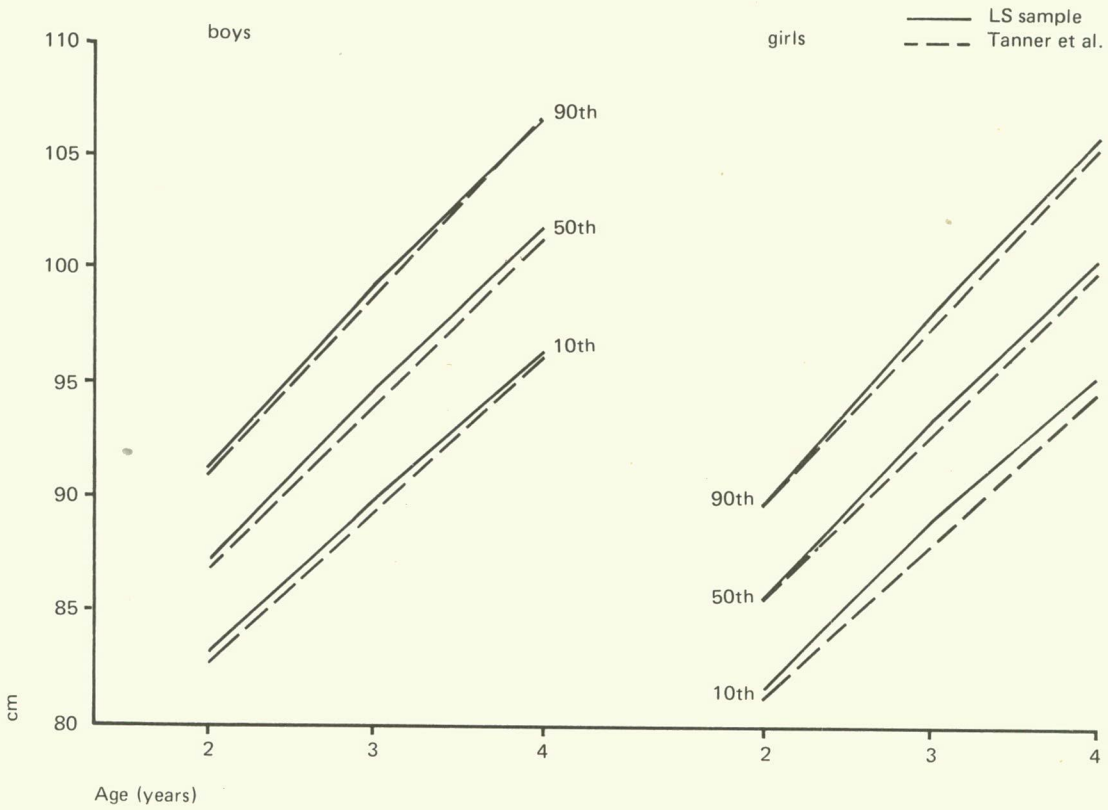


Table 5.5: *Mean Weights (kg) by Age and Sex*

year of birth	age	boys mean	boys sd	boys n	girls mean	girls sd	girls n
		A: cross-sectional samples					
1971	2	12·54	1·51	657	11·87	1·44	675
1970	3	14·67	1·83	680	14·10	1·99	617
1969	4	16·55	1·87	636	15·99	2·17	626
		B: longitudinal sample					
1973–1974	2	12·45	1·35	1476	11·85	1·35	1455
	3	14·56	1·59	1464	14·04	1·69	1437
	4	16·44	1·96	1491	15·99	2·07	1463

5.7 The relationship of anthropometric measurements to family and social environment

5.7.1 The social and economic factors discussed in this section are based on information collected in 1973 in the cross-sectional study and in 1976 in the longitudinal study, when the children were $2\frac{1}{2}$ years old.

5.7.2 *Family size.* Children with no siblings were taller than those with two or more (Table 5.7). The difference was found in all age-groups; it was about 0·7 cm in boys and 1·6 cm in girls, and is independent of social class. Comparison of the two samples showed a difference in boys aged 3–4 years: those with less than two siblings were 0·8 cm shorter in the longitudinal sample.

5.7.3 *Social class and economic status.* In both samples there were significant differences in height between social class groups (Table 5.8). Children in classes I–III NM were about 1 cm taller than those in classes IV–V. Class III M occupied an intermediate position. The size of the difference was the same for each sex and age group.

5.7.4 Differences in weight showed a similar pattern, running parallel with the height differences both between social classes and between family sizes.

5.7.5 The only difference between the CS and LS samples was found in social class III M in the 3 and 4-year old boys, who were about 0·7 cm shorter in 1976 than in 1973.

5.7.6 Children whose father (or father-figure) was not earning were on average 1 cm shorter than those whose fathers were in employment. The difference was the same for both sexes and for both temporarily and chronically unemployed fathers. Children in one-parent families showed no difference in height from those whose fathers were earning.

5.7.7 *Other factors.* The height of the child at 2–4 years is influenced by its size

Figure 5.4: *Centiles for weight (actual) – cross-sectional samples 1973*

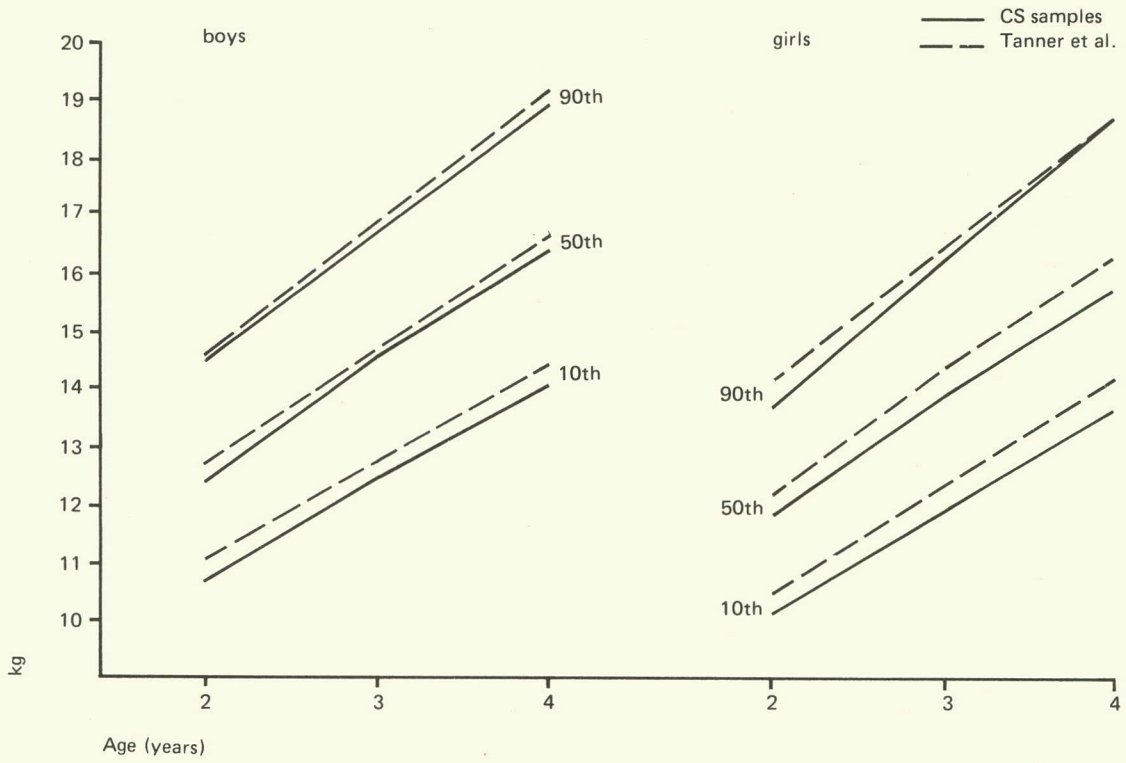


Figure 5.5: *Centiles for weight (actual) — longitudinal sample 1975–7*

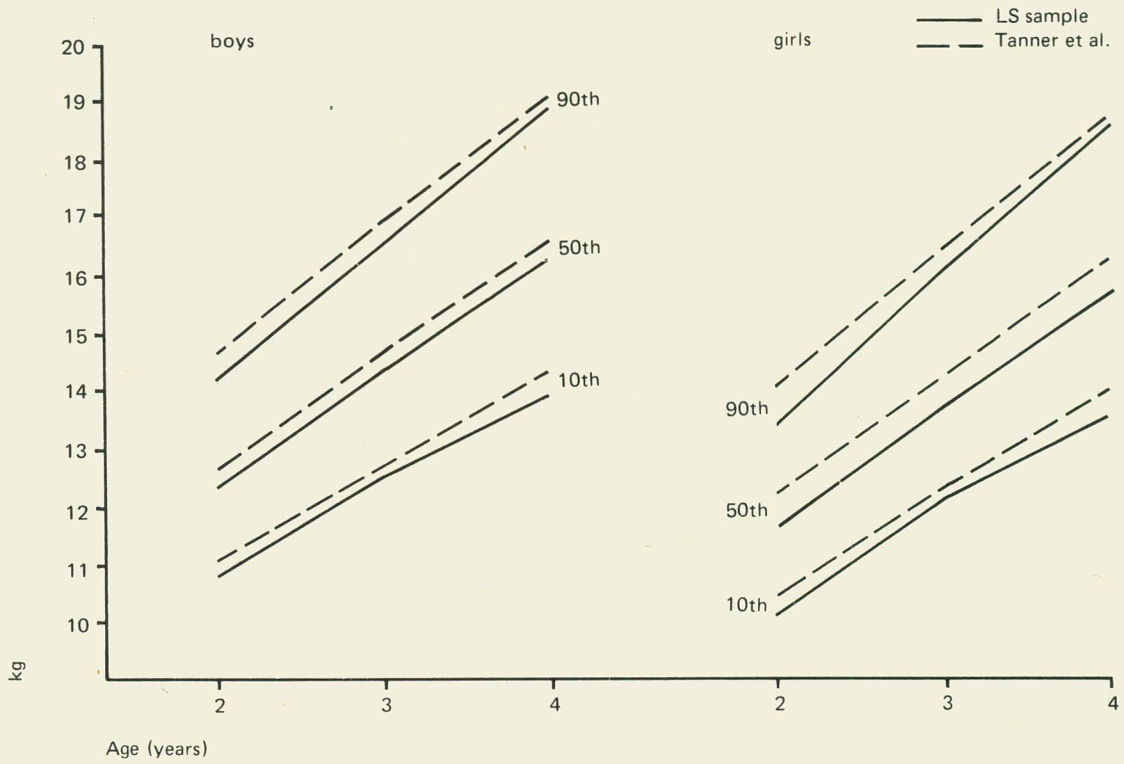


Table 5.6: *Head and Arm Circumference and Skinfolds, by Age and Sex*

age	Head circumference cm		arm circumference cm		biceps skinfold mm		triceps skinfold mm		subscapular skinfold mm		suprailiac skinfold mm	
	boys	girls	boys	girls	boys	girls	boys	girls	boys	girls	boys	girls
					A: cross-sectional samples							
2	49·05	47·74	16·14	15·90	5·29	5·53	8·61	9·02	5·65	5·94	6·02	6·68
3	50·21	48·85	16·68	16·54	5·41	5·70	8·58	9·17	5·44	5·92	5·92	6·86
4	50·95	49·62	16·95	16·90	5·32	5·64	8·44	9·19	5·25	5·57	5·83	6·79
					B: longitudinal sample							
2	49·13	47·94	15·90	15·63	5·27	5·39	8·50	8·79	5·57	5·83	5·70	6·35
3	50·37	49·13	16·30	16·13	5·30	5·44	8·82	9·18	5·44	5·79	5·60	6·57
4	51·06	49·89	16·57	16·55	5·07	5·45	8·86	9·55	5·04	5·48	5·23	6·27

The values tabulated are: for head and arm circumference, the mean of the actual measurements; for skinfolds, the values were converted using the transformation 100×log (skinfold×10−18) and the mean of the transformed values converted back into mm.

Dispersion: For each measurement, only the means differed between age and sex groups. Standard deviations are given for head and arm circumference. For skinfolds, the semi-interquartile ranges are as follows:

biceps	1·2 mm
triceps	1·5 mm
subscapular	1·3 mm
surailiac	1·8 mm

(The semi-interquartile range is half the difference between the first and third quartiles. For a normal distribution, it represents approximately two-thirds of the standard deviation.)

Table 5.7: *Mean Height by Age (cm) Sex and Family Size*

			A: cross-sectional samples			
	boys			girls		
Number of sibs	mean	s.d.	n	mean	s.d.	n
Age 2 born 1971	87·66	3·05	171	86·64	3·05	175
1	87·29	3·38	251	85·70	2·96	242
2	86·44	2·96	98	85·33	2·85	113
3+	86·50	3·15	77	84·54	3·15	76
Age 3 born 1970						
0	95·35	3·37	110	94·27	3·66	112
1	95·08	3·56	293	93·66	3·72	263
2	94·66	3·86	119	93·61	3·88	112
3+	94·31	3·51	87	92·86	3·96	72
Age 4 born 1969						
0	102·80	3·58	73	101·67	3·84	86
1	102·45	3·71	296	100·89	4·16	282
2	101·37	3·84	128	100·82	4·62	129
3+	101·44	4·06	87	99·89	4·11	92
			B: longitudinal sample			
Born 1973–4						
Age 2						
0	87·30	3·26	448	86·41	3·04	443
1	87·05	3·07	689	85·78	3·13	673
2	86·66	3·31	226	85·21	3·47	234
3+	86·22	3·24	125	84·54	3·22	113
Age 3						
0	94·82	3·84	373	94·25	3·30	391
1	94·60	3·54	583	93·62	3·52	559
2	94·27	3·69	180	92·81	4·03	198
3+	93·88	3·40	102	92·24	3·51	88
Age 4						
0	101·90	4·06	434	101·47	3·77	443
1	101·63	3·89	695	100·73	3·86	662
2	101·03	3·89	226	100·02	4·46	233
3+	100·77	3·85	122	99·00	4·24	116

at birth and by the height of its parents. When account was taken of these factors the difference in height between the social classes became smaller, but was still statistically significant. Thus, as it is well known, social class differences in parental height tend to be perpetuated in the children.

5.7.8 There was also an effect of the mother's age. For mothers of equal parity children were shorter if the mother was less than 22 years old when the child was born.

5.7.9 There are a number of overlapping factors which affect the child's environment, many of which vary with social class. For both samples the influence on height of some 30 factors, identified from the questionnaires, was examined by multivariate analysis. The mother's education had a significant

Table 5.8: *Mean Height by Age (cm) Sex and Social Class*

	A: cross-sectional samples					
	boys			girls		
Social class	mean	s.d.	n	mean	s.d.	n
Age 2 born 1971						
I-III NM	87·64	3·02	164	ß86·25	3·07	157
III M	87·37	3·22	278	85·62	3·00	316
IV-V	86.25	3·13	128	85·46	3·19	110
Other	86·20	3·89	27	85·79	2·90	23
Age 3 born 1970						
I-III NM	95·40	3·40	187	94·34	3·45	127
III M	94·83	3·68	281	93·66	3.74	293
IV-V	94·42	3·56	112	93·04	4·10	112
Other	94·87	3·81	29	93·20	4·12	27
Age 4 born 1969						
I-III NM	102·97	3·92	142	101·23	4·42	145
III M	102·09	3·55	309	100·86	4·10	300
IV-V	101·27	4.02	107	100·62	4·37	114
Other	101·14	4·45	26	99·39	3·81	30
	B: longitudinal sample					
Born 1973–4						
Age 2						
I-III NM	87·67	3·10	369	86·20	3·18	364
III M	86·87	3·23	716	85·65	3·07	703
IV-V	86·66	3·04	216	85·61	3·48	322
Other	86·54	3·03	103	85·67	3·31	74
Age 3						
I-III NM	95·31	3·54	316	94·05	3·64	312
III M	94·30	3·78	599	93·42	3·46	598
IV-V	94·41	3.44	236	93·39	3·74	258
Other	94·06	3·33	87	93·85	3·65	68
Age 4						
I-III NM	102·55	3·90	361	101·30	3·97	353
III M	101·34	4·00	716	100·56	3·94	701
IV-V	101·04	3·85	300	100·34	4·16	321
Other	100·90	3·44	100	100·82	4·27	79

effect on the child's height, which was independent of social class and family size. The children whose mothers left school at 15 were significantly smaller in stature compared with those who continued their education beyond this age. At 2 years, the difference was 0·4 cm, at 3 years, 0·7 cm and at 4 years, 1·0 cm. The differences were greater by the time the child was aged 4, and were twice as great for boys as for girls. The effects of maternal education were smaller in the LS than in the CS sample. Other factors which had a significant independent relationship to the children's height were the number of people per room and the receipt of welfare benefits (see below).

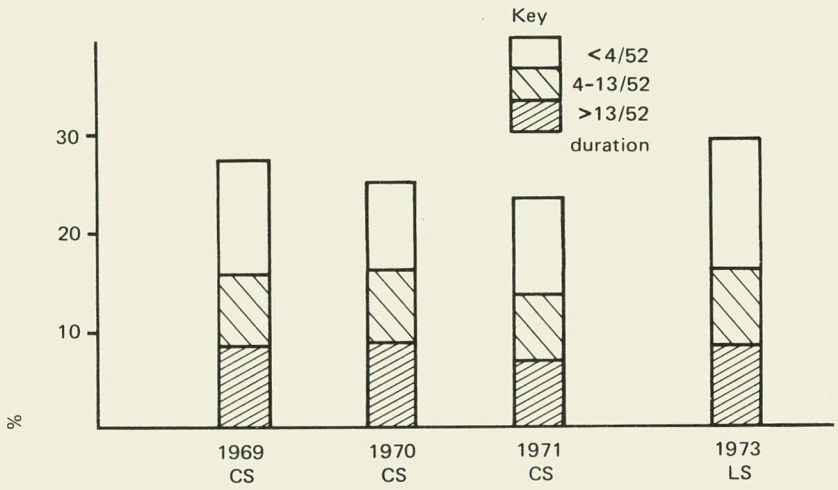
5.7.10 Parental height, birthweight and mother's age and parity explained about 25% of the variation in the children's height by the age of 2 years. Social

class differences were still significant after corrections had been made for these variables. The receipt of welfare benefits was found to be as good a discriminator of height as social class or father's income. The pattern was similar in both samples, except that in the LS sample the economic indicators played a relatively greater part in explaining the variation in height.

5.8 Breast feeding and intake of milk

5.8.1 *Breast feeding.* The proportion of mothers who breast fed their children was 27% in 1969 and 23% in 1971, increasing to 29% in 1973 (from the data obtained in the 1976 survey). In all samples mothers from social classes I–III NM were twice as likely to breast feed as those from other groups. Information on the duration of breast feeding is shown in Figure 5.6. In both samples breast fed children were slightly but significantly taller than those who were not breast fed, independently of social class.

Figure 5.6: *Rates for breast feeding*



5.8.2 *Milk intake.* In the samples studied in 1973, 75% of children in all the three age groups (2, 3 and 4 year olds) were receiving $\frac{2}{3}$ of a pint of milk or more per day at the time of the survey, and only 4% received less than $\frac{1}{3}$ of a pint. The proportions were the same in 1976. There was no difference between the social classes. Within all social classes the small number of children taking less than $\frac{1}{3}$ of a pint daily were on average more than 1 cm shorter than those who took more. The amount taken over $\frac{1}{3}$ of a pint made no difference to height.

5.9 The uptake of welfare milk

5.9.1 Table 5.9 shows the uptake of welfare milk during pregnancy and during

Table 5.9: *Percentage for Uptake of Welfare Milk by Social Class and Year*

A: % Rates for uptake of milk during pregnancy				
Social class	1968–9	1969–70	1970–1	1972–3
I-III NM	93·8	85·9	65·5	7·3
III M	94·4	89·7	58.7	10·2
IV-V	95.0	88·1	56·7	15·7
Other	90·6	89·5	53·1	38·8
Total	94·2	88·3	59·9	12·4
B: % Rates for uptake of milk during first year				
Social class	1969–70	1970–1	1971–2	1973–4
I-III NM	92·0	77·6	15·2	ß5·0
III M	93·0	81·0	13·9	ß9·4
IV-V	90·9	73·0	22·8	16·0
Other	94·3	89·3	57·7	50·7
Total	92·4	78·7	18·0	11·5

the first year of life of the child. In both categories there was a marked fall after the changes in legislation in 1971. The uptake was higher in the most disadvantaged groups, particularly in those who fell outside the social class classification, such as one-parent families and those with fathers unemployed. This is evidence that the benefit was going to those families who needed it most.

5.9.2 Since there was a social class gradation in the uptake of the benefit, it is necessary to compare results within social class groups, in order to examine more precisely whether the 1971 changes had any effect.

5.9.3 In social class I–III NM no differences in attained height were found between the CS and LS samples. With one exception (see below) a consistent pattern emerged for social classes III M, IV and V, whether we examined the effect of uptake of benefit during pregnancy, in the first year of life, or at the time of study.

5.9.4 For example, if we consider the effect of welfare milk during pregnancy in social classes IV and V, two comparisons can be made. The first is between the children of the CS sample born before 1971, the great majority of whose mothers received welfare milk (Table 5.9), and the children of the LS sample whose mothers did not receive milk (85% of the sample). There was no difference in height between these two groups of children, and one may therefore conclude that by this criterion withdrawal of the benefit had no adverse effect. The second comparison is between the children in the LS sample whose mothers did (15%) or did not (85%) receive welfare milk. The former were on average 1 cm shorter in height. This suggests again that the benefit was going to those most in need.

5.9.5 There is one exception to this general pattern. It has already been noted that within social class III M the boys of the LS sample at 3–4 years were shorter than their opposite numbers in the CS sample. When this difference was

examined in relation to the uptake of welfare milk, it was found that the boys born in 1973 of mothers who did not receive welfare milk (90% of the sample) were on average 0·5 cm shorter than those born before 1971. This may be a chance finding, since there was no difference in the girls. The children of the remaining 10%, whose mothers did receive the subsidy, were 1 cm shorter still, as in Social Classes IV and V.

5.9.6 It seems reasonable to conclude that those from whom the subsidy was withdrawn did not suffer, with a slight reservation in respect of some children in social class III M.

Acknowledgments

The survey was executed by the Human Nutrition Studies Group at the Department of Human Nutrition, London School of Hygiene and Tropical Medicine. The Group had the benefit of advice, particularly in the early stages, from a Steering Committee composed of Professor J M Tanner (Chairman), Professor M J R Healy, and the late Professors Donald Reid and Jack Tizard. We are grateful to them for their guidance.

The success of such a survey depends in great part on the quality of the fieldwork, and our thanks must go to the twenty or so members of our fieldwork teams for their care, perseverance and hard work. In particular we thank the team leaders, Mrs R Bicknell, Mrs D Darlow, Mrs B Snape and Mrs M Wilson, and also Mrs Dorothy Bailey, who spent much time checking questionnaires and ensuring the quality of the data.

Thanks are also due to those members of the Group in London who assisted with data processing and with the computing, especially to Janet Catterick and Sally Kerry for much of the production of the computer analyses.

References

Tanner, J.M., Whitehouse, R.H. and Takaishi, M., 1965
Standards from birth to maturity for height, weight, height velocity and weight velocity: British children 1965.
Archives of Disease in Childhood, **41,** 454 and 613.

Chamberlain, R. and Davey, A., 1976
Cross-sectional study of developmental test items in children aged 94 to 97 weeks. Report of the British Births Child Study.
Developmental Medicine and Child Neurology, **18,** 54–70.

6. The National Study of Health and Growth Surveillance of Primary School Children (1972–1976)

W W Holland, R J Rona, S Chinn, D G Altman, L M Irwig, J Cook, C du V Florey
Department of Community Medicine
St. Thomas's Hospital Medical School,
London SE1 7EH

6.1 Summary

6.1.1 A surveillance system of growth in primary school children was organized and 19300 children from 22 areas in England and 6 areas in Scotland participated in the study at least once in the period 1972–76.

6.1.2 Between 95·5% and 98·8% of the sample was measured every year, and a questionnaire completed by a parent had a response rate of around 90% every year. The quality of the measurements of height and weight was excellent and of triceps skinfold acceptable. Thus a surveillance system of growth in primary school children in England and Scotland is feasible.

6.1.3 In the first five years of the study we detected changes in unemployment rates in the community that mimic the national pattern and also a marked tendency towards smaller families. These changes may affect the pattern of growth in childhood.

6.1.4 Our standards of height and weight of primary school children based on a cross-section of geographic areas of England are similar to the values based on the 1959 and 1966 London County Council data. We found a gradient of height from south to north, on average children in the south were the tallest, children in Scotland the smallest, while children in the north of England had an intermediate height.

6.1.5 We were unable to detect any decrease in the height of later cohorts of children in comparison to earlier cohorts of children in England and Scotland in the period 1972–76.

6.1.6 While most of the explained variation in height of children is due to

parents height, father's social class, number of siblings in the family and whether the father is employed or not still make a contribution to the variation of height of school children in England and Scotland.

6.1.7 Respiratory symptoms in childhood are significantly related to child's height. This association is smaller than the association of social and family factors with height. Nevertheless in lower social classes and large families common respiratory symptoms are strongly related to stature.

6.1.8 Availability of free school milk did not affect height gain of boys and girls in England and Scotland. However we cannot discard the possibility that particularly deprived children benefit from school milk.

6.2. Objective of the study

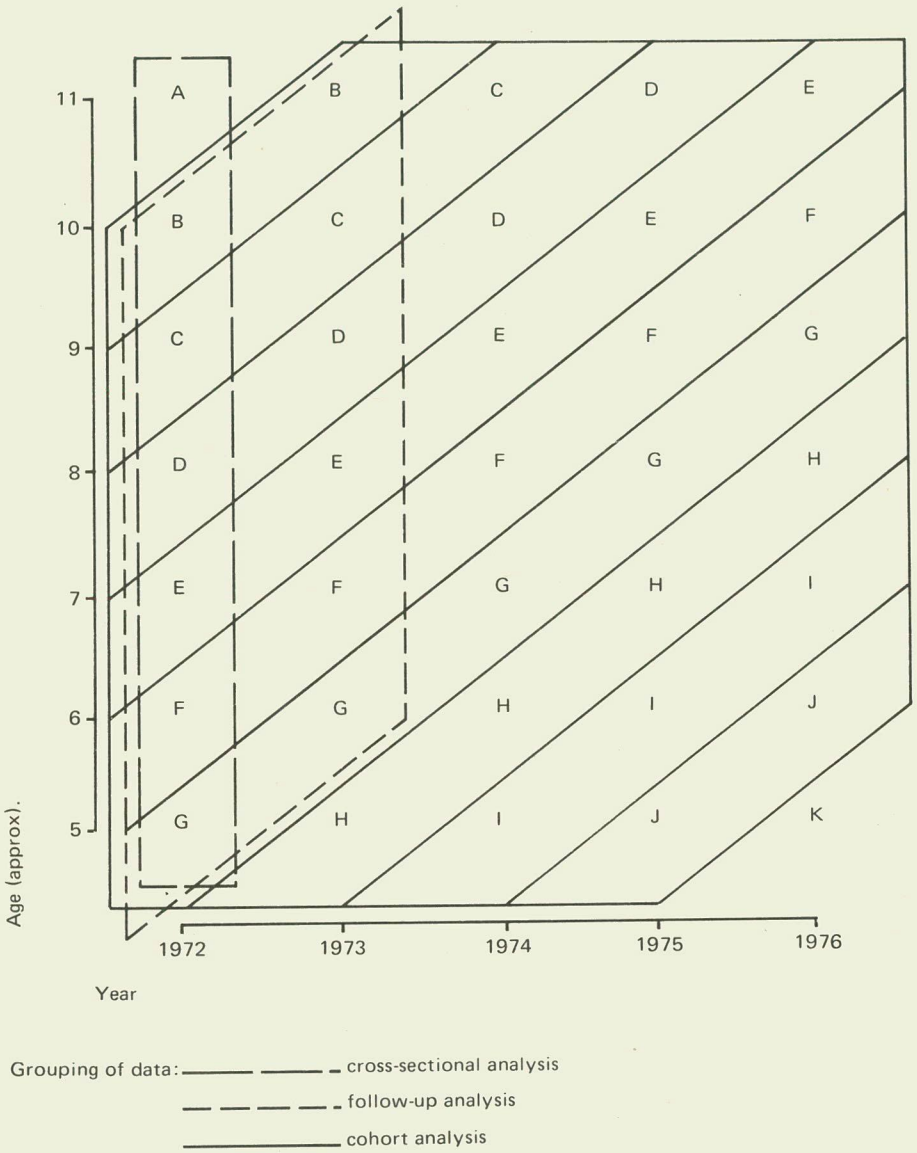
6.2.1 The objective of the National Study of Health and Growth, as recommended by the first Report of the Subcommittee on Nutritional Surveillance (1973) was to develop an anthropometric system of surveillance to assess the influence of changes in social circumstances or social policy on growth in primary school children.

6.3 Design of the study and collection of information

6.3.1 The mixed longitudinal design of the study was described briefly in the First Report of the Sub-Committee on Nutritional Surveillance (Department of Health and Social Security (1973) and is shown in Figure 6.1. The design has been described in detail by Altman and Cook (1973) and Irwig (1976). About 8000 children in England and 2200 children in Scotland aged five to 11 participated in the study every year; a total of 19300 children were attending a school in the study at the time of at least one survey from 1972 to 1976. Areas were divided into six socio-economic strata in England and four strata in Scotland based on unemployment figures, uptake of free school meals and the proportion of children leaving school aged 15 years; a random stratified sampling with proportionally more children from schools were selected in each area by local medical and education authorities. The geographical distribution of study areas is shown in Figure 6.2.

6.3.2 Methods of measurement of height, weight and triceps skinfold follow recommendations by Wiener and Lourie (1969) and Tanner and Whitehouse (1962). A self-administered questionnaire, completed by the child's parent or guardian, requested information on father's social class, employment status, family income, parents' education, sibship size and receipt of welfare benefits, parents' height and weight, child's birth weight, nutrition such as availability of milk and meals at school and health status in terms of respiratory symptoms.

Figure 6.1: *Design of the National Study of Health and Growth*



6.4 Acceptability of the study

6.4.1 One of our primary goals was to assess the feasibility of an ongoing surveillance system in terms of acceptability. Between 95·5% and 98·8% of the sample was measured every year. The variation was not related to the number of years of participation in the study nor to the country (Table 6.1a). The

Figure 6.2: *Areas in National Study of Health and Growth*

questionnaire had a response rate of 91% in 1972 falling to 87% in 1976. Response to the questionnaire based on reply to number of older siblings was analysed according to year of entry and year of survey (Table 6.1b). The response rate varied between 85·2 and 92·6% in England; this variation did not depend on the number of years of participation in the study but it tended to decrease slightly

Table 6.1: *Response (%) each year by country and year of entry.*

Year of Survey	England					Scotland				
	Year of entry									
	1972	1973	1974	1975	1976	1972	1973	1974	1975	1976
(a) Measurement of height obtained										
1972	98·8					98·4				
1973	98·4	97·8				98·3	97·4			
1974	97·4	96·6	96·7			97·2	96·2	96·7		
1975	97·6	97·7	98·0	97·6		96·6	98·1	97·0	95·7	
1976	97·7	97·8	98·3	97·6	97·8	97·0	97·3	97·7	97·2	95·5
(b) Response to questionnaire										
1972	92·0					89·4				
1973	89·8	88·7				88·4	88·7			
1974	91·0	91·0	92·6			86·6	88·5	87·5		
1975	88·6	87·6	88·4	87·8		87·3	87·8	84·7	86·0	
1976	87·4	87·9	87·6	86·0	85·2	87·6	87·4	86·9	89·1	83·8

as the years went by. The response rate in Scotland was slightly lower. Sensitive topics such as father's occupation had a worse response rate, (about 70 to 80%). No decrease in response rate has been observed since 1976. All the schools in the study cooperated for the first five years of surveillance.

6.5 Demographic and social changes in the first five years of the study

6.5.1 We examined these changes in terms of social class composition, father's employment status and sibship size in the first five years of the study.

6.5.2 In England there has been no consistent change in social class composition of new entrants and leavers. In Scotland a net loss in social class IV and V resulted from the redevelopment that took place in one area.

6.5.3 In 1972 28% in social class V were unemployed, about 6·5% in the other manual social classes and under 2% in non-manual social classes. In all social classes unemployment diminished in 1973 and 1974 and then increased to 1972 levels by 1976. This pattern corresponds with the national trend of unemployment although they are not strictly comparable. (Social Trends, 1977.)

6.5.4 The proportion of children with three or more siblings diminished between 1972 and 1976 in England and Scotland and the proportion with only one or no sibling increased in both countries from 1972 to 1976. The larger families are over-represented by classifying each child by sibship size, as they are more likely to have more than one child taking part in the study.

6.5.5 In conclusion the changes observed in the English sample followed the national pattern; the Scottish sample, because of its smaller size, is subject to

variations resulting from particular events in one area. Our study shows that big changes in demographic and social circumstances can be observed in relatively short periods of time.

6.6 Quality control of measurements

6.6.1 Actual measurements for the National Study of Health and Growth are made by nurses, employed in each area, under the direction of fieldworkers. Three fieldworkers were employed; between 1972 and 1976 there were only two changes of fieldworkers. The quality of the measurement techniques was assessed in two ways: by the precision, or the variation between measurements of the same quantity and, more importantly, by the relative bias between observers, i.e. the amounts by which their measurements differ on average. Relative bias between fieldworkers has been assessed each year in a trial involving 20–30 children. Few problems were encountered in training them to take comparable measurements of height and weight, but small differences in triceps skinfold measurements were usually detected, the more experienced fieldworkers obtaining smaller measurements on average.

6.6.2 Each year a systematic sub-sample of children in the study had check measurements taken by the fieldworker. From 1973 to 1976 two check measurements of height were made, which enabled the components of bias due to measuring and stretching to be separated. Analysis of the pairs of actual and check measurements showed that relative biases between nurses and fieldworkers were less than 0·1 cm for height and 200 g for weight, less than any difference between groups that would be considered meaningful. From 1972 to 1976 two measurements of triceps skinfold were made. Agreement between these pairs was good, but measurements made by the nurses were on average 0·4 mm greater than those made by the fieldworkers, and the differences showed considerable variation. It was concluded that variation between nurses accounted for almost all the error, and the second measurement of triceps skinfold made by the nurse could be omitted with hardly any loss of information.

6.6.3 Some results from the analysis of 1972 and 1973 check measurements have been reported before (Irwig, 1976).

6.7 Standards of height, weight and triceps skinfold

6.7.1 Data from the first year of the study in England have been used to obtain standards of height, weight and triceps skinfold. These standards were compared to measurements taken the same year in Scotland and U.K. Standards based on the 1959 and 1966 London County Council data, Tanner, Takaishi and Whitehouse (1966), Tanner and Whitehouse (1975) and Cameron (1977). A detailed description of methods and results has been published elsewhere (Rona and Altman, 1977).

6.7.2 The mean heights of English boys and girls were similar to the mean values produced by Tanner, Takaishi and Whitehouse (1966) and Cameron (1977). The mean heights of Scottish children were nearly 2 cm shorter than the English children for most age groups. Our English standards of weight were similar to the standards of Tanner, Takaishi and Whitehouse while Scottish children lagged behind at most ages in both sexes. From our analysis by geographic region, we have shown that the children south of latitude 53° are between 1 and 1·5 cm taller on average than children north of latitude 53° in the age range five to 11 years.

6.7.3 The similarity in height and weight between our data from 22 areas of England and the earlier London County Council data suggests two possible alternative explanations: the secular trend of height increase in the age range studied has stopped in England, or the secular trend is still in operation enabling, for example, poorer populations at present to achieve a similar stature to richer populations measured before.

6.7.4 Triceps skinfold among English children was greater than among Scottish children for both sexes. Some of our standards were different from those published by Tanner and Whitehouse: our third and 50th centile for girls and our third centile for boys were above their 1966 data. We measured triceps skinfold in a position slightly above that used by Tanner and Whitehouse (1975). Ruiz, Colley and Hamilton (1971) reported a tendency to increased triceps skinfold values as the site is higher up the arm. Thus the differences between our results and Tanner and Whitehouse might be due to the small differences in technique.

6.8 Surveillance 1972–1976

6.8.1 Table 6.2 of this report gives the numbers in each cohort present at each survey. Cohorts are defined by year of birth, rather than age at survey, so that a unique cohort is defined for each child. In addition to cohorts who enter the study at age five and leave it for secondary school some children move areas between the ages of five and 11; in general they are replaced by children in the same cohort who enter the area.

6.8.2 The average growth curves for the different cohorts were compared to seek evidence of any change in growth rate attributable to inadequate nutrition. These are shown in Figure 6.3 for English boys and Figure 6.4 for English girls. The growth of English boys followed a constant pattern with the possible exception of the 1962 cohort in which the children were on average a little over 0·5 cm smaller than the children in other cohorts. English girls showed some differences in growth rates. The later cohorts were somewhat taller than earlier cohorts at ages seven to nine, but their rates of growth were slightly less, so that by age 10 the heights of all cohorts were similar. Growth curves for Scottish children showed similar patterns, but appeared less consistent largely because of the smaller numbers involved; boys from the 1962, 1963 and 1964 cohorts were slightly shorter than the rest.

Table 6.2: *Number of children by birth cohorts seen at each Survey from 1972 and 1976*

Birth cohort	1972	1973	1974	1975	1976
England					
1960	272	—	1	—	—
1961	916	291	3	—	—
1962	1184	964	274	1	1
1963	1202	1213	987	291	1
1964	1275	1300	1325	1072	301
1965	1231	1266	1280	1278	1063
1966	1217	1227	1267	1262	1252
1967	825	1173	1204	1211	1231
1968	4	830	1223	1233	1270
1969	—	3	736	1084	1101
1970	—	—	4	728	1092
1971	—	—	—	3	771
1972	—	—	—	—	7
Scotland					
1960	49	1	—	—	—
1961	331	61	3	—	—
1962	320	314	33	3	1
1963	371	358	342	37	2
1964	331	322	304	300	33
1965	333	336	325	314	306
1966	358	333	318	319	308
1967	315	370	342	325	314
1968	9	308	344	324	321
1969	—	13	304	320	321
1970	—	—	11	290	333
1971	—	—	—	18	302
1972	—	—	—	—	21

6.8.3 Children in the 1960, 1961 and 1962 cohorts had free school milk available to them at older ages than later birth cohorts. Data for these three cohorts are limited but there is no evidence that they are taller than the other cohorts studied; if any difference existed it is that the 1962 cohort of English boys were shorter than the later cohorts to whom free milk was available only until the summer term after their seventh birthday.

6.8.4 Growth curves were also plotted for children from manual social classes with two or more siblings (as recorded at entry to the study) because they were thought to be more 'at risk' as a group than the rest. Allowing for the smaller numbers a similar pattern emerged to that observed for all the children.

6.8.5 No changes in growth of English boys have taken place which could be attributed to adverse economic circumstances or changes in government policy. The results for the girls are difficult to interpret. The later cohorts appear taller, although by age ten there is little difference, yet it is known that at a given age taller children grow faster than shorter children, so it might be expected that the later cohorts would maintain their height advantage. In other words it appears that although they experienced some advantage in pre-school years which led to a height advantage at ages five to seven, subsequently their height was similar to earlier cohorts.

Figure 6.3: *Mean growth curves by cohort, English boys.*

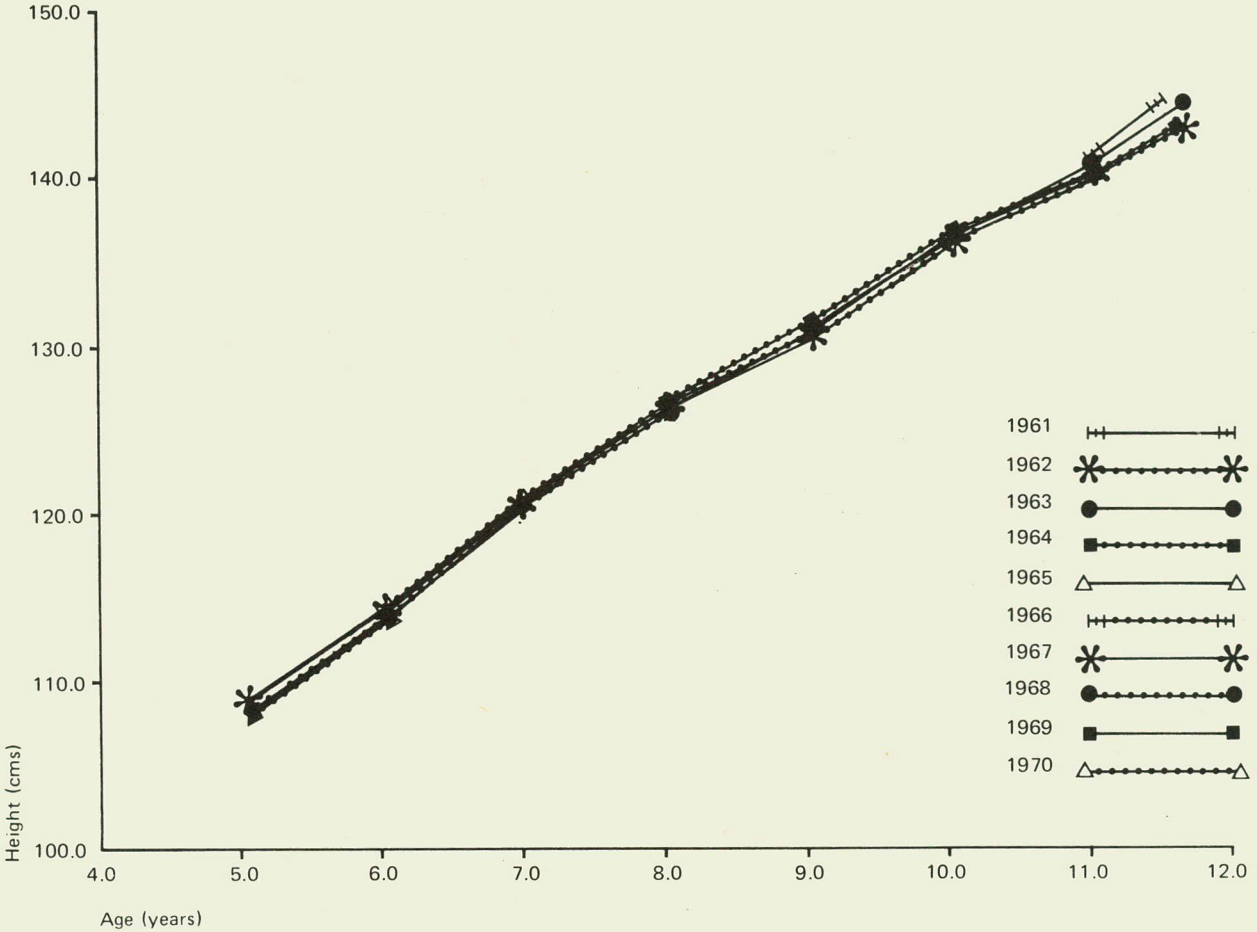
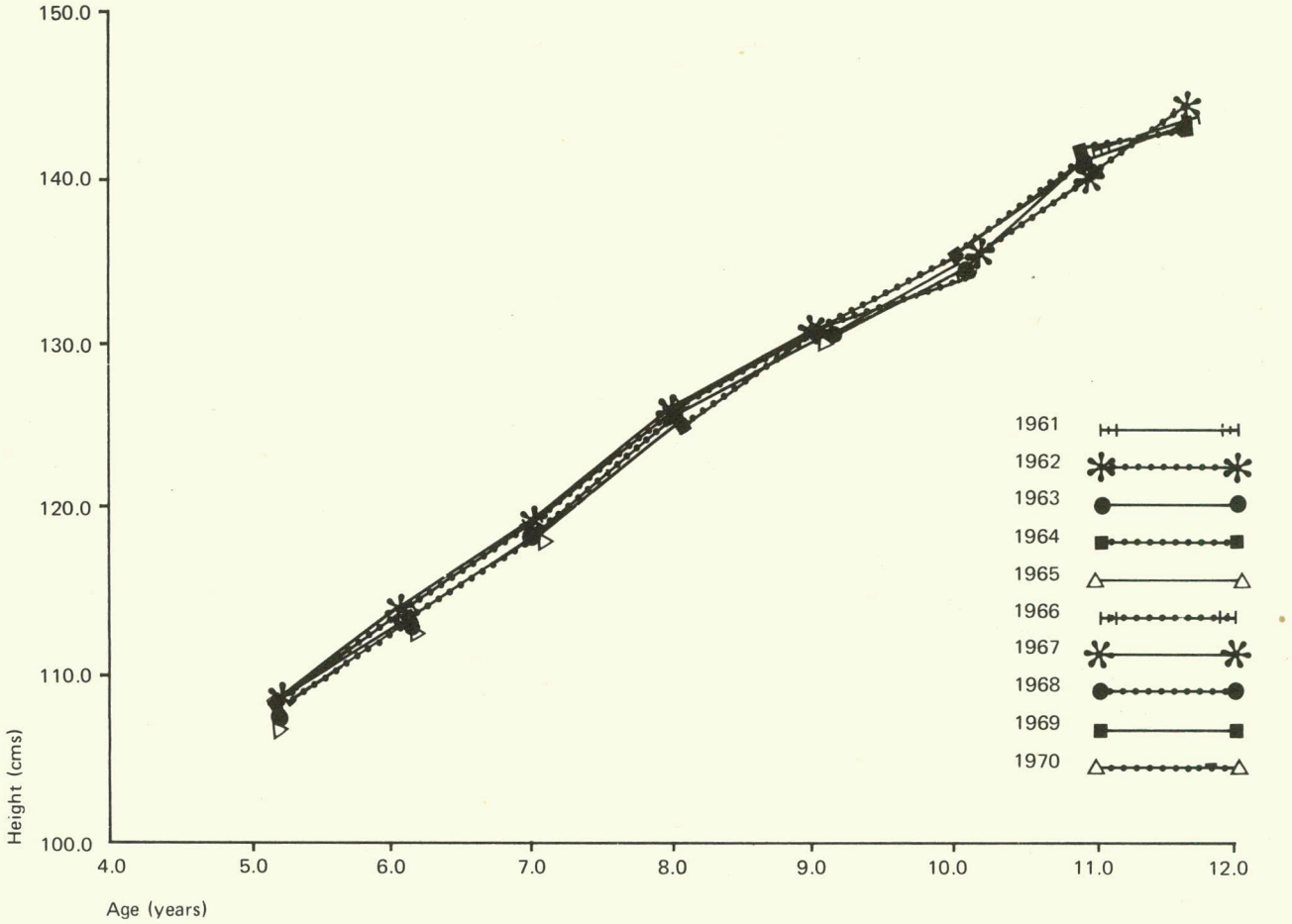


Figure 6.4: *Mean growth curves by cohort, English girls.*



6.8.6 Holland, Chinn and Wainwright (1980) reported a comparison of the weights of the 1965–1969 birth cohorts. The measurements used were those for 1972–1976 respectively so that each cohort had a mean age of about seven years at the time of measurement. No significant differences were found between the median weights of these cohorts.

6.9 The relationship between social factors and height

6.9.1 We assessed the influence of social factors on attained height and height gain in one year using data for father's social class, employment status (employed or unemployed), parents' education, parents' height, sibship size, child's birth weight and mother's age at child's birth (Rona, Swan and Altman, 1978; Rona, Wainwright, Altman, Irwig and Florey, 1979; Smith, Chinn and Rona, 1980). Height was analysed in terms of actual height in cm or standard deviation score[1] which takes age and sex into account. One standard deviation score is equivalent to about five to seven cm in our age groups.

6.9.2 In the single analysis of height by father's social class we found the trend of children's stature by father's social class was very similar in England and Scotland. There was little difference between the height of children from the non-manual social classes but children in manual social classes were smaller than children in non-manual social classes and between manual social classes there was a marked trend towards smaller stature in the less skilled occupations.

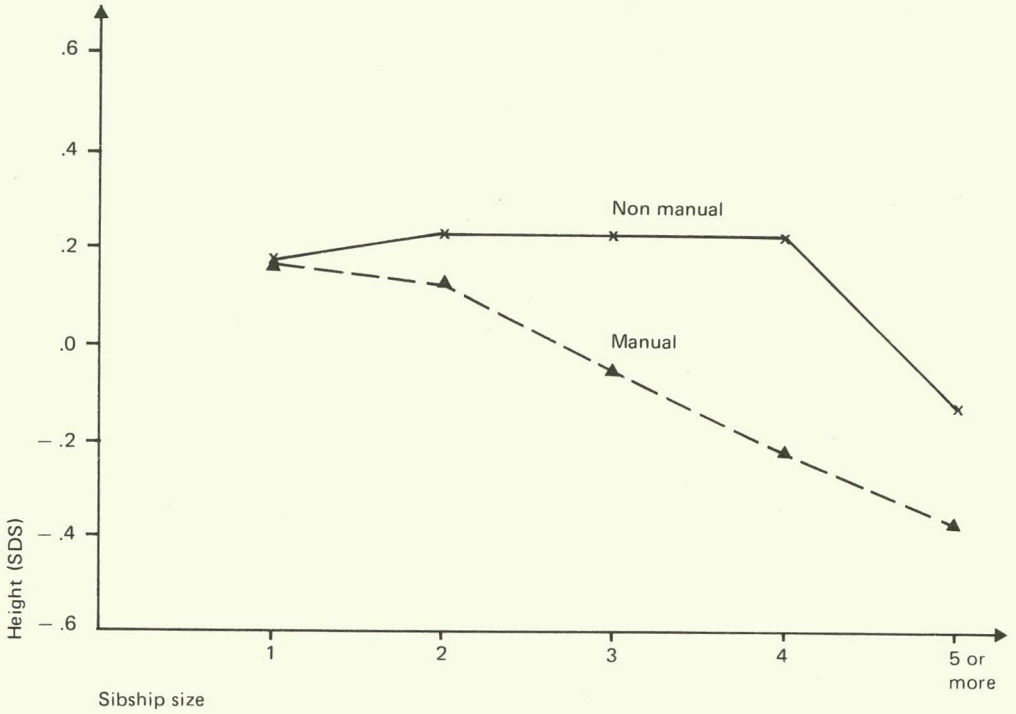
6.9.3 A linear model was used to assess the separate and combined influence on attained height of father's social class, sibship size, father's employment status, birthweight of the child, mother's age at child's birth and parents' reported height. Attained height was most strongly associated with parents' height after allowing for all the other variables in the model. There was a negative relationship between attained height and sibship size and a positive relationship between attained height and birth weight.

6.9.4 In Scotland father's employment status (employed or unemployed) was significantly associated with attained height after allowing for the other factors while in England father's social class was significantly associated to attained height after allowing for the other factors.

6.9.5 Attained height was analysed by father's occupation, manual or non-manual status and the number of siblings in the family. There was a negative relationship between attained height and sibship size in the manual social classes in England but in the non-manual group attained height decreased only for sibship size five or over (Figure 6.5). This may mean that sibship size is associated

[1] Standard Deviation Score (SDS) is calculated for each child as the difference between a child's own height and the mean height of children of the same age, sex and country of residence (England or Scotland) divided by the standard deviation of those children. This method removes the effects of age, sex and country of residence while standardising for the increasing variance of height in the age range of five to 11 years.

Figure 6.5: *Height of children in England expressed in Standard Deviation Score (SDS) according to the occupation status of their fathers and sibship size.*



(Redrawn from Rona, Swan & Altman 1978, with permission)

with height through economic hardship and that once this has disappeared differences which appear to be related to sibship size are partially eliminated.

6.9.6 The differences in height were already present in five year olds, so we analysed the relationship between height gain and social factors to assess whether there was an independent contribution of social factors to height after age five. Children from larger sibships grew more than expected given their initial heights. There was also an indication of greater relative height gain (change of standard deviation score from 1972 to 1973) in children from social class V than other social classes. Thus the associations of attained height and social factors in five-to ten-year-old children arise almost entirely before the age of five.

6.10 Height and respiratory illness

6.10.1 Children with morning cough, day and night cough, wheeze and a number of episodes of asthma and bronchitis in the last 12 months tended to be smaller than children without respiratory symptoms (Rona and Florey, 1980). Adjustments for parents' height, social class and number of siblings tended to eliminate the overall difference between children with and without symptoms with the exception of asthma. However, in lower social classes children with morning cough or day and night cough were shorter than children in the same social classes without these symptoms (Figure 6.6). Within large sibships children with morning cough or day and night cough were shorter than children without the respiratory symptoms. There was a highly significant trend showing that children with more episodes of asthma were shorter; this relationship did not diminish after adjusting for other variables and was of the same intensity in both sexes.

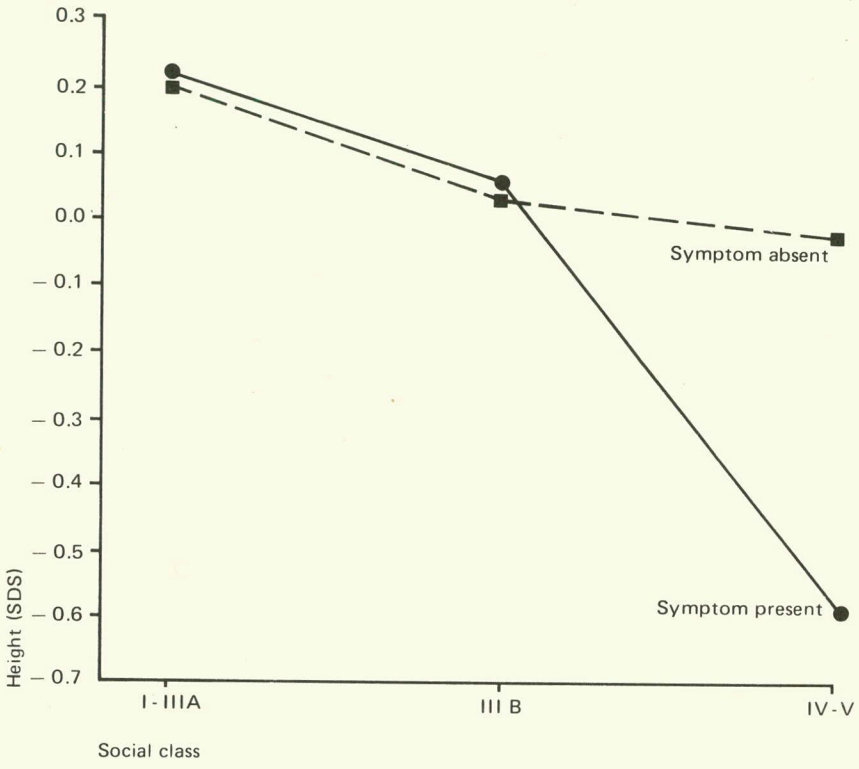
6.10.2 Children with respiratory symptoms tended to grow less in terms of cm/year than children without respiratory symptoms but only two significant relationships were found: boys with day and night cough and a positive trend in boys according to number of respiratory symptoms.

6.10.3 On balance our results indicate that with the exception of asthma the association between respiratory symptoms and height is only marginal. If respiratory symptoms affect growth they do so far less than parents' height, child's birth weight and social circumstances. Nevertheless in lower social classes and large families common respiratory symptoms are related to stature.

6.11 Social policy and growth: the influence of availability of free school milk on the height of children in England and Scotland

6.11.1 The National Study of Health and Growth, set up in 1972, was designed as a surveillance study to monitor effects, if any, on the nutritional status of schoolchildren following the change in the provision of free school milk in 1971. Pre-1972 baseline data were not available to assess directly the effect of the

Figure 6.6: *Morning cough and attained height by social class of father*



(Redrawn from Rona & Florey, 1980, with permission)

change in milk policy. However, because of variations in the way local authorities applied the post-1971 regulations limited data were available from the study to enable an investigation of the influence of free school milk on height gain. This investigation was reported in detail by Cook, Irwig, Chinn, Altman and Florey (1979) and is summarised here because of its importance.

6.11.2 At each survey information obtained from the parent or guardian on the availability of free school milk for each child and the number of glasses of milk drunk by the child at home. Data from two consecutive years were used to divide children into two groups: children to whom free milk was available in both years and children to whom milk was not available in either year. These two groups will be called the YES-YES and NO-NO groups. Had free school milk been provided for each child exactly as laid down by government policy the ages of the two groups could not have overlapped, but the variation in policy as applied allowed selection of cohorts containing approximately equal numbers of children, with similar age distributions, in the two groups. The cohorts were the 1965 birth cohort with data from the 1972 and 1973 surveys, the 1966 cohort data from 1973

and 1974, the 1967 cohort data from 1974 and 1975 and the 1968 cohort, data from 1975 and 1976. Each cohort had an average age of about seven years at the time of the first survey.

6.11.3 The mean height gain of the two groups were compared for each cohort, for each sex and country (England and Scotland), separately. Only two significant differences were found out of 16 comparisons: the YES-YES Scottish girls in the 1965 cohort and the YES-YES English boys in the 1966 cohort grew more than their NO-NO counterparts. Similar results were obtained for children of manual workers alone. There were too few children from social classes IV and V in any one cohort for separate analysis, but when the four cohorts were combined there was no significant *increase* in height for the YES-YES compared with the NO-NO group in any of the four sex-country groups.

6.11.4 No relation between height gain and total consumption of milk, at school and at home could be found among children of manual workers in the 1965 cohort.

6.11.5 The main hypothesis tested was that availability of free school milk leads to higher growth rates, as it is availability rather than consumption that can be affected by government policy. However this is dependent on the assumption that availability of free milk leads to increased consumption; over 90% of children in 1972 were reported to drink free school milk when available, but very few bought milk or brought it from home. Substantial quantities of milk were drunk at home by all groups of children, and any small differences found between the YES-YES and NO-NO groups were chance findings.

6.11.6 Because the overall results were not consistent with any alternative hypothesis we concluded that the availability of school milk has no real effect on group well-being when drinking milk at home is almost universal. It is possible, however, that particularly deprived children benefit from free school milk.

Acknowledgements

We would like to thank all the doctors, nurses, teachers, administrators and clerks in the study areas for their generous assistance. We are grateful to our colleagues in the team: fieldworkers, statistical assistants, research assistants and secretarial staff who collaborated so efficiently in the collection, processing and typing of the information. We wish to thank all the parents who cooperated in this study and dedicate this paper to all the children in our study who so patiently submitted to measurement year after year.

References

Altman, D. G. and Cook, J., 1973.
A nutritional surveillance study.
Proceedings of the Royal Society of Medicine, **66**, 646–647.

Cameron, N., 1977.
An analysis of the growth of London schoolchildren: the London County Council's 1966–67 growth survey.
Ph. D. Thesis. University of London.

Central Statistical Office, 1977.
Social Trends No. 8.
London, H.M.S.O.

Cook, J., Irwig, L. M., Chinn, S., Altman, D. G. and Florey, C. du V., 1979.
The influence of availability of free school milk on the height of children in England and Wales.
Journal of Epidemiology and Community Health, **33**, 171–176.

Department of Health and Social Security, 1973.
Reports on health and social subjects No. 6.
First Report by the Subcommittee on Nutritional Surveillance.
London. H.M.S.O.

Holland, W. W., Chinn, S. and Wainwright, A., 1980.
Weight and blood pressure in children. In: *Childhood prevention of atherosclerosis and hypertension.* pp 331–341. Edited by R. M. Laver and R. B. Shekelle.
New York: Raven Press.

Irwig, L. M., 1976.
Surveillance in developed countries with particular reference to child growth.
International Journal of Epidemiology, **5**, 57–61.

Rona, R. J. and Altman, D. G., 1977.
National Study of Health and Growth: Standards of attained height, weight and triceps skinfold in English children 5 to 11 years old.
Annals of Human Biology, **4**, 501–523.

Rona, R. J., Swan, A. V. and Altman, D. G., 1978.
Social factors and height of primary children in England and Scotland.
Journal of Epidemiology and Community Health, **32**, 147–154.

Rona, R. J. and Florey, C. du V., 1980.
National Study of Health and Growth: Respiratory Symptoms and height in primary schoolchildren.
International Journal of Epidemiology, **9**, 35–43.

Rona, R. J., Wainwright, A. H., Altman, D. G., Irwig, L. M. and Florey, C. du V., 1979.
Surveillance of growth as a measurement of health in the community.
Edited by W. W. Holland, J. Ipsen and J. Kostrzewski. Copenhagen.
In: *Measurement of levels of health.* Example **28**, p. 397–404.
World Health Organization European Series No. 7.

Ruiz, L., Colley, J. R. T. and Hamilton, P. J. S., 1971.
Measurement of triceps skinfold thickness, an investigation of sources of variation.
British Journal of Preventive and Social Medicine, **25**, 165–167.

Smith, A. M., Chinn, S. and Rona, R. J., 1980.
Social factors and height gain of primary school children in England and Scotland.
Annals of Human Biology, **7**, 115–124.

Tanner, J. M. and Whitehouse, R. H., 1962.
Standards for subcutaneous fat in British children. Percentiles for thickness of skinfold over triceps and below scapula.
British Medical Journal, **I**, 446–450.

Tanner, J. M., Whitehouse, R. H. and Takaishi, M., 1966.
Standards from birth to maturity for height, weight, height velocity and weight velocity: British children, 1965. Part I and II.
Archives of Disease in Childhood, **41**, 454–471, 613–635.

Wiener, J. S. and Lourie, J. A., 1969.
Human biology: A guide to fields methods.
International Biological Programme Handbook No. 9.
Oxford: Blackwell Scientific Publications.

7. A Randomized Controlled Trial of the Effect of the Provision of Free School Milk on the Growth of Children

I A Baker, P C Elwood, J Hughes, M Jones, P M Sweetnam, M.R.C Epidemiology Unit, South Wales.

7.1 Summary

7.1.1 The effect on the growth of 7 and 8 year old school children of one third of a pint of milk (190 ml) every school day for two years was assessed in a randomized controlled trial. Five hundred and eighty one children, all from families of four or more children, were selected from schools in which a high proportion of pupils were in receipt of free school meals.

7.1.2 The mean difference in height gain after 21 months was 3% or 2·9 mm. in favour of the children given the extra milk ($P < 0{\cdot}05$).

7.2 Introduction

7.2.1 In a controlled experiment in 1926, Corry Mann demonstrated that a daily supplement of one pint of milk could increase growth by height of 6–11 year old boys by 43% or 2 centimetres in one year. In 1934, subsidized milk was made available for school children. Under the Education Act of 1944, one third of a pint of free milk was to be provided daily to all children in maintained schools. This provision was withdrawn from secondary schools in 1968 and from 7–11 year children in 1971, except for those designated as 'in need' by School Medical Officers. The Sub-committee on Nutritional Surveillance of the Department of Health and Social Security were requested subsequently to monitor the effects of the withdrawal of free school milk.

7.3 Objectives

7.3.1. To determine, in a randomized controlled trial, the effect of the provision of free school milk on the growth of 7 and 8 year old children over two school years. To compare children selected for the trial with children of the same age in the general population of Mid-Glamorgan.

7.4 Method

7.4.1 Twenty-five schools in Mid Glamorgan were identified by 20% or more of their pupils receiving free school meals. Within these schools pupils were identified who were 7 and 8 years old on 1 September, 1976. Of these pupils, those who belonged to families of four or more children were selected for the trial. 581 children were selected in this manner and randomly allocated within schools to a group provided with one third of a pint (190 ml) of free milk daily for six school terms or to a control group.

7.4.2 Measurements of height with the Harpenden stadiometer and weight by beam balance were made by the same observer at the beginning of the study and on six subsequent visits over two school years. This observer was blind to the group allocation of the children. The subjects in the milk provided group drank their milk with pupils who were receiving milk on medical grounds, who had been excluded from the trial. The drinking of milk was supervised by school secretaries or members of the teaching staff. A second observer asked the subjects on each visit whether they were drinking milk at school and the responses were recorded. Information was also collected concerning other eating habits during the morning break.

7.4.3 In order to see whether the provision of free school milk has any effect on learning ability, reading assessment scores were recorded for each child, when available, for the three years of the study. As a standard test was not used for all schools in the trial, the results of the tests could only be considered within schools and not for all children combined.

7.4.4 To compare characteristics of children in the trial with children in the general population of Mid Glamorgan, a stratified random sample of children was drawn from the 208 primary schools in the county. The schools were stratified into four strata by percentage of pupils receiving free school meals, Table 7.1. Eight schools were selected randomly from each stratum. All children who were aged seven, eight or nine on 1 September 1977 were measured for height and weight by the same observer as in the milk trial. It was intended that selection in this manner would have some similarity with selection methods used in the National Study of Health and Growth in Schoolchildren in England and Scotland (NSHG) by members of the Department of Community Medicine of St.

Table 7.1 *Sample of Mid Glamorgan Schoolchildren measured for height and weight*

	% children receiving free school meals			
	0–9	10–19	20–29	30–39+1
No. of schools	86	86	24	12
No. selected, randomly	8	8	8	8
%	11	11	30	60
No. children aged 7, 8, 9 years selected	917	913	977	887

Thomas' Hospital, London. The questionnaire developed by the same Department for their National Study was also used and sent to all parents of selected children. 3694 children were measured and 3337 (90%) questionnaires were completed. The characteristics of the children were weighted according to the proportion of the total population which was contained in each of the above strata before comparisons were made with children in the milk trial.

7.5 Results

7.5.1 The effect of the provision of free school milk on growth by height and weight has been considered for the total interval between the initial visit and the last, seventh, visit and an intermediate interval up to the fourth visit. By the seventh visit 45 subjects (8%) had dropped out of the trial by having been persistently absent or having left the area. Absentees on any particular visit were re-visited and measured as soon as possible following their absence. During the study 3 subjects in the control group received milk and 13 subjects in the milk provided group disliked milk and did not drink it. The measurements of these small numbers of subjects were ascribed to the group of the subjects initial allocation.

7.5.2 The mean age of the subjects and their mean attained height are shown by group allocation in Table 7.2. Mean attained height was 4 mm greater in the control group. The mean time interval between the first and last measurements was just over 21 and a half months in both groups. Growth by height and weight over this total duration of the trial is shown for both groups in Table 7.3. The difference in growth was approximately 3% both for the height gain of 2·8 mm and the weight gain of 130 g.

Table 7.2: *Characteristics of the two groups for subjects measured on the 1st and 7th visits*

Subjects	Milk provided		Controls	
No.	281		239	
Mean Age Years (SD)	8·04	(0·55)	8·04	(0·58)
Mean Height on 1st Visit Centimetres (SD)	123·7	(6·31)	124·1	(6·22)
Mean Time Interval Months (SD)	21·56	(0·28)	21·53	(0·26)

Table 7.3: *Growth in subjects between 1st and 7th visits*

Subjects	Milk provided	Controls
No.	281	239
Height, Centimetres (SD)	9·46 (1·68)	9·18 (1·67)
Weight, Kilograms (SD)	5·25 (2·26)	5·12 (1·90)

7.5.3 Growth in height over any period relates to the attained height of subjects at the beginning of the period. In this trial subjects in the control group had a mean attained height at the beginning of the study 4 mm greater than the mean attained height in the milk provided group. This difference in height may act to diminish the height gain difference between the milk provided group and the control group. An analysis of covariance has been undertaken to allow for the effect on the heights of subjects in the two groups recorded at the seventh visit of their heights at the initial visit. By this analysis, the adjusted mean height of subjects in the milk provided group is 2·93 mm greater than the adjusted mean height of subjects in the control group at the seventh visit. Growth by height and weight for both sexes separately is shown in Table 7.4. The differences in growth by height were 1·1 mm for boys and 4·5 mm for girls. Differences for growth by weight were 210 g for boys and 50 g for girls.

7.5.4 The older children in the trial may have been approaching the beginnings of their pubertal acceleration of growth by the end of the two-year period. The effect on growth by height for two different age groups in the milk provided and control groups has been examined in Table 7.5. A few children had achieved the

Table 7.4: *Growth in boys and girls between 1st and 7th visits*

Subjects	Milk provided		Controls	
	Boys	Girls	Boys	Girls
No.	144	137	123	116
Height (SD) Centimetres	9·21 (1·35)	9·72 (1·94)	9·10 (1·40)	9·27 (1·91)
Weight (SD) Kilograms	4·94 (2·16)	5·58 (2·33)	4·73 (1·45)	5·53 (2·21)

Table 7.5: *Growth in height between 1st and 7th visits by sex and age*

Subjects		Milk Provided			Controls		
Sex	Age	N→	Mean Growth (cm)	←(SD)	N→	Mean Growth (cm)	←(SD)
Male	7	68	9·30	(1·50)	60	9·08	(1·48)
	8/9	76	9·13	(1·20)	63	9·11	(1·32)
	All	144	9·21	(1·35)	123	9·09	(1·40)
Female	7	56	9·64	(1·47)	46	9·27	(1·37)
	8/9	81	9·78	(2·22)	70	9·28	(2·21)
	All	137	9·72	(1·94)	116	9·27	(1·91)
Both	7	124	9·45	(1·49)	106	9·16	(1·43)
	8/9	157	9·46	(1·82)	133	9·20	(1·84)
	All	281	9·46	(1·68)	239	9·18	(1·67)

age of nine years by the date of their initial examination and these have been grouped with those children aged eight. There appears to be no evidence that growth varied significantly within the age groups shown for both sexes combined or separately, according to the provision of free school milk.

7.5.5 Growth with the provision of free school milk may also have varied with the social class or employment status of the father of the families from which the subjects were drawn. Two groupings of social class I, II, and III and IV and V are shown in Table 7.6, together with the characteristic 'unemployed' for fathers not working and not classified by social class. There is no evidence that the effect on growth by height of the provision of free school milk varies with the social class groupings or employment status.

7.5.6 The fourth visit took place approximately twelve months after the commencement of the trial. 533 subjects were seen and measured at this time. The mean initial heights, mean height gains and mean weight gains are shown in Table 7.7. The differences in mean height and weight gain for both sexes combined (1·9 mm and 130 g) and for boys (2·0 mm and 210 g) and for girls (1·8 mm and 50 g) for the milk provided groups over the control groups are consistent with the differences found at the seventh visit at the end of the trial.

Table 7.6: *Growth in height between 1st and 7th visits by social class and employment status for both sexes*

Subjects	Milk provided			Controls		
Social Class	N→	Mean Growth (cm)	←(SD)	N→	Mean Growth (cm)	←(SD)
I, II, III	125	9·32	(1·51)	96	9·12	(1·39)
IV, V	68	9·51	(2·00)	64	9·21	(1·94)
Unemployed	59	9·66	(1·61)	57	9·32	(1·89)
Others	29	9·55	(1·72)	22	9·00	(1·31)
All	281	9·46	(1·68)	239	9·18	(1·67)

Table 7.7: *Mean initial heights and growth in subjects between 1st and 4th visits*

Subjects	Milk provided			Controls		
	Boys	Girls	Total	Boys	Girls	Total
No.	147	140	287	127	119	246
Initial Height Centimetres (SD)	124·0 (58·2)	123·6 (56·5)	123·8 (62·7)	124·0 (63·1)	124·0 (63·7)	124·0 (63·3)
Height Gain Centimetres (SD)	5·42 (1·20)	5·53 (1·58)	5·47 (1·39)	5·22 (1·20)	5·35 (1·50)	5·28 (1·35)
Weight Gain Kilograms (SD)	2·78 (1·55)	3·03 (1·39)	2·90 (1·48)	2·57 (1·06)	2·98 (1·51)	2·77 (1·31)

7.5.7 The comparison of characteristics of children in the milk trial with children in the county of Mid Glamorgan is shown in Table 7.8. Information for social class, number of children in the family and number of single parent families was complete for 93%, 98% and 98% of the sample, respectively. Although all families in the School Milk Trial were classified by social class or employment status the percentage in the 'Others' category in whom the occupation could not be classified was quite high. The socio-economic disadvantage of the School Milk Trial population is indicated by the higher proportions of social classes IV and V and fathers unemployed. Selection for the School Milk Trial by the presence of four or more children in the family shows that this population was drawn from just over 20% of the children in the county. The percentage of single parent families was smaller in the School Milk Trial population than in the whole

Table 7.8: *Characteristics of children in the school milk trial and Mid Glamorgan*

Characteristic		School milk trial	Mid Glamorgan
Percentage Distribution By Social Class	I	0·0	1·7
	II	1·5	12·9
	III	40·8	46·4
	IV	19·3	15·6
	V	6·0	2·4
Unemployed		23·1	18·9
Others		9·3	2·1
Percentage Distribution By Number of Children in the Family	<4	0·0	77·8
	4–5	79·5	18·6
	⩾6	20·5	3·7
Percentage of Children from Single-Parent Families		7·9	9·2
Percentage of Children from Schools with 20%+ Free School Meals		100·0	19·0

county and may be related to these families being characterized by smaller numbers of children. Only a fifth of the schools of Mid Glamorgan have proportions of children receiving free school meals similar to the schools from which the School Milk Trial population was drawn.

7.5.8 The mean attained height and weights by age of initial examination are shown in Table 7.9 for the School Milk Trial children and for children in the county of Mid Glamorgan. Children in the School Milk Trial were 2–3 cm shorter and 1·5 kg lighter than children in the whole country. It would appear that in selecting children for a trial to study the effect on growth of the provision of free school milk the decision to include only those children coming from schools which had 20% or more of their pupils receiving free school meals and who had three or more sibs in their families resulted in a trial population at some

Table 7.9: *Mean attained height and weight by age for children in the school milk trial and Mid Glamorgan*

Characteristic			School milk trial	Mid Glamorgan
Mean Attained Height Centimetres	At Ages	7–	120·6	123·4
		8–	126·3	128·3
		9–	130·2	133·5
Mean Attained Weight Kilograms	At Ages	7–	23·1	24·8
		8–	25·8	27·1
		9–	28·7	30·2

socio-economic disadvantage, which was associated with mean attained heights and weights significantly lower than the general population of children of the same age in the same area. It is reasonable to assume that in such a population any benefit to growth of the provision of free school milk would be best demonstrated.

7.5.9 Many primary schools, in the absence of the provision of free milk, have undertaken to sell potato crisps to their pupils. Information was collected on the crisp eating habits of children for the final term of the milk trial. The results are shown in Table 7.10. There appears to be no significant difference between the frequency of crisp eating in the milk provided or control groups.

7.5.10 Assessment of reading ability in the milk trial population was limited by the lack of repetition of reading tests for most pupils. Further limitation was imposed by variation in the type of reading test employed. For a small number of schools it was possible to calculate the mean change in reading age over twelve months for the milk provided group of children compared with children in the control group, where the same standardized reading test had been used for both groups (either Schonell Graded Word reading Test, or similar instrument). Out of twelve schools, the milk provided group showed an increase in reading age greater than the control group in six and the control group showed an increase in reading age greater than the milk provided group in five. In one school, there was no difference in change of reading age for the two groups.

Table 7.10: *Weekly crisp eating habits of subjects in the milk trial*

Frequency	Milk provided		Control	
	No.	%	No.	%
Most days	119	50	90	44
Occasional	5	2	7	3
None	78	33	86	42
Not known	37	15	22	11
Total	239		205	

7.6 Discussion

7.6.1 The results we have presented indicate that the methods used to identify a group for the feeding trial did select a subgroup of the population which was at a distinct social, economic and growth disadvantage compared with the general population of children of the same age in the same area. In fact, in addition to the importance of social class and family size in defining such a group, we have shown elsewhere (Baker *et al.* 1979) that an index based simply on the proportion of children at a school who are in receipt of free school meals constitutes a further discriminant of shorter children. The use of all these criteria will undoubtedly have led to an increase in the sensitivity of the trial and the likelihood of detecting benefit from the milk supplement will have been enhanced. However at the same time the effects of selection will have to be taken into account in drawing conclusions of possible relevance to the whole school child population.

7.6.2 The trial demonstrated benefit to the growth of 7 and 8 year-old children from the provision of one third of a pint of milk each school day. While the benefit, 2·93 mm, was small, it was statistically significant at $P < 0{\cdot}05$ and the 95% confidence limits for the likely 'true' effect over two school years are 0·1 to 5·8 mm.

7.6.3 Under the Education Act (1944) school milk was supplied during the whole of a child's school life, a period of at least ten years, from 5 to 15 years. While the total benefit of school milk was likely therefore to have been much more than the estimates we obtained for two years, it would clearly be injudicious to increase our estimate proportionately. Furthermore, our estimate was derived from a selected sample of 'vulnerable' children and the mean benefit to all unselected children is likely therefore to have been much smaller than the estimate we obtained in our trial.

References

Baker, I. A., Elwood, P. C. and Sweetnam, P. M., 1979.
Lancet ii, 692.

Corry Mann, H. L., 1926.
Special Report Series, Medical Research Council, No. 105.

8. A Nutrition Study of Primary Schoolchildren aged 10–11 years in Bristol, Croydon and Sheffield made in the first three months of 1971

S J Darke and M M Disselduff

8.1 Summary

8.1.1 Between 1 January and 31 March 1971, a random sample of boys and girls aged 10–11 years from 3 schools in each of 3 areas, Bristol, Croydon and Sheffield, participated in a weighed dietary study. The schools were selected to include children thought to be nutritionally at risk because of the increased price of school meals and the cessation of school milk for this age group from 1 April 1971. Medical assessments were made within a few weeks of the dietary study.

8.1.2 Mean daily intakes of food energy and selected nutrients were similar in the 3 areas. Intakes were not related to social class, income of the head of the household, whether the mother was working either part-time or full-time, or to family size except that intakes of ascorbic acid ($P < 0{\cdot}05$) were greater for boys and girls when there were only 1 or 2 children in the family compared with larger families. Children whose mothers had continued their full-time education beyond the age of 16 had larger intakes of most nutrients than those whose mothers finished full-time education at or before 16 years. The percentage of energy from protein was 11·5%, from fat 38·5%, from carbohydrates 50% and from added sugars (chiefly sucrose) 16·5%. The proportions varied little between the girls and the boys.

8.1.3 Comparison with recommended daily intakes (Department of Health and Social Security, 1969) showed mean intakes of energy to be less than those recommended at the time. Since nutritional status of the children was good, this finding suggested that the recommendations for energy had been set too high.

8.1.4 Children who did not take breakfast (defined as an intake of 0·84MJ or more before going to school), and children who did not drink school milk, had smaller intakes of energy and some nutrients than those who ate breakfast or those who took milk at school. A larger proportion of children, whose mean daily intake was below the 20th centile and who were shorter and lighter than the

others, did not eat breakfast and did not drink school milk, but these children showed no clinical signs of undernutrition.

8.1.5 There were no differences in the mean daily intakes of energy and nutrients by children who ate the midday meal at school compared with those who ate at home. However the proportion of the total daily intake derived from the school meal was greater in children from large families and from social classes IV and V than in children from small families or from social classes I, II, III non-manual.

8.1.6 No children were undernourished and none had clinical signs of nutritional deficiency disease; 5·4% of the children were assessed as obese and another 11% as showing a tendency to obesity. Mean heights and weights of both boys and girls in this sample were just below the 50th centile compared with the standard charts of Tanner, Whitehouse and Takaiski, (1966).

8.2 Introduction

8.2.1 In October 1971, a Government White Paper entitled 'New Policies in Spending' announced an increase in the price of school meals and the abolition of school milk for children in primary schools in the school year following their 7th birthday. These changes became effective on 1 April 1971. Children of parents whose income was just above the figure at which they would have qualified for free school meals were thought to be possibly 'at risk' nutritionally. A nutrition survey was made between 1 January and 31 March 1971 in order to obtain base-line information about a sample of these children.

8.3 Method

8.3.1 In each of 3 areas Bristol, Croydon and Sheffield, three schools were chosen by the Principal School Medical Officer because they were likely to have a majority of children in the category described above. A random sample of 75 boys and 75 girls aged 10–11 was selected from the 3 schools in each area. Of the 450 children, 368 (82%) participated, and full information was obtained from 321 (71%) of the original sample.

8.3.2 A weighed dietary record was kept of all food and drink consumed, including school meals, for a period of seven consecutive days. The method has been previously described (Ministry of Health, 1968; Department of Health and Social Security, 1975). A socio-economic questionnaire was completed during the course of the week.

8.3.3 A medical assessment of each child was made by the same doctor in all areas within a few weeks of the week of the dietary survey. The children were examined wearing pants only. Nutritional status was subjectively assessed as good, fair or poor; obese or not obese. Clinical signs of dietary deficiency were

noted. Anthropometry included measurements of height, weight, arm circumference and skinfolds.

8.4 Results

8.4.1 *Socio-economic characteristics of the sample.* About one fifth of the children (boys 18%, girls 20%) were from R.G. social classes I, II, and III non-manual (combined), 58% of the boys and 56% of the girls were from social classes III manual and nearly a quarter (boys 23%, girls 24%) were from social classes IV and V. A larger proportion of the children from Croydon were from R.G. social classes I, II and II non-manual and had fathers with bigger incomes and mothers who stayed in full-time education after 16 years of age.

8.4.2 *Nutrient intakes.* Table 8.1 shows the mean daily intakes of food energy, selected nutrients and 'added sugars' (sugars, usually sucrose, which are added during food processing, cooking or at table as distinct from naturally occurring sugars). As expected, the boys ate more than the girls. Intakes of energy and most nutrients for the week of the survey were similar in the three areas and results have therefore been combined in the rest of the analysis. Intakes of energy and of iron were less than those recommended at that time (Department of Health and Social Security 1969). The mean percentage of energy derived from the three energy yielding nutrients was 11·5% from protein, 38·5% from fat, 50% from carbohydrates. Dietary sugars (chiefly sucrose) provided 16·5% of food energy. The proportions varied little between the boys and the girls or between the three areas.

8.4.3 *Intakes and socio-economic characteristics.* There were no differences in nutrient intakes in respect of R.G. social class, income of the head of the household, family size or whether the mother was working or not, for either boys or girls, except that mean daily intakes of ascorbic acid were larger ($P < 0{\cdot}05$) for both boys and girls where there were only one or two children in the family (Table 8.2). Children whose mothers had continued their full-time education to 16 or more years had larger mean daily intakes of protein, fat, calcium, ascorbic acid and some other vitamins, and smaller mean intakes of carbohydrates and of added sugars than the children whose mothers left school at 16 years and had no further education.

8.4.4 *Intakes from breakfast.* Children were said to have eaten breakfast if their energy intake was 200 kcal. (0·84 MJ) or more before going to school on at least 3 days of the week of the survey. According to this definition, 14% of the boys and 19% of the girls did not take breakfast. The mean daily intakes of energy and of some nutrients of children who ate breakfast were larger than those of children who did not have breakfast and these differences were significantly bigger for energy and for more of the nutrient intakes of the girls when compared with those of the boys (Table 8.3).

8.4.5 *Intakes in relation to taking school milk.* At the time of this survey all

Table 8.1: *Mean daily intakes of energy and selected nutrients during a 7 day dietary survey of boys and girls aged 10–11 years in Bristol, Croydon and Sheffield in 1971*

					Boys			Girls		
Number of Children			All boys 163	All girls 158	Bristol 47	Croydon 55	Sheffield 61	Bristol 55	Croydon 50	Sheffield 53
Energy	Mean	MJ	9·08	8·02	9·11	9·22	8·92	8·09	7·99	7·96
	S.D		1·63	1·56	1·51	1·65	1·72	1·64	1·36	1·67
	Mean	kcal	2169	1916	2177	2204	2131	1933	1909	1903
	S.D		390	372	361	394	410	392	324	398
Total protein	Mean	g	62·5	55·4	62·0	63·9	61·5	54·3	56·2	55·8
	S.D		12·5	11·3	12·1	12·6	12·8	12·6	10·1	10·9
Animal protein	Mean	g	39·1	35·6	38·5	41·7*	37·3	33·6	37·1	36·2
	S.D		9·9	9·2	9·2	9·6	10·4	10·2	8·7	8·4
Fat	Mean	g	90·7	82·8	89·5	94·3	88·4	81·0	83·8	83·6
	S.D		19·6	19·9	17·7	20·3	20·3	20·3	18·7	20·7
Carbohydrate	Mean	g	292	251	298	291	289	262	246	246
	S.D		58	57	60	57	58	51	46	58
Calcium	Mean	mg	889	787	916	943	846	757	852	758
	S.D		231	224	236	240	210	212	194	251
Iron	Mean	mg	10·8	9·7	10·8	10·7	11·0	10·1	9·6	9·5
	S.D.		2·6	2·3	2·7	2·3	2·8	2·6	2·2	2·1
Retinol	Mean	μg	893	813	878	998	809	817	956	672
	S.D		549	453	481	602	540	461	521	322
Thiamin	Mean	mg	1·03	0·88	1·04	1·00	1·05	0·90	0·88	0·85
	S.D		0·28	0·21	0·26	0·24	0·33	0·24	0·18	0·22

Riboflavin	Mean	mg	1·42	1·24	1·46	1·48	1·35	1·22	1·37**	1·13
	S.D		0·40	0·36	0·40	0·40	0·41	0·37	0·30	0·36
Nicotinic acid	Mean	mg	11·19	9·57	11·02	11·10	11·40	9·96	9·24	9·46
	S.D		3·13	2·45	3·03	2·74	3·55	2·85	2·16	2·26
Pyridoxine	Mean	mg	1·16	1·05	1·14	1·22	1·13	1·08	1·04	1·01
	S.D		0·24	0·23	0·18	0·24	0·26	0·25	0·21	0·21
Ascorbic acid	Mean	mg	48·5	46·2	47·1	51·6	46·8	51·6	45·2	41·4
	S.D		24·4	23·4	19·8	30·5	21·4	29·9	20·1	17·0
Ergocalciferol	Mean	μg	1·66	1·44	1·80	1·52	1·68	1·39	1·60	1·33
	S.D		1·02	0·74	1·34	0·66	0·99	0·84	0·76	0·56
% energy from										
protein			11·5	11·6	11·4	11·6	11·5	11·3	11·8	11·7
fat			37·8	39·0	37·2	38·4	37·2	37·7	39·6	39·7
carbohydrate			50·7	49·4	51·4	50·0	51·3	51·0	48·6	48·6
added sugars			16·4	16·7	16·9	16·9	15·8	17·0	16·3	16·7

* $P<0·05$, ** $P<0·01$—mean intakes significantly different from those of boys and girls in the other two areas.

children who attended primary schools were offered one-third of a pint of milk every day of the week and 10% did not take it. The corresponding numbers for the 158 girls were 51% and 16%. Boys and girls who did not take school milk on any day in the week of the survey had lower mean daily intakes of food energy

Table 8.2: *Mean daily intakes of energy and selected nutrients in a 7 day dietary study of children aged 10–11 years in Bristol, Croydon and Sheffield according to different socio-economic characteristics*

	Socio-economic characteristic		No of children	Energy MJ	Energy kcal	Protein Total g	Protein Animal g	Fat g	Cht g
Boys	Social class	I II III NM	29	8·9	2138	64·6	42·9	92·7	277
		III M	92	9·0	2161	61·4	38·1	89·2	295
		IV V	37	9·4	2249	64·0	38·9	94·3	303
	Income band of father	under £25	46	9·3	2212	62·1	38·3	91·4	303
		£25–£30	42	8·9	2131	61·0	37·4	88·3	289
		over £30	66	9·2	2186	63·7	41·0	92·7	291
	No of children under 15yr	1	25	8·6	2·59	61·7	39·7	88·3	270
		2	59	9·2	2195	63·9	41·2	95·0	287
		3	36	9·3	2217	60·4	35·6	88·1	313
		4	20	8·6	2062	59·7	37·5	85·4	280
		5 or more	21	9·4	2253	64·0	38·8	91·0	312
	Mother's work status	not working	68	9·2	2200	62·4	38·4	91·1	299
		working	94	9·0	2145	62·4	39·6	90·4	287
	Age at which mother completed full time education	15yr or under	141	9·1	2174	62·3	38·8*	90·2	295
		over 15yr	18	9·1	2187	65·0	43·8	96·0	281
Girls	Social class	I II III NM	31	8·6	2043	59·8	38·7	92·1	259
		III M	88	7·7	1838	53·1	34·1	78·6	243
		IV V	58	8·3	1992	57·4	36·7	85·0	265
	Income band of father	under £25	48	7·8	1874	55·0	35·6	80·6	246
		£25–£30	39	8·1	1931	54·5	34·3	82·0	258
		over £30	46	8·3	1986	58·5	38·1	88·4	253
	No of children under 15yr	1	27	7·8	1853	56·3	37·4	83·3	232
		2	49	8·3	1986	58·7	38·5	86·9	257
		3	41	7·7	1841	52·1	33·0	77·9	247
		4	28	8·1	1928	54·3	33·5	81·7	259
		5 or more	12	8·4	1997	54·3	33·1	84·4	271
	Mother's work status	not working	73	8·1	1926	55·5	35·7	83·6	252
		working	84	8·0	1918	55·6	35·6	82·4	252
	Age at which mothers completed full time education	15yr or under	132	8·0	1908	54·7*	34·8*	81·6	253
		over 15yr	24	8·3	1974	60·0	40·4	89·4	246

* P<0·05, ** P<0·01 mean intakes significantly larger than those of children whose mothers left school at 16 yrs.

and protein ($P < 0{\cdot}05$) and of calcium ($P < 0{\cdot}01$) than those who took school milk on at least one day a week (Table 8.4). Intakes of thiamin and riboflavin were also significantly less ($P < 0{\cdot}01$) for the boys who did not take school milk although for the girls the difference was not significant.

8.4.6 *Intakes from school meals.* There were no significant differences in the mean daily intakes of food energy and selected nutrients by children who ate all 5 midday meals provided at school in the week of the survey compared with those who ate 3 or 4, 1 or 2 or no school meals (Table 8.5). About 30% of the total daily energy intake, about one third of the total daily intake and about 50% of the dietary intake from vitamin D was provided by the school meal for both boys and girls (Table 8.6).

Calcium mg	Iron mg	Retinol μg	Thiamin mg	Riboflavin mg	Nicotinic acid mg	Pyridoxine mg	Ascorbic acid mg	Ergocalciferol μg
965	10·8	1045	1·04	1·54	11·5	1·16	52·3	1·8
881	10·6	824	1·02	1·38	11·0	1·16	47·5	1·6
909	11·4	958	1·08	1·47	11·6	1·18	46·1	1·7
890	10·8	823	1·05	1·39	11·19	1·15	46·4	1·5
863	10·6	845	1·02	1·40	11·21	1·18	45·3	2·8
935	10·9	983	1·04	1·49	11·31	1·17	50·6	2·6
830	10·5	694	0·91	1·24	10·4	1·19	50·3	1·6
935	11·1	952	1·05	1·45	11·3	1·19	53·1	1·6
885	10·7	936	1·11	1·50	11·6	1·14	48·5	1·7
859	10·5	1000	0·95	1·40	10·6	1·05	37·4	2·1
931	11·0	764	1·06	1·43	11·6	1·18	44·5	1·4
893	11·0	929	1·05	1·41	11·4	1·17	49·7	1·6
897	10·8	869	1·01	1·43	11·1	1·16	47·7	1·7
889	10·9	861*	1·03	1·41	11·2	1·16	47·9	1·6*
992	10·8	1163	1·02	1·56	11·4	1·22	55·9	2·2
849	10·5	1000	0·92	1·35	9·8	1·12	50·4	1·8
745	9·4	754	0·85	1·17	9·4	1·01	44·9	1·3
839	10·0	802	0·91	1·31	9·8	1·08	45·7	1·4
784	9·6	755	0·85	1·17	9·1	1·02	44·0	1·4
768	9·7	816	0·92	1·20	10·0	1·03	44·5	1·4
839	10·1	899	0·93	1·37	10·2	1·13	52·1	2·6
781	9·6	685	0·86	1·23	9·2	1·09	49·4	1·4
807	10·4	834	0·90	1·29	10·1	1·13	51·1	1·6
760	9·4	890	0·85	1·23	9·3	0·99	42·2	1·3
764	9·4	744	0·90	1·12	9·7	1·02	42·1	1·4
870	9·1	816	0·88	1·31	8·6	0·90	37·1	1·4
884	9·4	788	0·89	1·26	9·4	1·03	44·2	1·4
750	10·0	840	0·87	1·22	9·7	1·06	44·8	1·5
775	9·6	767**	0·87	1·20**	9·5	1·02**	45·0	1·4*
864	10·4	1081	0·94	1·49	10·2	1·18	53·4	1·8

8.4.7 Children from larger families were in general found to have obtained a bigger proportion of their weekday intakes from school meals than those from smaller families and when there were 5 in the family, the proportions of several nutrients derived from the school meals were significantly greater ($P < 0{\cdot}05$) for the boys than when there were no siblings. For the girls the trend was the same but the differences did not reach statistical significance (Table 8.7).

Table 8.3: *Mean daily intakes of energy and selected nutrients of children who took breakfast compared with those who did not during a 7 day dietary study of schoolchildren aged 10–11 years in Bristol, Croydon and Sheffield* (mean values with standard deviations).

			Boys		Girls	
Number of children			Taken 132	Not taken 21	Taken 124	Not taken 29
Energy	MJ	MEAN	9·21	8·61	8·24***	7·08
		SD	1·57	1·97	1·45	1·66
	kcal	MEAN	2201	2058	1969***	1693
		SD	376	470	347	396
Total protein	g	MEAN	63·7*	57·7	56·9***	49·2
		SD	12·5	12·1	10·5	12·8
Animal protein	g	MEAN	39·9	35·9	36·6**	31·4
		SD	10·2	7·9	8·9	10·2
Fat	g	MEAN	91·8	89·4	84·7*	74·2
		SD	19·3	22·1	19·3	20·2
Carbohydrate	g	MEAN	297	271	259***	219
		SD	57	67	50	51
Calcium	mg	MEAN	925**	776	815**	687
		SD	226	225	209	266
Iron	mg	MEAN	11·0	10·4	10·0**	8·6
		SD	2·7	2·4	2·3	2·3
Retinol	μg	MEAN	914	798	859**	597
		SD	579	434	460	302
Thiamin	mg	MEAN	1·06*	0·90	0·91***	0·72
		SD	0·28	0·26	0·21	0·17
Riboflavin	mg	MEAN	1·46*	1·25	1·29***	1·00
		SD	0·41	0·39	0·34	0·37
Nicotinic acid	mg	MEAN	11·35	10·40	9·89***	8·19
		SD	3·16	3·16	2·49	2·01
Pyridoxine	mg	MEAN	1·17	1·16	1·06	0·99
		SD	0·24	0·22	0·23	0·20
Ascorbic acid	mg	MEAN	47·6	45·4	47·6	41·1
		SD	21·1	13·8	25·0	15·6
Ergocalciferol	μg	MEAN	1·67	1·62	1·55***	1·00
		SD	1·03	0·78	0·77	0·32

* $P<0·05$, ** $P<0·01$, *** $P<0·001$—mean intakes of children who took breakfast significantly larger than those who did not.

8.4.8 In this survey, the percentage of the daily intake of energy and all nutrients for the boys, and of all except retinol for the girls, obtained from school meals was larger for social classes IV and V than for I, II and III non-manual, but the numbers of children in the groups were too small for the differences to be statistically significant (Table 8.8). No such differences were found for children from families analysed by income of the head of the household.

8.4.9 *Medical assessment.* None of the children was of poor nutritional status, and only 3 children (all from Sheffield) were said to be of fair (intermediate)

nutritional status. Sixty one of the 365 children (12% of the boys and 21% of the girls) were assessed either as obese (20 children) or having a tendency to obesity. None of the children had any clinical signs which could be attributed to nutrient deficiencies.

8.4.10 When compared with the standard charts of Tanner, Whitehouse and Takaishi (1966) the mean heights of both boys and girls were near (just below) the 50th centiles. Of the 368 children who were measured, 47, (25 boys and 22 girls) did not complete the diet record. The mean values of the various anthropometric measurements for these children were not significantly different from those of the 321 children who participated fully and there were not significant area differences in any of the mean values (Table 8.9).

8.5 Discussion

8.5.1 The response rate (82%) for this study of primary schoolchildren aged 10–11 years, with full participation by 71% compares with that of Cook, Altman, Moore, Topp, Holland and Elliott (1973) in a study in Kent which included children aged 8–11 years. Children in the study reported here were selected from schools thought to include a large proportion of their pupils from families who were not quite the 'worst-off'; and that this was borne out by the socio-economic characteristics of the sample. No information was available about non-responders but anthropometric measurements indicated that the children who participated fully in all aspects of the survey were not different in height, weight or skinfold thickness from those who did not complete a dietary record.

8.5.2 The most important finding of the survey was the absence of clinical signs of under-nutrition or of any vitamin deficiency disease in the 321 children (163 boys and 158 girls) who participated fully. Although 3 of the children were described as of fair nutritional status, none was under-nourished. By contrast, 20 children (5·4%) were classified as obese and twice that number appeared to have a tendency to obesity. Jacoby, Altman, Cook and Holland (1975) assessed 11% of Kent schoolchildren in 1968–70 as clinically obese.

8.5.3 Cook et al (1973) also found in their survey of Kent school-children that social class, number of siblings and mother's work status were not reflected by any difference in the mean daily intake of energy and selected nutrients or in intakes/MJ except in relation to mother's education. The results presented here confirmed these findings. However when the mother had not continued her full-time education beyond 16 years, the mean intakes of energy and many nutrients were less for both boys and girls. The somewhat larger intakes by children in the Croydon area may be due to the fact that a bigger percentage of Croydon mothers had continued their full-time education after school leaving age.

8.5.4 The percentage of energy derived from protein, fat and carbohydrate was remarkably constant for boys and girls between the 3 areas, and was comparable

Table 8.4: *Mean daily intake of energy and selected nutrients of boys and girls who did not take school milk during the 7 day dietary study of schoolchildren in Bristol, Croyden and Sheffield in 1971 (mean values and standard deviations)*

			Boys				Girls			
No. of days on which school milk was taken			0	1,2,3	4	5	0	1,2,3	4	5
No. of children			16	21	20	104	25	28	25	80
Energy	MJ	mean	8·24*	9·28	9·24	9·16	7·45*	7·56	8·38	8·24
		SD	1·76	1·58	1·74	1·59	1·23	1·50	1·82	1·52
	kcal	mean	1969*	2218	2208	2190	1781*	1806	2003	1969
		SD	421	377	417	319	295	358	435	363
Total protein	g	mean	53·9**	64·4	65·2	63·1	52·5	53·6	57·7	56·3
		SD	11·4	14·7	13·8	11·4	7·7	10·4	13·7	11·6
Animal protein	g	mean	32·2**	40·3	42·4	39·6	33·0	33·9	36·9	36·6
		SD	8·8	13·1	9·6	8·9	8·1	9·4	10·7	8·9
Fat	g	mean	84·8	92·5	90·4	91·7	77·4	79·5	88·4	83·8
		SD	23·2	20·2	20·6	18·8	16·6	19·3	25·7	18·7
Carbohydrate	g	mean	263*	299	300	295	232*	232	259	262
		SD	51	55	61	59	50	54	53	50
Calcium	mg	mean	617**	872	977	933	627**	744	832	839
		SD	235	195	257	198	204	244	222	199
Iron	mg	mean	10·1	11·4	10·6	10·9	9·5	9·3	10·7	9·7
		SD	1·6	3·0	2·5	2·6	1·4	1·9	3·4	2·2

Retinol	μg	mean	747	884	985	907	748	892	866	788
		SD	416	409	875	515	395	568	488	418
Thiamin	mg	mean	0·83**	1·03	1·06	1·06	0·82	0·86	0·88	0·90
		SD	0·16	0·28	0·30	0·28	0·19	0·19	0·20	0·23
Riboflavin	mg	mean	1·03**	1·46	1·53	1·46	1·11	1·21	1·33	1·26
		SD	0·34	0·43	0·45	0·37	0·38	0·38	0·39	0·33
Nicotinic acid	mg	mean	9·97	11·86	11·32	11·29	9·80	9·26	9·78	9·54
		SD	1·62	3·23	3·82	3·12	1·75	2·10	2·91	2·63
Pyridoxine	mg	mean	1·10	1·22	1·14	1·17	1·03	0·99	1·13	1·05
		SD	0·22	0·23	0·28	0·24	0·20	0·17	0·27	0·24
Ascorbic acid	mg	mean	46·7	61·7	40·9	47·1	45·6	42·2	48·3	47·1
		SD	10·4	44·3	13·1	20·0	16·9	16·0	20·5	28·0
Ergocalciferol	μg	mean	1·37	1·81	1·95	1·63	1·35	1·38	1·52	1·46
		SD	0·61	0·95	1·25	1·03	0·54	0·78	0·82	0·75

* P 0·05, ** P 0·01—significantly different from the mean intake for boys or girls who took school milk on at least one day.

Table 8.5: *Mean daily intakes of energy and selected nutrients of 321 schoolchildren in Bristol, Croydon and Sheffield in 1971 in relation to the number of school meals taken during the week of the survey (mean values and standard errors)*

			Boys				Girls			
No of school meals			5	3/4	1/2	None	5	3/4	1/2	None
No of children			59	33	23	48	63	25	27	43
Energy	Mean	MJ	8·95	8·99	9·58	9·04	8·05	8·05	7·79	8·09
	S.D.		1·65	1·56	1·68	1·64	1·44	1·76	1·56	1·63
	Mean	kcal	2140	2148	2290	2161	1923	1924	1862	1933
	S.D		394	374	402	393	345	420	372	390
Total protein	Mean	g	62·2	62·3	64·6	61·8	56·2	53·1	54·1	56·5
	S.D		11·9	11·9	12·2	13·8	11·6	11·0	10·2	11·6
Animal protein	Mean	g	40·1	40·8	39·8	36·6	37·0	32·8	34·8	35·6
	S.D		9·5	9·5	8·8	10·9	9·2	8·5	8·6	9·8
Fat	Mean	g	91·1	89·9	94·7	88·8	81·5	81·4	83·7	84·8
	S.D.		19·3	19·2	20·4	20·2	18·1	19·6	21·1	22·0
Carbohydrate	Mean	g	284	289	312	295	256	260	236	250
	S.D		60	56	52	59	49	60	49	54
Calcium	Mean	mg	914	894	912	877	821	764	743	780
	S.D.		257	248	204	200	193	227	251	246
Iron	Mean	mg	10·9	10·2	11·4	10·9	9·8	9·8	9·3	9·8
	S.D.		2·4	2·1	2·2	3·2	2·6	2·7	1·5	2·1

Retinol	Mean	μg	884	850	1069	850	837	807	762	813
	S.D.		454	711	638	480	430	549	363	488
Thiamin	Mean	mg	1·03	1·00	1·08	1·02	0·90	0·85	0·87	0·86
	S.D.		0·33	0·23	0·26	0·26	0·23	0·23	0·23	0·18
Riboflavin	Mean	mg	1·45	1·39	1·52	1·38	1·30	1·25	1·14	1·20
	S.D.		0·40	0·47	0·33	0·40	0·35	0·43	0·31	0·35
Nicotinic Acid	Mean	mg	11·26	10·56	12·28	11·02	9·60	9·44	9·71	9·50
	S.D.		3·28	2·66	3·09	3·21	2·64	2·73	2·39	2·10
Pyridoxine	Mean	mg	1·20	1·14	1·19	1·12	1·07	1·04	1·04	1·02
	S.D.		0·24	0·22	0·21	0·26	0·25	0·26	0·14	0·22
Ascorbic acid	Mean	mg	49·6	42·7	55·2	47·9	50·8	45·5	43·8	41·2
	S.D.		20·9	13·9	39·6	24·5	30·6	19·8	13·4	16·5
Ergocalciferol	Mean	μg	1·62	1·61	1·54	1·81	1·50	1·38	1·56	1·32
	S.D.		0·79	0·62	0·96	1·43	0·78	0·66	0·95	0·55

Table 8.6: *Mean daily intakes of energy and selected nutrients obtained from the school meal during a 7 day dietary study of schoolchildren in Bristol, Croydon and Sheffield in 1971 and the percentage that these intakes represent of the total intake for the whole day on which the school meal was taken*
(mean values and standard errors)

		All Children			All boys			All girls		
No of children		Mean	SE 230	% whole day	Mean	SE 115	% whole day	Mean	SE 115	% whole day
Energy value	MJ	2·6	0·05	29·2	2·7	0·06	29·0	2·5	0·07	29·3
	kcal	617	13·0		648	19·0		586	17·3	
Total protein	g	20·3	0·49	33·1	21·5	0·71	32·8	19·1	0·66	33·4
Animal protein	g	14·9	0·41	36·6	15·9	0·61	36·5	13·9	0·53	36·7
Fat	g	28	0·64	31·1	29	0·88	30·9	27	0·92	31·2
Total carbohydrate	g	76	1·66	27·3	79	2·5	27·0	72	2·12	27·6
Calcium	mg	260	8·0	26·5	280	12·3	26·7	240	10·7	26·3
Iron	mg	3·9	0·112	37·1	4·0	0·165	36·5	3·8	0·150	37·7
Retinol	μg	430	33	41·8	480	46	42·2	390	34	41·4
Thiamin	mg	0·3	0·006	28·8	0·3	0·009	28·6	0·3	0·008	29·1
Roboflavin	mg	0·5	0·017	30·7	0·5	0·026	30·2	0·4	0·021	21·2
Nicotinic Acid	mg	3·6	0·095	35·0	3·8	0·149	34·0	3·4	0·116	35·9
Pyridoxine	mg	0·4	0·009	38·8	0·5	0·013	38·4	0·4	0·012	39·1
Ascorbin Acid	mg	17	0·40	38·6	18	0·62	39·6	16	0·49	37·7
Ergocalciferol	μg	0·8	0·04	50·5	0·8	0·05	49·3	0·8	0·06	51·6

Table 8.7: *Mean daily intake of energy and selected nutrients obtained from the school meal during a 7 day dietary study of school children in Bristol, Croydon and Sheffield in 1971 expressed as a percentage of the total daily intake for children from families of different size.*

	Boys					Girls				
No. of children under 15 years	1	2	3	4	5+	1	2	3	4	5+
No. of children in sample	18	45	26	12	13	23	32	33	20	6
Energy	27·1	28·1	28·5	33·0	32·0	29·8	27·0	30·0	30·4	31·1
Total protein	30·0	32·2	32·9	35·3	37·0*	32·9	31·3	33·1	36·8	36·7
Animal protein	32·0	35·5	37·5	38·4	42·6*	35·3	34·9	35·5	41·2	43·2
Fat	26·8	29·3	31·8	35·9	36·0*	30·7	29·0	32·3	32·0	34·8
Carbohydrate	27·0	26·4	25·9	30·5	28·3	28·9	24·9	27·9	29·0	28·2
Calcium	28·2	25·0	26·9	28·5	29·0	28·3	24·7	25·1	27·8	28·4
Iron	30·8	35·0	38·0	40·7	41·5*	36·9	35·4	38·3	40·0	43·8
Retinol	37·0	39·4	44·7	41·6	52·1	38·5	40·9	45·4	39·5	43·4
Thiamin	29·2	27·8	28·2	30·7	29·4	29·8	26·9	29·3	31·5	27·8
Riboflavin	28·7	28·5	31·8	31·4	33·2	30·9	30·2	31·6	32·1	34·2
Nicotinic acid	30·5	33·5	33·6	37·5	38·4	36·6	33·3	34·1	40·5	41·9
Pyridoxine	32·3	36·6	41·7	41·2	44·4*	37·4	35·6	39·4	43·7	45·1
Ascorbic acid	33·3	38·1	43·1	42·6	44·0*	36·7	34·0	38·0	43·7	41·8
Ergocalciferol	42·9	47·6	48·7	58·8	55·1	51·7	48·5	53·6	54·6	45·8

* $P<0{\cdot}05$ — mean intakes significantly different from those of children without siblings.

Table 8.8: *Mean daily intake of energy and selected nutrients obtained from the school meal during a 7 day dietary study of schoolchildren in Bristol, Croydon and Sheffield in 1971 expressed as a percentage of the total daily intake for children from families of different socio-economic groups.*

	Boys			Girls		
Socio-economic group	I II III NM	III M	IV V	I II III NM	III M	IV V
No of children	17	69	25	19	68	27
Energy	29·1	28·5	31·6	28·2	29·5	30·0
Total protein	31·1	32·5	35·9	31·3	34·0	33·6
Animal protein	32·5	36·5	40·3	35·1	37·0	36·9
Fat	29·8	30·4	34·3	30·1	31·4	31·8
Carbohydrate	28·3	26·4	29·0	26·0	27·6	28·9
Calcium	23·8	27·0	28·6	23·8	26·5	27·3
Iron	37·9	34·7	41·2	36·2	38·7	36·5
Retinol	46·4	37·7	51·5	40·2	42·8	38·4
Thiamin	27·3	27·8	32·3	28·1	29·4	29·4
Riboflavin	27·0	28·5	37·4	27·8	32·4	30·8
Nicotinic acid	32·4	33·0	38·8	32·3	37·2	35·7
Pyridoxine	35·3	37·3	45·6	37·2	39·2	40·4
Ascorbic acid	42·6	37·4	46·2	35·5	37·4	40·2
Ergocalciferol	50·4	48·4	52·7	50·3	52·2	52·1

Table 8.9: *Anthropometric measurements of children who participated fully in the 7 day dietary study in Bristol, Croydon and Sheffield in 1971 compared with those of partial respondents*
(mean values and standard deviations)

			Boys					girls				
No of children			All boys 163	Bristol 47	Croydon 55	Sheffield 61	Partial respondents 25	All girls 158	Bristol 55	Croydon 50	Sheffield 53	Partial respondents 22
Height[1]	cm	mean	138·7	138·0	140·0	138·1	138·6	136·8	137·1	137·5	135·8	136·5
		SD	5·5	5·3	6·0	7·1	5·5	6·5	6·5	7·0	5·9	7·1
Weight	kg	mean	31·4	31·1	31·7	31·5	33·3	31·5	32·4	30·8	31·2	31·1
		SD	5·6	5·5	5·3	6·0	8·5	6·9	6·8	7·8	6·0	6·1
Quetetet's Index[2]		mean	1·62	1·62	1·61	1·64	1·71	1·67	1·71	1·62	1·68	1·66
		SD	0·21	0·24	0·18	0·21	0·31	0·27	0·26	0·31	0·23	0·23
Arm circumference	cm	mean	20·6	20·7	20·5	21·6	21·5	21·9	21·0	21·6	21·2	
		SD	2·4	2·8	2·1	2·4	3·3	2·8	2·8	2·9	2·5	2·7
Skinfold thickness	mm	mean	6·9	7·0	6·7	8·1	8·9	9·3	8·8	8·5	8·1	
		SD	3·3	4·2	2·5	3·1	5·0	3·9	3·9	4·8	·8	2·9

[1] Corrected to the mid-point of the age range.
[2] Kemsley, Billewiez and Thomson, 1962.

with figures obtained by Durnin, Lonergan, Good and Ewan (1974) in surveys of Glasgow children aged 14 years in 1964 and 1971 except that the Glasgow children derived more energy from protein than some of the primary school-children. About 16·5% was derived from added sugars chiefly sucrose. These figures are in accord with the findings in other surveys (Department of Health and Social Security, 1972, 1975).

8.5.5 Mean food energy intakes of both boys and girls were below those recommended for children of the same age in 1969. This has been confirmed by other workers (Cook et al 1973; Durnin et al 1974) and suggests that recommendations for energy intakes were set too high. They have now been reduced (Department of Health and Social Security, 1979).

8.5.6 The provision of a midday meal at school did not, in this survey, make any difference to the total mean daily intakes of children since these were the same whether the midday meal was taken at school or at home. However, the proportion of the total daily intake which was derived from the school meal was bigger for children from large families and for those from social classes IV and V compared with only children and those from social classes I, II, III non-manual in this survey. These findings are in accord with those of Durnin et al (1973) and Cook et al (1975) and a study of Birmingham schoolchildren (Department of Health and Social Security, unpublished). The school meal seemed to be not only a convenience for children who had long distances to travel and for those whose parents worked, but was probably of particular nutritional importance for children who were from large families and social classes IV and V and who might be considered to be less well-off nutritionally. Other studies of school meals by Bender, Magee and Nash (1972), Essex-Cater and Roberts-Sargeant (1973) and Bender, Harris and Getruer (1977) either measured energy and nutrient intakes but did not relate these to total daily intakes or used a 24-hour recall method, and are therefore not strictly comparable to this study.

8.5.7 Children who took school milk every day, compared with those who did not, had larger intakes of energy, protein, calcium, thiamin and riboflavin. This confirms the findings of Cook et al (1975) in the 1968–70 survey of Kent schoolchildren. Children who had breakfast of not more than 200 kcal (0·84MJ) also had larger nutrient intakes than those who did not. The numbers of children in this survey were too small for any analysis of the anthropometric findings in relation to taking school milk or having breakfast. Nevertheless, none of the children showed signs of undernutrition.

Acknowledgements

We are grateful to the Principal School Medical Officers of Bristol, Croydon, and Sheffield, to the headmaster, headmistresses, school meals organizers, teachers and pupils of the schools in which we worked, and not least to colleagues in the Department of Health and Social Security for help in analysing the results of the survey and discussing the findings.

References

Bender, A. E., Magee, P. and Nash, A. H., 1972.
Survey of School meals.
British Medical Journal, **2,** 383–385.

Bender, A. E., Harris, M. C. and Getreuer, A. 1977
Feeding of schoolchildren in a London borough.
British Medical Journal, **1,** 757–759.

Cook, J., Altman, D. G., Moore, D. C. M., Topp, S. G., Holland, W. W. and Elliott, A., 1973.
A survey of the nutritional status of schoolchildren. Relation between nutrient intake and Socio-economic factors.
British Journal of Preventive Social Medicine, **27,** 91–99.

Cook, J., Altman, D. G., Jacoby, A. and Holland, W. W., 1975.
The contribution made by school milk to the nutrition of primary schoolchildren.
British Journal of Nutrition, **34,** 91–103.

Department of Health and Social Security, 1969.
Recommended intakes of nutrients for the United Kingdom. Reports on public health and medical subjects, No. 120.
London, HMSO.

Department of Health and Social Security, 1972.
A nutrition survey of the elderly.
Report on health and social subjects, No. 3.
London, HMSO.

Department of Health and Social Security, 1975.
A nutrition survey of pre-schoolchildren.
Reports on health and social subjects, No. 10.
London, HMSO.

Department of Health and Social Security, 1979.
Recommended daily amounts of nutrients for groups of people in the United Kingdom.
Report on health and social subjects, No. 15.
London, HMSO.

Durnin, J. V. G. A., Lonergan, M. E., Good, J. and Ewan, A., 1974.
A cross-sectional nutritional and anthropometric study, with an interval of 7 years, on 61·1 young adolescent schoolchildren.
British Journal of Nutrition, **32,** 169–179.

Jacoby, A., Altman, D. G., Cook, J. and Holland, W. W., 1975.
Influence of some social and environmental factors on the nutrient intake and nutritional status of schoolchildren.
British Journal of Preventive and Social Medicine, **29,**116–120.

Essex-Cater, A. and Robert-Sargeant, S., 1975.
Value of school meals.
Health and Social Service Journal, April 5, 758–759.

Kemsley, W. F. F., Billewicz, W. Z. and Thomson, A. M., 1972.
A new weight-for-height standard based on British anthropometric data.
British Journal of Preventive and Social Medicine, **16,** 189–195.

Ministry of Health, 1968.
A pilot survey of the nutrition of young children in 1963.
Reports on Publich Health and Medical Subjects, No. 118.
London, HMSO.

Tanner, J.M., Whitehouse, R.H. and Takaishi, M., 1966.
Standards from births to maturity for height, weight, height velocity, weight velocity-British children.
Archives of Disease in Childhood, **41,** 454–603.

9. Conclusions and Recommendations

9.1 Background

9.1.1 About fifty years ago, the milk-in-schools scheme was initiated because feeding experiments had shown that such a scheme would help to promote better health and vitality in children, especially among the poor (Thomson, 1978). Further measures were taken during World War II to safeguard the nutritional status of pregnant and lactating women and their children of pre-school age.

9.1.2 About ten years ago, changing circumstances led the Government to restrict the conditions under which school meals, school milk, and welfare milk could be provided at public expense (New Policies for Public Spending, 1970). The work described in this Report was initiated because the restrictions which became effective in April 1971 might have resulted in reduced consumption of milk by pregnant women and by children, with consequent adverse effects on their health.

9.1.3 Milk is an important constituent of diets, especially for pregnant and lactating women and for growing children, because it is the main source of calcium which is necessary for satisfactory skeletal growth, and is also an important source of high-quality protein and of many vitamins. In 1971, it would have been unjustifiable to assume that milk consumption would remain unchanged despite increased cost or that, if consumption did decline, the supply of essential nutrients from milk would be made good from other dietary sources.

9.2 The Studies

9.2.1 A special study by the National Food Survey showed that, in the event, the legislative changes in 1971 had little effect on total milk consumption by families. With hindsight, we can afford to say that this was not very remarkable and confirms that social habits relating to the purchase and consumption of milk were very stable, so that changes in cost had relatively little direct effect on uptake. But this could not have been confidently predicted in 1971, and surveillance was therefore necessary. It should be noted that the special investigation of the National Food Survey related to the household consumption of milk only. It is difficult to be sure that the increased expenditure on milk by families did not lead to economies in the purchase of other foods. However, the overall results of the National Food Survey, which are published in its Annual Report, do not suggest that the higher cost of milk, *per se*, had important

consequential effects on overall dietary patterns or quality. Trends in household diets from 1970 to 1975 have been described and discussed in the Annual Report of the National Food Survey for 1975 (Ministry of Agriculture, Fisheries and Food, 1977). They did not provide any cause for concern.

9.2.2 These findings, were, of course, not available to the Sub-Committee when the programme of surveillance was initiated. The Sub-Committee decided that the measurement of height and weight provided the most practicable means of detecting possible changes in the nutritional status of children. Anthropometric surveys of both pre-school and schoolchildren (Sections 5 and 6) were commissioned. A controlled feeding trial in South Wales (Section 4) was also comissioned by the Department of Health and Social Security in order to determine whether any difference in growth and health could be detected by comparing groups of pregnant women and the children born to them, who continued to receive free or cheap milk, with similar groups who did not. Another controlled feeding trial was commissioned from South Wales (Section 7). In this trial, height and weight measurements of children, predominantly from large, poor families in schools which supplied free school milk as before 1971, were compared with heights and weights of similar children who did not receive free school milk.

9.2.3 Members of the Sub-Committee frequently commented that the value of anthropometric measurements would be increased by the simultaneous study of the diets eaten by the individuals who were being measured. This, however, was not feasible in the main studies (para 8.2.2) within the resources available. One dietary study, between 1 January and 31 March 1971, was made of primary schoolchildren aged 10–11 years from families who were thought to be at possible risk, when the April 1971 changes became effective, because they just did not qualify for the benefit of free school meals (section 8). The children were also assessed clinically and height and weight were measured. They appeared to be of satisfactory nutritional status with no evidence of malnutrition except signs of obesity in some children. This study provided satisfactory base-line information and was not repeated.

9.2.4 The anthropometric studies have not yielded any evidence of deterioration in growth and health following the legislative changes in 1971. Since milk consumption and the nutritive value of household diets scarcely changed, this is what would be expected.

9.2.5 It is, however, necessary to sound a note of caution. Changes in height and weight in populations of children are relatively small over a period of time and are likely to become manifest rather slowly. Again, as is stated in (para 4.5.2), the trial of milk supplementation for pregnant women and their children was an evaluation of entitlement to milk supplementation; it was not a satisfactory test of the biological effect of a given amount of supplementary milk actually consumed. The absence of benefit found in the trial must be interpreted within this context. On the other hand, although for the school children who received free school milk a demonstrable benefit over a period of about two years was

trivial, even minor benefits, if continued over the whole of the period of human growth, might have an important cumulative effect.

9.2.6 These surveys and feeding trials were undertaken during a period when the national economic climate was deteriorating. Average purchasing power seems to have increased pari passu with rising costs, but the specific surveillance procedures described in this resport were not designed to measure possible effects of gradual economic change and, in particular, the evidence is inadequate to show whether adverse effects may yet appear in particularly vulnerable groups, such as the families of unemployed parents or poorer families with many children. There was evidence from the growth study of pre-school children (section 5) that those children who received subsidized welfare milk, were in fact those most in need, especially those from the larger families of the manual social classes.

9.2.7 Vital statistics also do not provide a sensitive index of possible changes in nutritional status. The evidence briefly reviewed in Section 3 has not provided any grounds for disquiet. On the contrary, the continuing (and possibly accelerating) fall in perinatal and infant mortality rates continues to be satisfactory.

9.2.8 In pursuance of its remit to detect possible changes "at a time when any harmful effects of the changes are likely to be mild and reversible" (terms of reference) the Sub-Committee made regular interim reports to its parent Committee on Medical Aspects of Food Policy during the period covered by the present Report.

9.3 The value of the studies of pre-schoolchildren and school-children

9.3.1 The anthropometric data described in sections 5 and 6 (which have been or will be elaborated in scientific journals) are of considerable scientific value. As was noted in the First Report of the Sub-Committee (1973), there was insufficient anthropometric information available in 1970–71 to provide a base-line with which any changes could be compared. The Committee in 1973 recommended "that studies be undertaken which will provide further baseline information about the present nutritional status of schoolchildren, pre-schoolchildren and pregnant women". The information subsequently collected has provided a base-line which can be used in future comparisons of height and weight.

9.3.2 Information assembled during recent years generally confirms that the reference standards of growth used in Britain (Tanner, Whitehouse and Tahaiki, 1966), although in fact derived from a small sample, were representative of a larger population, continue to be reliable and are similar to those obtained in the study made in the 1970s. But there is no guarantee that this situation will remain unchanged in future, and the continuing importance of having up-to-date information on growth needs to be stressed, particularly at a time when rapid

socio-economic changes are occurring which may lead to lower dietary standards.

9.3.3 The information obtained in the studies reported here confirms the existence of important differences in growth in different parts of the country and between different socio-economic groups. It is not clear whether these local and socio-economic differences are attributable to a difference in nutritional status (with the implication that they can be reduced or eliminated by selective improvements of diets) or represent innate differences of growth potential in different groups of people. Both explanations might work together to produce the observed effects, but only "environmental" factors can be significantly influenced by social and political action. Further information is needed about the nature and significance of such differences in physical size. A policy of laissez-faire would be short-sighted as long as social class and family size differences continue to be demonstrable.

9.3.4 Surveillance along the lines already established should not only continue but should be extended to cover minority groups of people in, for example, areas of high unemployment or in areas with a large proportion of immigrants. Future surveillance plans should not only determine the average picture in nationally representative samples, but should also provide reliable information about important sub-groups. Even if the average picture remains satisfactory, this would not necessarily disprove the possible existence of pockets of deterioration in nutritional status.

9.3.5 While continuous anthropometric surveillance is undoubtedly desirable, consideration should be given in future to providing systematic ad hoc parallel studies of individual diets, particularly among groups where the existence of sub-optimal growth is suspected or demonstrated. It is particularly important to monitor such 'at risk' groups, eg families of the unemployed, immigrants, the elderly, and perhaps those living in areas of the U.K. where industrial conditions are severely depressed.

9.3.6 There is also a need for continued technical studies of the analysis and interpretation of differences and trends in anthropometric data. For example, Professor Holland's study (section 6) of primary schoolchildren demonstrated no differences in attained height between the non-manual social class groups (I, II, III non-manual) in England and in Scotland. However a relationship between attained height and family size was found. Attained height was smaller with increasing family size in both manual and non-manual social classes in Scotland and in manual social classes in England, but for the non-manual social classes in England the relationship only held in families of 5 or more children. Rona, Swan and Altman (1978) have published further details, showing that the heights of primary school children were influenced by factors such as father's social class and employment status; but the child's weight at birth and the height of its parents were associated with even greater differences in attained height at age 5 to 11 years. It is by no means clear whether such complex patterns are produced mainly by "social" or "biological" influences. For example, if measurements are

standardized to remove the effect of parental size, does this eliminate a predominantly genetic effect or account for an environmental effect which was present during the growth of the parents and which continued to influence the next generation directly? Professor Waterlow and his colleagues (section 5) found social class differences in the heights of English pre-school children to persist even when parental height had been accounted for. Clearly, more information is required. There are suggestions that secular trends in growth of most children in Britain and Sweden may be attaining a maximum, which would point to the special importance of environmental influences, including nutrition.

9.3.7 Present knowledge so far indicates rather clearly the special importance of growth from conception up to about 2 years of age. Foundations laid during this early stage may determine in large measure what happens subsequently. Nutritional and anthropometric surveillance is therefore of special importance in relation to infants and young toddlers.

9.4 Adult studies

9.4.1 The Sub-Committee has hitherto concentrated its efforts upon pregnant women, pre-school children and primary school children. It is, however, concerned about the lack of detailed information on adults, especially with reference to obesity and and its effects on health and physical fitness. As noted in Chapter 1 (para 1.4.5) arrangements have been made with the Office of Population Censuses and Surveys to collect information on the height and weight of adults aged 16 to 64. Such information will provide a base-line against which possible future changes in adult physique can be evaluated. In this connection, a similar study, including additional, physiological information has been commissioned by the Ministry of Defence.

9.5 General conclusions

9.5.1 The situation, so far, appears to be generally satisfactory. The 1971 changes in legislation affecting school milk and welfare foods do not seem to have had adverse effects on milk consumption or on the health and physique of pregnant women, pre-schoolchildren and children attending primary schools.

9.5.2 But there are no grounds for complacency. As already indicated, geographical and social differences may indicate the existence of pockets of poor nutrition for example among newly arrived Asian people. A rapidly changing economic climate, and general change in social conditions indicate a need for continuing vigilance. We therefore endorse the recommendation in our first Report (Department of Health and Social Security, 1973) that the studies undertaken so far should be regarded as the basis of a permanent monitoring service. The experience gained 'will be of the greatest value in showing how similar information might continue to be most effectively obtained on a permanent basis'.

References

Department of Health and Social Security, 1973.
Reports on Health and Social Subjects, No. 6.
First Report by the Sub-Committee on Nutritional Surveillance.
London, HMSO.

Ministry of Agriculture, Fisheries and Food, 1977.
Household Food Consumption and Expenditure: 1975.
Consumption of milk by different categories of persons, pp 45–47.
London, HMSO.

Rona, R. J., Swan, A. V. and Altman, D. G., 1978.
Social factors and height of primary schoolchildren in England and Scotland.
Journal of Epidemiology and Community Health, **32,** 147–154.

Tanner, J. M., Whitehouse, R. H. and Takaishi, M., 1966.
Standards from birth to maturity for height, weight height velocity and weight velocity: British children, 1965. Part I and II.
Archives of Disease in Childhood, **41**, 454–471, 613–635.

Thomson, A. M., 1978.
Boyd Orr Memorial Lecture. Problems and politics in Nutrition Surveillance.
Proceedings of the Nutrition Society, **37**, 317–332.

Treasury, 1970.
New Policies for Public Spending (Cmmd, 4515).
London, HMSO.

Appendix A.
The Heights of a Sample of Welsh Children

P C Elwood, I A Baker, J Hughes, M Jones, P M Sweetnam,
M.R.C. Epidemiology Unit, South Wales.

Summary

A survey is described, based on a representative sample of 3694 children aged 7, 8 and 9 years attending a stratified random sample of schools in Mid Glamorgan, the largest of the Welsh counties. The technique used to measure height, and the questionnaire used to obtain background information were identical to those used in the National Study of Health and Growth in England and in Scotland. There were small differences in the three national samples with respect to social class and family size. The distributions of height in the Welsh boys and the Welsh girls were almost identical to those for English children of the same age, and both were taller than the children in the Scottish sample.

Introduction

The National Study of Health and Growth (NSHG) studied children in England and in Scotland. We report here the results of a study in Wales which was set up and run to be closely comparable with the English and Scottish surveys.

The data we report here relate alone to height. Further data, together with evidence on weight is given elsewhere (Baker, Sweetnam and Elwood, 1980).

Method

The County of Mid Glamorgan was chosen for the survey. This is the largest of the Welsh counties and contains a number of industrial areas and mining valleys in which the population is at some socio-economic disadvantage compared to most of the rest of Wales.

Details of all the primary schools in Mid Glamorgan were obtained. These were stratified according to the percentage of children within each school who were in receipt of free meals. Free school meals are allocated on the basis of the socio-economic circumstances of a child's family, and the criteria adopted are identical in England, Wales and Scotland (see section 1.2.1). Evidence accrued later in this study to indicate that this was a valuable discriminant, and children

at schools, ranked by the proportion receiving free meals, differed in mean height, even after due allowance had been made for social class (Baker, Elwood & Sweetnam, 1979). Four strata were defined, schools in which less than 10%, between 10 and 19%, between 20 and 29% and over 30% of children received free meals. Within each stratum schools were divided into two groups by size and within the larger and the smaller group four schools were selected at random.

The thirty-two schools selected were visited in haphazard order and each child aged seven, eight or nine was seen. Height and weight were measured on a Holtain stadiometer and a beam balance by two observers who had been trained by the group at St. Thomas' Hospital involved in the National Study of Health and Growth. The parents of each child were asked to complete a copy of the questionnaire used in the National Study of Health and Growth.

Results

Population numbers are shown in Table A.1. The number of children aged 7, 8 and 9 years in the 32 schools selected was 3,694 and complete data are available for 3337 (90%).

The sample of children drawn were a stratified random sample and the effect of this stratification has to be allowed for in any estimation of means or distributions appropriate for the whole county. This has been done and the data are summarised in terms of age and sex specific means and standard deviations in Table A.2.

It is of interest to compare the distribution of heights in the sample of Welsh children with those for the English and Scottish children examined in the National Study of Health and Growth. However before this is done several matters have to be considered. Firstly secular changes could have occurred between the time of the English and Scottish surveys (1972) and the Welsh survey (1978). However observations made in the National Study of Health and Growth on children 5–11 yrs. of age in England and Scotland from 1972 to 1976 indicate that this did not occur (Rona—personal communication).

Secondly, the comparability of heights in different populations will depend on

Table A.1: *Total numbers of children at schools in Mid Glamorgan, subdivided by the percentage of children at each school who were in receipt of free school meals. The total stratified sample drawn and the numbers of children for whom data is complete, are also shown.*

% Free School Meals	Estimated No. Children 7–9 yrs	Sample drawn	Complete Data Obtained
0–9	7928	917	793
10–19	9392	913	818
20–29	2838	977	889
30+	1169	887	837
Total	21327	3694	3337

Table A.2: *Estimated mean height (S.D.) of Mid Glamorgan schoolchildren.*

Age Group (years)	Mean height (S.D.) in cms	
	Boys	Girls
7–7·4	122·7 (5·1)	121·8 (4·9)
7·5–7·9	124·5 (5·4)	124·1 (5·5)
8–8·4	127·7 (6·4)	126·3 (5·3)
8·5–8·9	129·9 (5·9)	129·1 (5·7)
9–9·4	132·6 (5·6)	131·5 (5·7)
9·5–9·9	135·3 (6·3)	134·7 (5·9)

environmental and other factors known to be relevant to growth. Two of the most important factors are social class and family size. Table A.3 shows the distributions of children by the social class of their fathers. This last was not available for 29% of the Welsh children and 30% of the English and Scottish children. There are differences, the Scottish sample being biased slightly towards the lower social classes and the Welsh children being, in general, intermediate between the English and the Scottish. Social class has an association with height (Rona, Swan and Altman, 1978) and so these differences, although they are relatively small, could be important. In summary their effect will be to increase the mean height in the English sample and decrease the mean height in the Scottish sample relative to the Welsh children.

Another variable of importance to the growth of a child is the size of its family (Goldstein, 1971). The distributions of the children in the three national samples are shown in Table A.4. For 11% of the Welsh sample and 13% of the English and

Table A.3: *Percentage of Children by Social Class in the English, Welsh and Scottish samples.*

Social Class	England	Wales	Scotland
I	5·3	1·9	2·6
II	16·4	15·2	8·9
III NM	9·2	5·4	10·4
III M	47·3	52·5	55·8
IV	14·9	21·0	14·8
V	6·9	4·1	7·4

NM—non manual.
M—manual.

Table A.4: *Percentage of Children in the English, Welsh and Scottish samples by family size.*

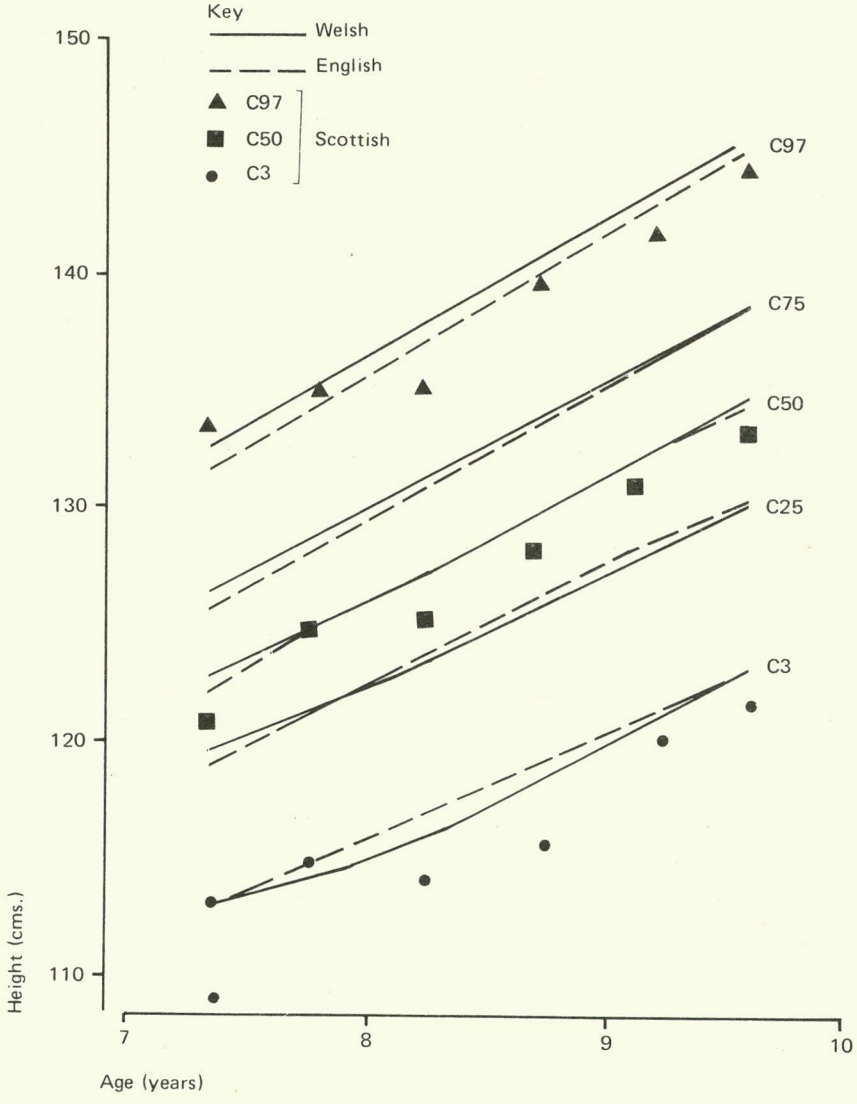
No. of Sibs.	England	Wales	Scotland
0	7·4	9·1	6·6
1	34·8	41·5	28·8
2	28·3	27·2	26·6
3	14·9	12·9	17·8
4 or more	14·7	9·3	20·2

Data for the English and Scottish samples kindly supplied by Dr. Rona.

Scottish samples this information was not available. Again, differences occur, the most notable of which is the rather larger proportion of smaller families in the Welsh sample and the rather larger proportion of large families in the Scottish sample. The effect of these differences will be to increase slightly the overall mean height for the Welsh and to decrease slightly the overall mean height for the Scottish sample.

Ideally the effects of the differences in social class and family size and the interaction between these, should be allowed for in comparisons of the heights in

Figure A 1: *Centiles for height for Welsh boys, 1977-8. Comparison with centiles for height for English and Scottish boys (NSHG) 1972 (based on Fig. 3 Annals of Human Biology, 4, No. 6, 508, 1977).*

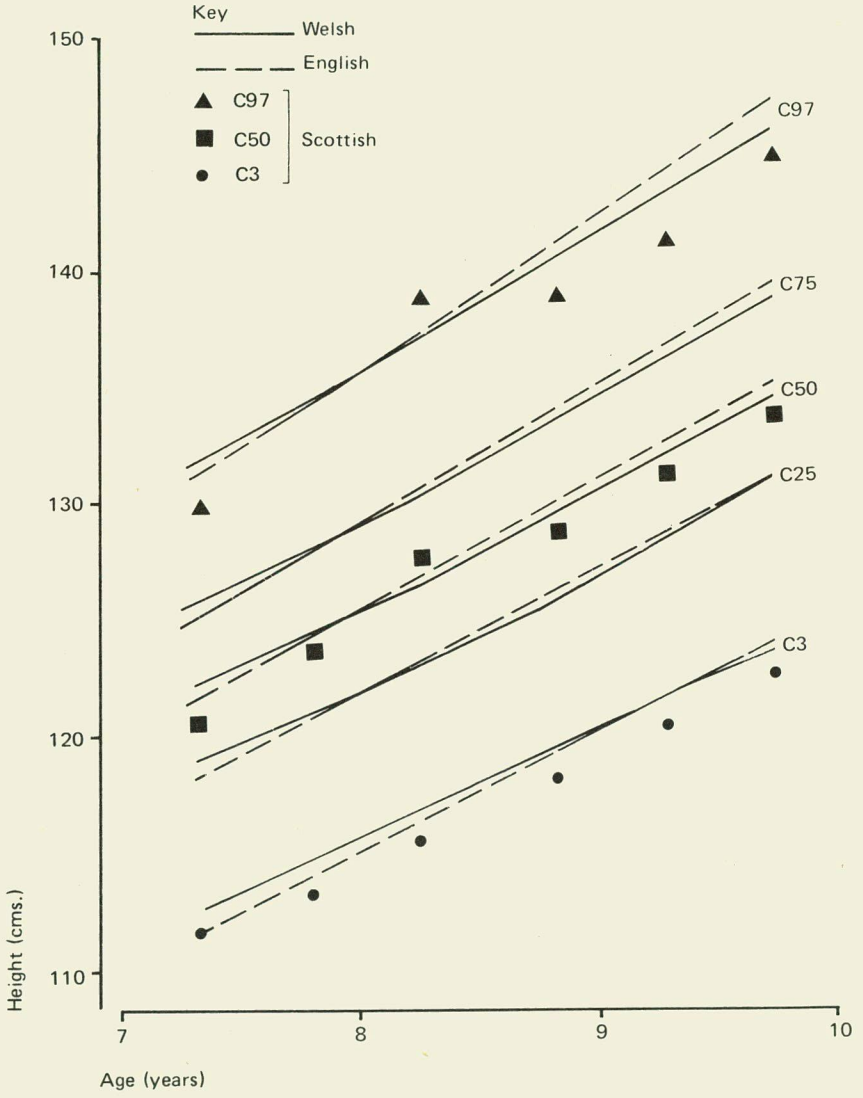


the three national samples. This has not yet been done and so the likely effects of the dissimilarities in the three samples will have to be considered when interpreting differences in heights and weights.

Figures A.1 and A.2 show a number of centiles for height for boys and girls in the three samples. The height values for the Welsh and English children are remarkably similar. Scottish boys and girls are smaller.

As noted earlier, the samples are not entirely comparable with respect to social class and family size. The effect of these disparities cannot be assessed easily. The

Figure A2: *Centiles or height for Welsh girls, 1977–8. Comparison with centiles for English and Scottish girls (NSHG) 1972 (based on Fig. 4 Annals of Human Biology, 4, No. 6, 509, 1977).*



differences in both factors act to the disadvantage of the Scottish children and undoubtedly explain something of their smaller measurements. For the Welsh children the disparity in Social Class acts in favour of the English children but the difference in family size acts in favour of the Welsh sample.

Conclusion

Further analyses will be required to define more precisely the differences in height and other measurements of growth in English, Welsh and Scottish children. However the data available from extensive surveys in the three countries suggest that while Scottish children are slightly shorter, Welsh children are of very similar height to English children of the same age.

References

Baker I. A., Elwood P. C. and Sweetnam P. M. (1979)
Free school meals and height of Welsh schoolchildren (letter)
Lancet, **2**, 692.

Baker I. A., Sweetnam P. M. and Elwood P. C. (1980)
Heights and weights of Welsh children In: Genetic and Population Studies in Wales (Ed. P. S. Harper and E. Sunderland)
University of Wales Press (in press).

Goldstein H. (1971)
Factors influencing the height of seven year old children; results from the National Child Development Study.
Human Biology, **43**, 92–111

Rona R. G. and Altman D. G. (1977)
National study of health and growth: standards of attained height, weight and triceps skinfold in English children 5 to 11 years old.
Annals of Human Biology, 4, 6, 501–523

Rona R. G., Swan, A. V., and Altman D. G. (1978)
Social factors and height of primary schoolchildren in England and Scotland.
Journal of Epidemiology and Community Medicine, **32**, 147–154

Printed in England for Her Majesty's Stationery Office by The Alden Press, Oxford
Dd 698622 K11 2/81

HER MAJESTY'S STATIONERY OFFICE

Government Bookshops

49 High Holborn, London WC1V 6HB
13a Castle Street, Edinburgh EH2 3AR
41 The Hayes, Cardiff CF1 1JW
Brazennose Street, Manchester M60 8AS
Southey House, Wine Street, Bristol BS1 2BQ
258 Broad Street, Birmingham B1 2HE
80 Chichester Street, Belfast BT1 4JY

Government Publications are also available through booksellers

ISBN 0 11 320751 4