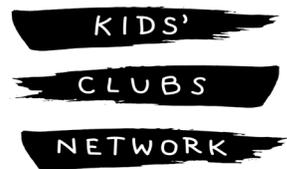


FIT FOR SCHOOL

HOW BREAKFAST CLUBS MEET HEALTH,
EDUCATION AND CHILDCARE NEEDS

Edited by Nick Donovan and Cathy Street



FIT FOR SCHOOL

HOW BREAKFAST CLUBS MEET HEALTH, EDUCATION AND CHILDCARE NEEDS

CONTENTS

	Page
Introduction	
Cathy Street	1
Nutritional Needs of School Children	
Wynn timer Chan	8
The Effects of Breakfast on Educational Performance, Attendance and Classroom Behaviour	
Cornelius Ani and Sally Grantham-McGregor	11
Out-of-School Breakfast Clubs: The Solution for Parents and Children	
Maggie Walker	18
Families and Food Poverty	
Elizabeth Dowler	23
New Findings About Child Nutrition and Cognitive Development	
J. Larry Brown	28
About The Authors	36
Endnotes	37

Acknowledgements

The New Policy Institute would like to thank the contributors to this report for all their generous help.

We would also like to thank those who spoke at and attended our initial seminar: Tessa Jowell MP, Minister of State for Public Health; Anne Longfield, Director of the Kids' Clubs Network; Dr. Wynnie Chan, Nutrition Scientist at the British Nutrition Foundation; Marilyn Toft, National Healthy Schools Scheme Co-ordinator; and Joe Harvey, Director of the Health Education Trust.

We are particularly grateful to the Centre for British Teachers and the Kids' Clubs Network for supporting our research into breakfast clubs.

Responsibility for content and any errors, of course, remains with the authors alone.

Published by the New Policy Institute

First published March 1999

New Policy Institute
109 Coppergate House
16 Brune Street
London E1 7NJ
www.npi.org.uk

Tel: 0171-721 8421
Fax: 0171-721 8422
Email info@npi.org.uk

ISBN 1-9020-800-68

INTRODUCTION

Cathy Street

Introduction

This collection of essays presents and develops a number of important health, education and welfare policy issues which were raised in a seminar which the New Policy Institute, together with the Kid's Clubs Network, organised in December 1998. The seminar explored the benefits, new opportunities and the difficulties which face one specific form of out of school provision - breakfast clubs for school age children.

In the last decade, there has been a considerable expansion in many types of out of school provision, both before and after school and also services which operate exclusively during school holiday periods. Breakfast clubs are an example of 'before school provision', where providing the meal of breakfast is a core part of the clubs' operation, alongside the provision of a safe, adult-supervised environment.

Data from the Kid's Clubs Network database suggests that, at the present time, there are over 700 breakfast projects of some kind operating in the UK. These projects have developed in many different ways: some clubs operate within schools, whilst others use premises such as church halls or local community centres. Some are for the exclusive use by pupils from one particular school whilst others support several schools. Many have been started by and are run by parents on a voluntary basis. Others have been developed by school staff, or by staff from charitable organisations; a number reflect initiatives by local education and health promotion departments and a few owe their origins to local business interests.

Meeting children's needs

Breakfast clubs have attracted widespread interest in the 1990s because they can collectively meet: children's health needs by providing a balanced meal at the beginning of the day; educational needs in terms of ensuring children start the school day on time, feeling well-nourished and settled; and the childcare needs of children and their families through the provision of a safe, supervised environment before school starts.

Furthermore, they may have a serious contribution to make in tackling a range of current areas of concern:

- The poor long-term health prospects arising from the imbalanced diets of many children.
- The social isolation experienced by children unable to enjoy the same foods as their friends.
- Educational difficulties due to the erratic attendance and the poor concentration and behaviour in school exhibited by a significant number of children right from the first years of primary school.
- The poor socialisation of pupils and increasing problems in schools with bullying amongst pupils.
- The lack of adult supervision before school experienced by a significant number of ‘latchkey children’, which may heighten the risks of road accidents.

Consolidating and developing government initiatives

There are a number of government initiatives which may be helped and consolidated through the development of breakfast clubs provision. The *National Healthy Schools Scheme* is designed to integrate schools’ approaches to the healthy meals they offer their pupils together with their lessons about nutrition, cooking and food hygiene. The *National Childcare Strategy* will coordinate and fund a large expansion of out-of-school childcare. Furthermore, by providing a cross-departmental approach to meeting children’s needs and providing support for young children and their families, breakfast clubs complement the government’s *Sure Start* programme.

Breakfast clubs may have a key role to play in the ‘whole school approach to food and nutrition’ outlined in the 1998 DfEE consultation paper on school meals: *Ingredients for Success*. They may also provide one route towards tackling inequalities in health amongst children by improving access to healthy foods at reasonable prices. Tackling health inequalities is a stated aim of the current Government. It is highly relevant that both the *Health Survey for England ’95-’97: Young People* (1998) and the report by Sir Donald Acheson, the *Independent Inquiry into Inequalities in Health* (1998), highlight differences in children’s diet based on social class and income group.

Changes in the funding of school meals and the delegation of budgets set out in the 1998 DfEE consultation paper *Fair Funding: Improving Delegation to Schools*, actually provide the practical means through which new and innovative ways of providing food for the school population, including breakfast clubs, can be supported and developed. Furthermore, such developments may be able to utilise spare capacity in already existing school catering facilities and may, as such, be highly cost-effective.

Raising healthy children – whose responsibility?

Whose responsibility is it to ensure that our children are raised well, in terms of receiving a healthy balanced diet? Is the state or the family responsible for supporting children? If it is the state, should provision be universal or targeted and means tested? Complex questions about parental responsibility are raised. For some children, there is no reason to suggest that breakfast provision should move from outside their family domain. For others, however, where there are concerns about the adequacy of their diet, in particular those children who frequently miss this important meal completely, then quite clearly they and their families would benefit from support of some kind.

There is also no conclusive agreement about the root causes of the poor diets experienced by many children in this country. Differing analyses of the causes throw up quite different policy solutions.

For example, if the underlying cause of children missing breakfast or eating the wrong sorts of foods is lack of money, then perhaps what is needed is adjustments to state benefit levels, especially for those households without work. Alternatively, the state could, in theory, provide subsidies for essential foodstuffs.

Or is the root problem a lack of knowledge of what constitutes a balanced diet? If so, this would imply a greatly increased role for education.

If the issue is more to do with geographical access to a good choice of reasonably priced foods, then an area-based policy might be more appropriate. This would involve the eradication of so called ‘food deserts’: those areas which lack even a small supermarket and where residents have to rely on expensive corner shops which sometimes do not stock any fresh foods. Alternatively, government attention could focus on improving public transport provision to ensure that all families can reach the shopping facilities they need.

Finally, if breakfast is such an important meal, should provision outside the home rely on local interests or should it be the target of a nationally led strategy and prescribed nutritional standards along the same lines as those being pursued for school lunches?¹ Indeed, should the duty set out in *Fair Funding* with regard to school lunches, which requires schools “to provide free school meals to eligible pupils”² be extended to cover breakfast?

This pamphlet focuses upon one possible form of support provided outside the family: breakfast clubs for school children.

The possible benefits of breakfast clubs from a health perspective

The first paper presented in this pamphlet, by Dr. Wynnie Chan of the British Nutrition Foundation, discusses the nutritional needs of school children and the important contribution that breakfast can make to their diet.

Both these overall dietary needs and the role of breakfast in meeting these requirements clearly illustrate why the development of breakfast club provision might be a very welcome development in attempts to address current concerns about children’s diets, their health and development.

These health concerns relate to several key areas. First, at the most basic level, breakfast is a meal frequently missed completely by children. Last year, figures from Gardner Merchant, school caterers, indicate that 18% of the 15-16 year old girls surveyed, 12% of the boys of the same age, and 6% of all children aged 8-16, miss breakfast. Only 4% of socio-economic grades A and B have no breakfast whereas this doubles to 8% amongst socio-economic grades D and E.³ Completely missing a meal may reduce the chances that a child’s total daily intake of the essential nutrients needed for healthy growth and development will be adequate.

Second, there is widespread concern about the imbalance in many children’s diets, especially their over-reliance on ‘grazing’ on high fat and snack foods throughout the day instead of eating ‘proper’ meals.⁴ In her paper, Dr. Chan highlights the adverse health effects which may arise from this sort of diet.

Breakfast clubs may also help to develop healthy eating habits in childhood which, it is now widely accepted, positively influence adult eating patterns. In other words, breakfast clubs may bring both immediate and long-term benefits. In addition, there is a growing awareness of the susceptibility of children to be

influenced by the advertising of unhealthy foods often targeted at this age group.⁵ Breakfast clubs may be one way of providing the knowledge and understanding of healthy eating needed to counteract such harmful advertising effects.

Breakfast clubs and education

In the second paper, Professor Sally McGregor and Dr. Cornelius Ani from the Institute for Child Health examine the complex links between breakfast consumption and classroom behaviour, educational performance and school attendance.

The positive contribution breakfast can make to a child or young person's educational performance has been a focus of intense research for some years now. Research has focused on the effects of eating breakfast on a child's energy levels, their attention span, their creative thinking, their accuracy and skills in problem solving, and their levels of disruptive behaviour.

Given the current concerns about the numbers of children being excluded from school, and also reports of high and increasing rates of bullying within schools, obviously this is a very topical research area. Although the findings to date must be treated with caution since more UK based research is needed, there is a wealth of more anecdotal evidence which is quite unequivocal in its view that breakfast consumption brings clear educational benefits for both individual pupils and for the school as a whole.

By providing this meal in a club setting, there may be a number of important spin-offs: better socialisation between pupils of different ages; improved staff pupil relationships where school staff run and themselves use the breakfast club; and, in some situations, better parent-teacher dialogue where parents have an active role in the clubs' operation. And whilst it sounds simplistic, the provision of a more calm, less pressured supportive environment for a period before the formal school day begins, may well be an important element in actually getting some children into school in the first place and from this, into a frame of mind receptive to teaching.

Support to families

The third important argument for breakfast clubs provision – family support – is examined in the third and fourth papers. Maggie Walker, Head of Operations for the Kids' Clubs Network, examines the need for before-school

childcare and describes some of the new government initiatives in this area. This is followed by a paper by Dr. Elizabeth Dowler from the London School of Hygiene and Tropical Medicine who discusses families and food poverty.

With an increasing number of mothers now engaged in paid employment outside the home – 1998 figures from the DfEE report an increase from 52% to 62% in ten years⁶ – and the government initiatives on getting lone parents into employment, before-school childcare provision is of great importance to a growing number of families. This need is clearly illustrated by the findings of the Kid’s Clubs Network in 1996, that almost a quarter of primary school age children go to and from school without an adult.⁷

For many families, providing an adequate diet for their children is a major struggle, both in terms of the money needed and in being able to shop for fresh healthy foods locally. Sometimes women on low incomes skip meals in order to feed their children, and in doing so, may adversely affect their own health.⁸ This is point forcefully brought out by Dr. Dowler in her contribution. Children too may miss meals; in 1995, research by Barnardos indicated that one in nine children nation-wide regularly missed breakfast for economic reasons - many parents said simply that they could not afford to give their children an adequate breakfast.⁹

An international perspective

The final essay is by Dr. J. Larry Brown, Director of the Center on Hunger, Poverty and Nutrition Policy in Boston, Massachusetts. Dr. Brown discusses the important role of nutrition right from the moment of conception onward, and highlights the life-long effects of undernutrition which may result from children being “*unable to benefit fully from schooling which, in turn, diminishes their potential as adults*”. He also summarises the current scientific research findings on the links between nutrition and cognitive development, and provides an evaluation of some of the key nutrition programmes for children in America. The latter is particularly important in providing a context in which we can evaluate current UK based initiatives.

Conclusion

Breakfast clubs present an opportunity to tackle some very significant health, education and childcare concerns about children in this country. However, important questions are also raised by this overview – and were much discussed at the seminar. For example, whilst there has been an expansion in

the number of breakfast clubs, many areas of the country lack any provision. Sustaining breakfast clubs once the initial start-up efforts begin to wane and securing long-term funding are critical issues. And for hard-pressed schools already bombarded with a whole range of new requirements and standards to meet, it must be asked how welcome is yet another raft of initiatives?

Following the seminar, the New Policy Institute launched a research project to examine these issues in more depth, and, in particular, to explore the opportunities for breakfast club development which may be presented by both Education Action and Health Action Zones. This work will be ongoing throughout the Spring and Summer, and a research report will be produced in the early Autumn of 1999.

NUTRITIONAL NEEDS OF SCHOOL CHILDREN

Wynnie Chan

Over the last 50 years, the main focus of concern on the nutrition of British school children has changed from being worried about the inadequacy of their diets, to being worried about imbalances in their diets, the effects of which might be manifested later in life.

What is known about the diets of British schoolchildren and the likely nutritional consequences of these diets?

A small number of studies have been conducted to investigate the diets of representative groups of British schoolchildren.¹⁰ In addition, smaller studies investigating the diets and nutrient intakes of selected groups of children from different age groups have been carried out.¹¹

As different methodologies have been used to investigate the dietary habits of schoolchildren from these various studies, it is difficult to make direct comparisons between age groups. However, results from these studies do give a good overall picture of what British schoolchildren are eating.

Summary of research results

- Children's diets are high in fat. For example, Crawley's study (1986) of over 4,000 16-17 year olds found that the average fat intake was 42% of total energy, with much of the fat being derived from meat and meat products, and milk and milk products.¹² The proportion of energy derived from fat has not changed significantly despite recommendations by COMA (Committee on Medical Aspects of Food Policy) in 1991 to reduce the proportion to 35% of food energy.¹³
- The energy intake of children appeared to be adequate, indeed many children are actually consuming more energy than they require. This could carry an increased risk of children becoming overweight as adults.¹⁴ Obesity and being overweight are now major nutritional problems among both adults and children. Obesity in adulthood is linked to an increased risk of stroke, coronary heart disease and high blood pressure.
- The consumption of added sugar among children is high. Surveys by Hackett et al (1980) and Adamson et al (1990) on 11-12 year olds found that non-milk extrinsic sugars are higher than the Department of Health's

recommendations.¹⁵ The obvious risk is that of dental caries which are related to the frequency and amount of sugar consumed. The most important message for caries prevention is to emphasise the brushing of teeth with fluoridated toothpaste.

- The consumption of fruit and vegetables and fibre is low and reflects adult social class and regional variations. Whincup (1992) found among 3000 children aged 5-7 years that those in the manual social groups and in the North ate less fruit and vegetables than those in the South.¹⁶ Among older children, the dietary reference value of 18g fibre¹⁷ was achieved by only a quarter of boys and 10% of girls.¹⁸
- Iron intakes among children are low, particularly among adolescent girls also because of menstruation. This puts them at an increased risk of iron deficiency and therefore anaemia. The Department of Health's survey (1989) indicated that 1 in 3 girls have iron intakes lower than the Lower Reference Nutrient Intake (LRNI).^{*} Nelson's study (1990) on 400 children aged 12-14 year olds in London found that prevalence of anaemia was 14.5 % in the group with iron intake less than the LRNI and low vitamin C intakes.¹⁹ Besides the general fatigue and breathlessness due to anaemia, functional effects of iron deficiency include adverse effects on intellectual performance and behaviour. Pollitt et al (1985) and Deinhart et al (1986) found that iron deficiency anaemia has been associated with low scores on tests of development, learning and school achievement.
- Calcium intakes are relatively low among schoolchildren, especially boys. Although there are no obvious short term consequences of low calcium intakes these may be influence bone formation and peak bone mass in early adulthood which relate to the risks of rapid bone loss and osteoporosis in later life.²⁰
- Children in low income families have low intakes of several nutrients, particularly, iron, calcium, folate and antioxidant nutrients. In Bull's study (1985) of over 900 15-18 year olds, it was found that those in the manual social groups had lowest average intakes of vitamins B₁, B₂ and calcium.²¹

Why is breakfast so important?

Breakfast can make an important contribution to the nutrient intake of schoolchildren.²² It can be seen from the example given below that a common breakfast such as fortified cereal with milk can provide between one-fifth and

nine tenths of schoolchildren’s reference nutrient intake for certain vitamins and minerals – depending upon the age, gender and particular nutrient. This is important for schoolchildren because their nutritional requirements increase rapidly as they are growing quickly and becoming more active. Young children may find it difficult to eat enough to satisfy their nutritional needs if they skip breakfast.

What foods should breakfast contain?

A healthy breakfast should be high in carbohydrates and low in fat. An uncooked breakfast could contain milk, breakfast cereals, breads, yoghurts, fruits and fruit juice. A cooked breakfast could contain grilled lean bacon, grilled vegetables, porridge and poached eggs.

Taking the example of a serving of fortified wholegrain breakfast cereal and semi-skimmed milk, an analysis of the nutrient profiles show that these are useful sources of protein, iron, fibre, vitamins and minerals particularly, B group vitamins, folic acid and calcium. The following table illustrates the nutrients in terms of their percentage contribution to the Reference Nutrient Intake (RNI).²³

Age Group	% RNI contribution from a serving of fortified wholegrain breakfast cereal and semi-skimmed milk				
	Vit. B ₁	Vit. B ₂	Niacin equiv.	Calcium	Iron
7-11 years	71	90	50	34	35
Girls 11-14 years	71	81	50	24	21
Girls 15-18 years	42	81	43	24	21
Boys 11-14 years	56	75	40	19	27
Boys 15-18 years	46	69	33	19	27

Taking another example of a portion of egg (boiled), wholemeal toast and orange juice, this would provide 2.2 mg iron which represents between 15%-25% RNI, 2 mg fibre and 62 mg vitamin C which represents more than double the RNI for schoolchildren.

Conclusion

Schoolchildren need a nutrient dense diet, which is particularly rich in calcium, iron, fibre, fruit and vegetables. Breakfast can make an important contribution to the nutrient intakes, and, in particular, the micronutrient intakes, of British schoolchildren.

THE EFFECTS OF BREAKFAST ON EDUCATIONAL PERFORMANCE, ATTENDANCE AND CLASSROOM BEHAVIOUR

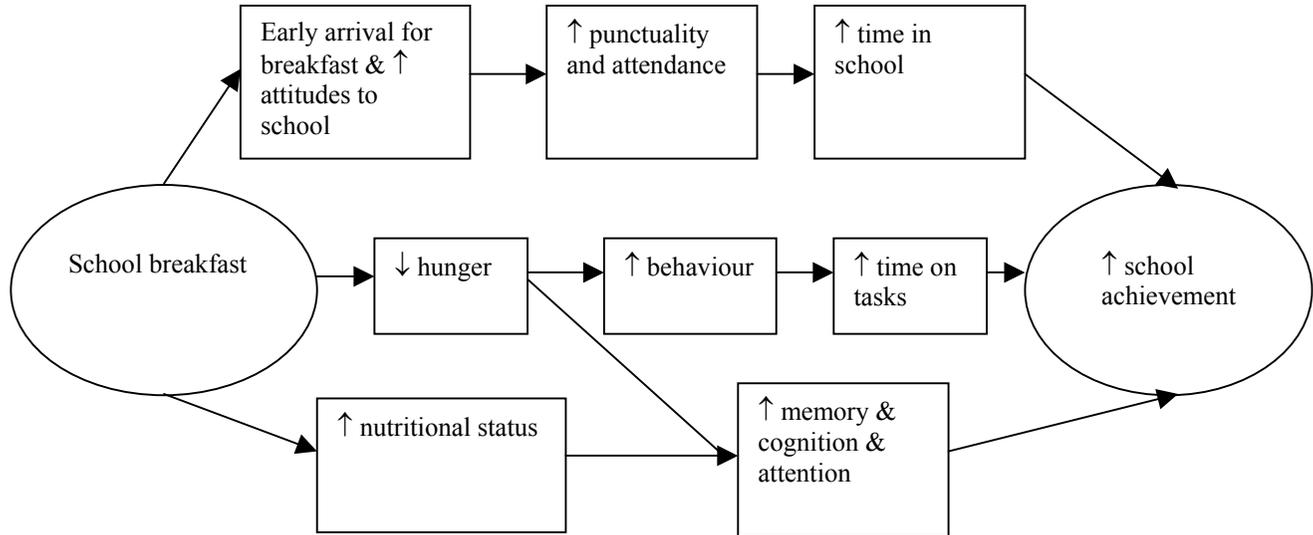
Cornelius Ani and Sally Grantham-McGregor

Introduction

Achievement in school determines to a large extent the future quality of children's lives. Failure can lead to a life-time of poverty whereas improved levels of educational attainment may help to break the cycle whereby succeeding generations in families continue to live in poverty. Most attempts to improve children's educational achievement have focused on the quality of teaching. However, the state of the child is also important and often ignored. Children may be undernourished, come to school tired or hungry and be unable to benefit from teaching. Providing breakfast at school is one way of ensuring that they are not hungry; however this is costly and we need to know the size of the problem and what the benefits are before investing large sums of money.

There is limited information available on the diets of children in Britain. Wendy Doyle and colleagues found that a third of children attending an inner city school in London had had no breakfast and many of those who ate breakfast consumed just crisps and confectionery.²⁴ Nelson reported that school children's diet in the UK generally failed to meet recommended standards.²⁵ Although the energy content usually met recommended levels the children tended to eat too much sugar and fat and intakes of calcium, folic acid, fibre and iron were low in a substantial number of children.

In this paper, we review some of the evidence of the effects of breakfast on children's cognition, school achievement, classroom behaviour and attendance. We will not discuss benefits to health and nutrition. However, the provision of breakfast has been shown to benefit children's dietary intakes,²⁶ especially in needy children,²⁷ and nutritional status. School meals also provide an opportunity to establish good dietary practices which will have long term benefits on the children's health.



How can school breakfast influence educational outcomes?

We will first consider hypotheses suggesting ways whereby breakfast might benefit school achievement. The hypotheses are illustrated in Figure 1: they can be divided into social and biological mechanisms. First, the provision of subsidised or free meals would reduce the parent's costs of sending children to school and may improve both the parents' and children's attitude towards school. Improved attitudes might lead to better attendance. In addition the children may arrive earlier in the morning in order to eat breakfast and thus be on time for the first lesson. Consistent and regular attendance ensures that the sequence of instruction is maintained and should facilitate learning.

Second, hungry children may be too sleepy or easily distracted to pay attention to learning tasks. It has been shown that the more time children spend on a task the more likely they are to learn.²⁸ Thus the provision of school breakfast can increase not only the time the child is physically present in school but also time actually spent on attending to educational tasks. This combination is likely to improve educational outcomes.

Children who miss breakfast at home may suffer short term hunger during morning school work. This may result in impaired memory and attention span and reduced efficiency of information processing. These effects can be relieved by providing school breakfast thus enabling the children to learn more in the available time.

It is also possible that school breakfast could improve intellectual outcomes by correcting any specific micronutrient needs of the children which may lead to low achievement. For instance, a school breakfast providing iron may correct iron deficiency anaemia and thereby improve the achievement of iron deficient children.²⁹ It is also likely that regular school breakfast given in the long term will result in overall improvements in general nutritional status which could in turn affect cognition.

Problems with studies of the effects of school breakfast

Unfortunately many of the studies of breakfast have lacked scientific rigour. Many of them have failed to have measures of the outcome variables before the introduction of breakfast, and have failed to have appropriate control groups. In addition some have relied on teachers who know that the children were given breakfast to assess the benefits. In the following discussion we will focus on the better designed studies.

Short term effects of breakfast on cognition

Four studies examined the short term effect of missing breakfast on children's cognitive functions using cross-over designs in which the children's performance when they received breakfast or a placebo was compared in laboratory situations. They were admitted to a residence overnight to ensure dietary control. These are probably the most rigorous investigations of the effects of missing breakfast on children's intellectual functions.

In two of the studies, conducted in the United States, when adequately nourished children received breakfast their performance on a test of visual perception and problem solving improved.³⁰ In another study conducted in Jamaica, undernourished children's performance on tests of fluency, coding, visual perception and problem solving deteriorated when they missed breakfast whereas adequately nourished children were not detrimentally affected.³¹ The fourth study which was carried out in Peru also found that undernourished children performed poorly on tests of memory when they missed breakfast while well-nourished children showed no adverse effects.³²

Two other studies did not find any adverse effect of missing breakfast on the cognitive functions of children. However, neither study was as rigorous as the previous four.³³

Another Jamaican study was conducted in four rural schools using a cross-over design.³⁴ In this case there was no control over what the children ate at home before coming to school. However, the findings were similar to the other Jamaican study described above,³⁵ in that the undernourished children showed an improvement in cognition when they received breakfast.

A Swedish study, which was also conducted in schools with a cross-over design, found that children who were randomly assigned to receiving an adequate breakfast performed better in tests of creativity and addition, and persevered more in physical exercises, than those assigned to inadequate breakfasts.³⁶

Benton and Parker have shown a correlation between memory function and blood glucose concentrations.³⁷ They also found that missing breakfast adversely affected tests of memory and that this decline in memory was reversed by the consumption of a glucose-supplemented drink.

In conclusion the evidence reviewed in the above studies appears reasonably strong that having breakfast has a short term effect on children's cognition. The question remains as to whether this improvement leads to benefits in school achievement.

Effects of school breakfast on child behaviour

If the saying that 'a hungry man is an angry man' is correct, then it would follow that children who miss breakfast would be less likely to behave well in school. Benton and colleagues showed that children who were given a glucose drink were more attentive and showed fewer signs of frustration in an experimental task.³⁸

In South Africa, researchers used a pre- and post-test design to show that giving school breakfast for 6 weeks reduced the occurrence and duration of off-task and out-of-seat behaviour among the experimental children.³⁹ They also found improvements in active class participation and positive peer interaction in the experimental group.

When the effect of school breakfast on children's classroom behaviour was examined in four rural schools in Jamaica, the changes varied depending on the quality of the schools.⁴⁰ Children in better organised schools concentrated on tasks for longer periods and made fewer undesirable movements. In contrast, in the poorly organised school children's behaviour deteriorated when school breakfast was provided and they were more often off task and moving around.

In another study in the USA the degree of improvement shown by the children in their 'on task' behaviour varied depending on the tasks they were doing.⁴¹

These findings suggest that the effects of school breakfast on children's behaviour may depend on other factors in the children's environment and may only benefit children's behaviour if the classroom infrastructure is satisfactory.

Effects of school breakfast on school attendance

Several studies have found benefits from providing breakfast to children's attendance. A study in Peru which compared participants of a school breakfast programme with non participants found that despite its short duration (15-30 days) attendance was significantly increased among the participants.⁴²

In the United States, participants in a school breakfast programme were less likely to be absent or late compared with non participants.⁴⁵ A recent review of the United States Department of Agriculture School Breakfast Programme concluded that the programme had significantly reduced absenteeism and lateness among participants.⁴⁴

In an early pilot study in Jamaica, students' attendance improved when given breakfast for one term.⁴⁵ This finding was recently replicated in a larger study in which children were randomly assigned for one year either to a group which was given breakfast, or to a control group.⁴⁶ Compared with the control group, students in the school breakfast group attended significantly more during the year. Their nutritional status also significantly improved.

In conclusion, these studies consistently showed an improvement in attendance when breakfast was provided.

Effects of breakfast on school achievement

In addition to the laboratory studies above, other researchers have examined the effect of school breakfast programmes on children's school achievement in school settings. In the United States, 335 low income public (state) school children who participated in a school breakfast programme for three months were compared with 688 non-participating children from similar socio-economic backgrounds. The participants scored better in school tests of language, maths and reading.⁴⁷

In a small study in a rural area of Jamaica, researchers gave school children in three classes either breakfast, a low calories drink, or nothing over a school term and found that the class receiving breakfast improved more than the other classes in arithmetic.⁴⁸ As the nutritional status of the children in the breakfast class did not improve over the same period, the researchers argued that the improvement in arithmetic was most likely due to relief of short term hunger.

In Peru, 201 children who participated in a school breakfast programme for 15-30 days were compared with 151 non-participants and no differences were found between the groups in school achievement tests.⁴⁹ However, children who were nutritionally 'at risk' and received breakfast, improved more in their vocabulary scores than similar children who did not participate in the breakfast programme.

We located only one trial of breakfast that lasted more than 3 months. This trial was recently conducted in Jamaica and used a randomised controlled design. The younger students in the breakfast group improved in arithmetic and boosted their nutritional status.⁵⁰

The above evidence indicates that providing school breakfast had at least short term benefits on school achievement in most studies, however only one study lasted more than three months and that was in a developing country. There is a need for data from long term studies in developed countries.

Conclusions and policy implications

The evidence discussed indicates that school breakfast may improve children's cognition, attendance and classroom behaviour. Behaviour appears to interact with the classroom environment so that where necessary the classroom organisation needs to improve along with giving breakfast. There is also evidence that school achievement improves at least in the short term. Only one study examined the effects over one school year so more long term studies are needed. As greater improvements were often noted in undernourished or younger children, it may be appropriate to target these subgroups for school meals where resources are too limited to feed all children.

OUT-OF-SCHOOL BREAKFAST CLUBS: THE SOLUTION FOR PARENTS AND CHILDREN

Maggie Walker

What is out-of-school childcare?

Out-of-school childcare is now widely recognised by government and others as a vital support for families with school-age children (4-14 years old). In particular, the drive to support parents through ‘Welfare to Work’ now requires many of them to seek childcare, including before-school care. It is this childcare which can provide that vital local component to support the economic and social welfare of families.

Childcare can be provided in the home by childminders or, often, at an out-of-school club. These clubs are available before school, after school or during the holidays. Before-school places are provided in schools, or by community groups, and are commonly known as breakfast clubs.

Characteristics of breakfast clubs

Although representing a small proportion of out-of-school childcare places overall, breakfast clubs, where they exist, do support children and families in many ways. A breakfast club's opening time varies according to local need but usually they run from 7.30 or 8.00 a.m. until school begins. In holiday clubs, breakfast provision is sometimes integrated into an all day service that runs from 8.00 a.m. until 6.00 p.m. Children might attend one, two or more days a week, depending on the working patterns of their parent(s) and other care arrangements which might be in place.

There are a number of different types of provision: for example, clubs can be based in schools or in community centres. Some schools run their own breakfast care schemes that enable children to attend school earlier than normal and have a nutritional breakfast. Some are able to do their homework and others participate in various activities, for example, arts and crafts, and free play within a club setting. Whether clubs run before or after school, either on school or other premises, children generally have the opportunity to eat at the club, and do their homework at a time appropriate to the child or young person.

It is also worth noting that breakfast clubs can be found in both rural and urban communities although the former tend to have fewer children and need to be able to transport children to school if based in community premises.

Why have breakfast clubs?

Breakfast clubs enable parents to reconcile family and work life. They also provide valuable social opportunities for children.

Many parents do not work regular ‘nine to five’ hours. Many work in shifts, or they commute to their places of work, leaving early in the morning. A main aim of breakfast clubs is to provide a safe place for children before they attend school, and to enable parents to go to work or attend college. The period before school begins is often a difficult time for parents as they are getting ready to go to work and also preparing their children for school. Breakfast clubs therefore help to fill that time and make it meaningful for children. Although breakfast clubs do not hold the complete solution for all families, they can certainly go a long way to helping them combine work and family life. In particular, lone parents benefit from breakfast care, as it can provide that extra support they need in order to work and search for work.

Breakfast clubs also give children opportunities to play with their peer group, eat a nutritious breakfast and, in some cases, support children who are more vulnerable. By integrating care and education some children are encouraged to attend school and improve their school attendance. By simply having the opportunity to attend school before the start of the school day with their friends and peers they are encouraged to remain there.

Looking at the research

Recent research has indicated that a number of children are vulnerable after-school. *Home Alone Too? Latchkey Kids - The Solution*,⁵¹ a report of a national survey of children's after-school activities, stated that only 2% of school age children attend a kids’ club after school. Knowing that there are many more after-school than before-school kids' clubs, it is possible to state that there are even fewer children attending a club before school.

Profile of Provision: The Expansion of Out-of-school Care, is an analysis of Kids' Clubs Network's (KCN) survey of its members’ kids’ clubs at the beginning of 1997.⁵² Although it doesn’t include non-KCN members and the survey took place before the large increase in out of school provision took place, it does

provide a picture of out-of-school childcare across England and Wales. There were estimated to be 3,500 kids' clubs – of which 8% provided both before and after school care and less than 0.1 % opened only for breakfast. According to our database approximately 21,500 children attended breakfast clubs and 86,000 attended after-school clubs. A follow up survey, in 1998, of 4,000 KCN clubs, revealed that breakfast clubs catered for 23 children on average – less in rural areas – and that the percentage of clubs providing both breakfast and after-school provision had increased to 9%.⁵³

So what types of organisation run breakfast clubs?

Percentage of out-of-school clubs for 'breakfast' session

Type of Organisation	Per cent
Local Authority	12
Voluntary/Registered Charity	22
Community Business	31
Employer led	32
Private business	40
Educational/School run	42

Local authority run clubs are therefore less likely to open for breakfast than clubs run by other organisations.

There are now plans for a major expansion in the provision of out-of-school childcare places between 1999-2003 and this will include the provision of breakfast club places. It remains to be seen how many are set up and where, as local Early Years Development and Childcare Partnerships convened by every local authority hold the key to developments.

The new initiatives

Legislative Framework

The legislative framework that applies to breakfast care includes the provisions under the Children Act (1989), Food Safety Act (1990) and the Health & Safety Act (1974) which ensure various requirements are met by breakfast clubs. Essentially, out-of-school clubs are required to ensure that they are run by 'fit persons' and operate in 'fit premises'. Most clubs are required to register under the Children Act - although some are exempt if they run for less than 2 hours.

A review of the Regulation of Early Education and Daycare is currently underway. It seems likely that this review is set to change the regulation agenda

for these types of project and to affect the responsibilities of local authorities in registration of facilities.⁵⁴

Working Families Tax Credit

The Working Families Tax Credit (WFTC) when it is introduced in October 1999, will provide support to low income families. Within the WFTC a new childcare tax credit will help pay for registered childcare. Families with one child will be able to get up to £70 a week. Families with two or more children will be able to get up to £105 a week. Parents will be able to recoup the costs of sending their children to an out-of-school club, including breakfast clubs, so long as the club meets the eligibility criteria.⁵⁵

The National Childcare Strategy

In May 1998, the government published *Meeting the Childcare Challenge*, a green paper on establishing a National Childcare Strategy covering children aged 0-14 years.⁵⁶ Acknowledging the vital links between care and education, it was proposed that the National Strategy should be planned at local level via local childcare partnerships, now known as Early Years Development and Childcare Partnerships.

Early Years Development and Childcare Partnerships

The new Early Years Development and Childcare Partnerships are designed to build on the existing Early Years Development Partnerships convened by every local authority in 1997. They have a strategic role in planning new out-of-school childcare places for this age group. Within this broader framework, there are now opportunities to fund more out-of-school childcare places, including breakfast places, from September 1999, via the New Opportunities Fund.

Planning for the future

Increasing the number of out-of-school clubs

The rate of development of after-school and breakfast clubs is set to increase. The government has estimated that between 20,000-30,000 new kids' clubs will be set up, providing approximately 865,000 new childcare places between 1999-2003. The actual total number of places set up throughout the three year programme is yet to be confirmed by the DFEE.

Childcare Plans

Each Early Years Development and Childcare Partnership has been required to compile a childcare plan including the number of out-of-school childcare places

planned between 1999-2002. This three year target will include the provision of breakfast places, whether alone or combined with after-school or holiday care. Each local authority is expected to implement the local childcare plan, beginning in April 1999, with between 100 and 1500 out-of-school childcare places being developed – depending on the size and type of authority.

Impact on local families

This increase in the number of kids' clubs will have an enormous impact on local families. They will start to demand and expect services locally and will often look to the local primary schools for a kids' club. Some schools may decide to set up breakfast places alone, as many appreciate the difficulties parents have and know how many children would benefit from access to a breakfast club. In time, there will be less barriers to work for many parents and increased opportunities for children to attend before-school activities.

Asking the children

Every Early Years Development and Childcare partnership is required to ask children how they enjoy their out-of-school hours. Children were surveyed and invited to focus groups to ask what they did out of school and what services they would like to use. This is included in the new audit of childcare which began in 1998. For the first time, this is a national profile of what services exist for children – both before and after school and during the holidays.

Conclusion

In conclusion, breakfast clubs are good for children and good for families - they support the family unit both economically and socially. There is, however, a long way to go before all children and parents have access to a breakfast club.

FAMILIES AND FOOD POVERTY

Elizabeth Dowler

Most families with children face similar problems when it comes to feeding them: getting children (of all ages) to eat good food which contributes to their health; to eat a variety of foods and try new dishes; and dissuading them from eating too much that might be unhealthy. For those who live on low incomes these problems can be particularly acute. Children can be picky about what they eat, and unadventurous. If you have little money to spend on food, you cannot afford to throw food away, or to provide an alternative. You can't try out new recipes, or buy things that your children have previously refused to eat. People who are confident cooks usually bring their children up to eat a variety of foods and dishes; for some, managing to prepare interesting meals on a tight budget is a challenge they try to meet. Many parents, however, struggle to put a decent dinner on the table day after day, particularly when the rent or bills are due. Birthdays and other celebrations, which in every culture call for special food and, ideally, guests, are often difficult and sometimes impossible.

Family poverty

There are many ways of defining and measuring poverty: low income, worklessness, and dependence on means tested benefits. However it is defined it is accurate to say that households with children shoulder a disproportionate amount of the burden of poverty in Britain. Put another way, children are more likely than adults to be poor. Twenty five per cent of children are in the bottom fifth of the income distribution compared with just 14 per cent in the top fifth.⁵⁷ Of the 14 million people living in households below half average income more than half are families with dependent children – two thirds of these are couples and the remainder lone parents.⁵⁸ Families with children make up nearly two thirds of the people in workless households – one third of workless households are headed by a lone parent.⁵⁹

Children in lone parent families are particularly vulnerable: two thirds of lone parent families are likely to be below 60% of average income, and nearly a quarter are below 40% average income.⁶⁰ The experience of living with only one parent is an increasingly common life-cycle stage for children in the UK (about 20%, 2.2 million, do so). Lone parenthood is not usually a selfish choice, and the children are not neglected or undisciplined. But poverty,

unemployment and debt are common experiences.⁶¹ The barriers to employment for lone parents are formidable and those who do work tend to be on low wages. Access to affordable child-care is particularly critical to the success of government policy to improve the lot of lone parent families.⁶²

Food poverty

The amount of money families on low incomes spend on food is surprisingly small: usually between £20-£25 a week, depending on family size and ages.⁶³ This is much less than is needed to meet requirements for health.⁶⁴ Since such families seldom go out, the money has to cover all the food eaten by everyone in the household, unless the family is claiming income support, in which case school-aged children are entitled to free school meals. Spending as low as this means that fruit, leaner cuts of meat and even wholemeal bread, become luxury items. Those in the lowest income decile spend about £1 a week on fruit, if they buy it all, unlike families in the highest income decile, who can spend about £4.50 on fruit alone.⁶⁵

Indeed, food expenditure is what people often cut to avoid or reduce indebtedness, or meet bills for rent, fuel or a phone: for many it is the only flexible budget item. Many studies have shown poor households develop careful strategies for managing money and budgeting.⁶⁶ Parents economise on food either by buying cheaper or different items (no fruit, fewer vegetables, cheaper processed meats), or by omitting meals altogether (they eat sandwiches or breakfast cereals). Both anecdotal evidence and empirical research shows that parents will go to great lengths to protect their children's diets and health as much as they can. If they have meat, or fruit, it is the children who eat them; they go without food themselves rather than have children go to bed hungry. They become very ingenious in cooking with whatever is left in the cupboard or fridge, especially just before their benefit is due, or they borrow food or money for food.

One lone parent said: *'I normally buy four packets of bread [but if I'm running out of money for food] we just buy two. So those who have six slices I tell them to take four, those taking four I tell them to take three and I don't eat... When we don't have enough, say one boy comes and says, "Mummy I'm hungry," and I say "wait until the others come and we can divide it," or if he's badly hungry I give him a portion and say, "don't take any more – the rest has to go to the other children". He says, "Mummy trust me" ... sometimes I lie to them [then] they say, "Mummy, don't we know you're trying to keep us alive, but*

*don't starve yourself, let's share it" ... They are very good children, they understand.*⁶⁷

Many poor women smoke in response to poverty: to control their stress, relieve hunger, and as their only luxury. Their own nutrient intakes almost certainly suffer as a consequence, though their children's may be less affected. In our study of lone parent family's nutrition, vitamin C and iron intakes were particularly low in poor women who smoked, but their children's diets were no worse than those of poor non-smokers.

When it comes to food shopping, since so many other costs are fixed, poorer women are usually skilled at stretching their remaining money by shopping around, and using cheap markets or discount stores, relying on "bargains" offers and the freezer. But these strategies only work if people have ready access to decent shops and markets. Many low-income families live in local authority accommodation and are often in isolated, large estates with poor facilities and little cheap public transport to better shopping centres. Those who have young children or are physically disabled are particularly vulnerable, as buses are difficult to use with pushchairs and shopping. Women in this position tend to use small corner shops, which are usually more expensive, or discount stores, which can be cheap but carry a limited product range, and are often rather uninspiring places.

The number of food outlets in the UK has dropped by 35% over the last 15 years, mainly at the expense of small specialist shops and street market stalls. There has been a fourfold increase in superstores designed for car access on the edges of towns; town centre supermarkets and food shopping facilities have declined, to be replaced partially by small stores and discounters.⁶⁸ The resulting food price differentials are quite critical for low income households. Food is measurably more expensive in corner shops, convenience stores, and independent small supermarkets than in large supermarkets or discounters, for basic "filling" foods as well as those recommended for a healthy diet (wholemeal products, leaner meat, fresh fruit and vegetables). For instance, Piachaud and Webb found that, on average, basic foodstuffs cost 24% more in small stores than in the big supermarkets. When they took supermarket 'own brands' into account, the differences in costs were 60%. They calculated that a households on benefits would have to spend 25% more of their income on food if they could not get to a large supermarket or street market.⁶⁹

Many people on low incomes find shopping a very depressing experience, with the constant search for bargains that will fill a family. Price and familiarity usually dictate food choice; people try and eat like everyone else to avoid embarrassment, while adopting cooking and meal patterns which use cheap foods cheaply prepared, or they eat sandwiches, which require no cooking. Low-income families often rely on so-called convenience foods, partly for the same reasons as the rest of the population (the foods can be prepared easily, and are popular with children) but also because these foods are relatively cheap, acceptable and predictable, with no waste and regular portion sizes.

However, poor women do not necessarily want food that is cheap and outside mainstream culture. In *Nutrition and Diet in Lone Parent Families in London*, many said they aimed to shop for food that was fresh and of reasonable quality, even though their circumstances were limited because they claimed income support.⁷⁰ ‘Value for money’ was what they looked for, and those who aimed for these things in fact did achieve healthier dietary patterns, although those who were not so poor did better still. There is no convincing evidence that those who live on low incomes are less well informed than the general population about ‘healthy eating’. Some may be less experienced in cooking, partly because they cannot afford to experiment and try new recipes. But many lone parents in our study were quite good cooks, and extremely ingenious in the dishes they could devise using very little money.

Consequences for nutrition, health and wellbeing

There has been no large scale survey of food and low income in the UK,⁷¹ and use has to be made of data from national surveys of food and diet in the general population, supplemented by smaller scale surveys of particular groups where incomes are likely to be low (the unemployed, large families, lone parents) or of benefit claimants. These data are summarised elsewhere.⁷² Briefly, the annual national household food survey published by Ministry of Agriculture, Fisheries and Food shows that intakes of many vitamins and minerals known to be protective against heart disease and cancer are well below reference nutrient intakes in those with incomes below £150 a week, or in households with more than three children, or headed by a lone parent. In fact, intakes among the poorest fifth of families has declined dramatically over the last 15 years: vitamin C by 23% and β -carotene by 47%.⁷³ Surveys of nutritional status in individuals of different ages give similar findings. Men, women or pre-school children from households headed by someone unemployed, or claiming benefit, or in social classes IV and V, had

significantly lower intakes of many vitamins and minerals than people not in these categories.⁷⁴ In Department of Health's study on diets of school children, those who received free school meals had lower vitamin and mineral intakes than their peers.⁷⁵

In our survey of nutrition and diet in lone-parent families we found the diets of income support claimants were much less likely to be adequate than those not claiming benefits, findings that were largely independent of smoking habits, and parental attitudes to shopping, cooking and health. However, we also looked at the cumulative effects of living on a low income. Nutrient levels were very much less likely to be adequate (in terms of % reference nutrient intakes) in parents who were long-term unemployed, and who lived in local authority housing on benefits, particularly where automatic deductions were made from those benefits for rent or fuel debt recovery. Such benefit deductions in fact occur in about one in five income support claimants. Parents living in the worst deprivation had about half the nutrient intakes of parents not in such circumstances.⁷⁶ Their present and future health was likely to be in serious jeopardy.

Food, then, is a marker of social exclusion. Those who cannot afford to eat what everyone else eats; who find food shopping stressful because they have insufficient money, or because the shops they can reach are inadequately stocked with poor quality goods; whose children cannot have a packed lunch similar to their friends' - these are families excluded from the mainstream of society. Food is an expression of who a person is and what they are worth, and their ability to provide their family's basic needs. It is also a major contribution to health and well-being. Both are compromised in low income families and communities.

NEW FINDINGS ABOUT CHILD NUTRITION AND COGNITIVE DEVELOPMENT

J. Larry Brown

Introduction

It is now known that from the moment of conception onward, inadequate nutrition threatens the behavioural and cognitive development of young children. Not surprisingly, children who suffer from inadequate nutrition also typically suffer from a range of other environmental insults associated with poverty. Poor housing, inadequate health care, unemployment and weakened family and community support systems all interact with undernutrition to impede a child's healthy development.

Recent research provides compelling evidence that undernutrition – even in its ‘milder’ forms – during any period of childhood can have detrimental effects on the cognitive development of children and their later productivity as adults. In ways not previously known, undernutrition impacts upon the behaviour of children, their school performance, and their overall cognitive development. These findings are extremely sobering in light of the existence of hunger among millions of American children.

Undernutrition harms children silently. Even before it is severe and its results are readily detectable, inadequate food intake limits the ability of children to learn about the world around them. When children are chronically undernourished their bodies conserve the limited food energy available. Energy is first reserved for maintenance of critical organ function, second for growth, and last for social activity and cognitive development. As a result, undernourished children decrease their activity levels and become more apathetic. This in turn affects their social interactions, inquisitiveness, and overall cognitive functioning.

Even nutritional deficiencies of a relatively short-term nature influence children's behaviour, ability to concentrate, and to perform complex tasks. Deficiencies in specific nutrients, such as iron, have an immediate effect on the ability to concentrate. Child hunger, defined by inadequate nutrient intake during the early years, is capable of producing progressive handicaps – impairments which can remain throughout life. This evidence suggests that undernutrition costs far more than the diminished well-being of youngsters

during childhood. By robbing children of their natural human potential, undernutrition results in lost knowledge, brainpower and productivity for the nation. The longer and more severe the malnutrition, the greater the likely loss and the greater the cost to our country.

Undernutrition begins to exact its toll even before the child is born. Pregnant women who are undernourished are more likely to have low birthweight babies. Along with other health risks that are common to low birthweight babies, these infants are more likely to suffer developmental delays. In the case of very low birthweight infants, permanent cognitive deficiencies associated with smaller head circumference may reflect diminished brain growth.

Research shows that increasing independence and the development of social skills are central to a child's early development. When these activities are curtailed due to undernutrition, a child's overall cognitive development is threatened. Undernourished children typically are fatigued and uninterested in their social environment. Compared with their well-nourished peers, they are less likely to establish relationships or explore and learn from their surroundings.

When children reach school age, developmental delays associated with pre- and post-natal malnutrition often result in a greater need for costly special education services. Undernourished children are also more susceptible to illness and therefore more likely to be absent from school. Children who attend school hungry have diminished attention spans and are unable to perform tasks as well as their nourished peers. In these cases, the full value of the education provided is lost.

Anaemia is one of the most prevalent nutritional disorders in the world, and affects nearly one quarter of all low-income children in the United States. Recent research shows that iron deficiency anaemia has an adverse effect on a child's ability to learn by influencing attention span and memory. This pervasive deficiency is now known to have a severe impact on cognitive development.

Beyond its independent effect on cognitive development, iron deficiency anaemia puts children at higher risk of lead poisoning. Scientific evidence shows that high lead levels result in neurodevelopmental disorders. Low-income children face a double-jeopardy – they are more likely to be anaemic

and more likely to live in an environment where the risk of lead poisoning is high.

Lost opportunities

Perhaps the greatest costs associated with undernutrition among children are the more intangible ones. In economic terms, these are ‘opportunity costs’ – the costs of lost opportunity in which productivity with financial benefits would otherwise occur. In this area the lost opportunity is the contribution that nutritionally-deprived children might otherwise make to society as a whole and to the productivity and well-being of their families in adult life.

The life long effects of chronic undernutrition are cognitive limitations and behavioural impairments that restrict educational experiences and later adult productive capacity. One of the better predictors of a person's lifetime productivity is the number of years of school completed. Poor performance early in school is a major risk factor for dropping out of school in later years. Nutritionally deprived children are unable to benefit fully from schooling which, in turn, diminishes their potential as adults. This is a cost the nation pays indirectly through lost contributions, and directly through the provision of additional social welfare services.

With this greater understanding of the serious threats posed by even mild undernutrition in childhood comes a ‘silver lining’. Unlike some social and health problems plaguing our young, undernutrition is preventable and its effects often modifiable. Many existing programs and treatments are known to be effective. Nutrition and prenatal care for women reduces the incidence of low-birthweight babies and subsequent developmental delays associated with that condition. Iron repletion therapy can reverse some of the effects of anaemia on learning, attention and memory. Research consistently establishes that federal initiatives such as the School Breakfast Program and the Special Supplemental Food Program for Women, Infants and Children (WIC) have positive effects on the cognitive development of children. The benefits include higher performance on standardised tests, better school attendance, lowered incidence of anaemia, and reduced need for costly special education.

Overview of recent research findings

A body of scientific evidence – some of it very recent – points to a highly compelling link between nutritional intake and cognitive development in children. Much of the human research in this area has been conducted in

developing countries where undernutrition is severe, identified by kwashiorkor (protein deficiency), and marasmus (protein/calorie deficiency).

The degree of undernutrition identified most often in the United States is mild-to-moderate undernutrition. Typically it is caused by inadequate nutrient intake which can result in conditions such as iron deficiency anaemia. On a longer-term basis it may result in actual growth retardation, where the child's body stops growing as reflected in diminished weight or height for age. While it is not appropriate to conclude that mild undernutrition has the same effects as severe malnutrition, conditions associated with the milder forms of undernutrition more typically experienced by poor children in the U.S., do pose a serious threat to children's well-being.

Many researchers no longer emphasise that malnutrition alone causes irreversible damage to the brain. This indicates that the mechanism causing long-term cognitive impairment is not necessarily alteration of brain structure itself, although evidence is insufficient to rule out structural damage altogether.

Cognitive deficits related to undernutrition are now believed to result from complex interactions between environmental insults and undernutrition. A cumulative effect of persistent exposure to undernutrition and poverty has been shown clearly. The longer a child's nutritional, emotional and educational needs go unmet, the greater the overall cognitive deficits. Continuous low nutritional intake, for example, usually affects psychological factors such as motivation, attentiveness and emotional expression. These in turn, may have a negative effect on critical developmental processes including parent-child interaction, attachment, play and eventually learning. But unless major and irreparable physiological insult has occurred, improved nutrition and conditions in the social environment can modify the developmental effects of biological and social risk factors to which the child is exposed in early life.

In addition to favourable qualities in a child's environment, nutritional supplementation can modify and, in some instances rectify, cognitive impairment caused by earlier undernutrition. A study of children malnourished during pregnancy showed that those children who received only standard medical care displayed cognitive and interpersonal performance deficits until at least age three. In comparison, malnourished infants who received both nutritional supplementation and post-natal environmental

stimulation were indistinguishable in cognitive or interpersonal functions from adequately nourished children.

In general new research findings show that lack of sufficient food during childhood, even on a relatively mild basis, is far more serious than previously thought. It can produce cognitive impairments in children which may last a lifetime. But the evidence also suggests that adequate nutrition can prevent many of these undesirable outcomes, and is capable of modifying harm that actually has occurred.

Current Scientific Research Links Nutrition and Cognitive Development:

- Undernutrition along with environmental factors associated with poverty can permanently retard physical growth, brain development, and cognitive functioning.
- The longer a child's nutritional, emotional and educational needs go unmet, the greater the likelihood of cognitive impairments.
- Iron deficiency anaemia, affecting nearly 25 per cent of poor children in the United States, is associated with impaired cognitive development.
- Poor children who attend school hungry perform significantly below non-hungry low income peers on standardised test scores.
- There exists a strong association between family income and the growth and cognitive development of children.
- Improved nutrition and environmental conditions can modify the effects of early undernutrition.
- Iron repletion therapy can reduce some of the effects of anaemia on learning, attention and memory.
- Supplemental feeding programs can help to offset threats posed to the child's capacity to learn and perform in school which result from inadequate nutrient intake.
- Once undernutrition occurs, its long-term effects may be reduced or eliminated by a combination of adequate food intake and environmental (home, school) support.

The role of key nutrition programs for children

America has in place a network of nutrition programs that were developed with the underlying aim to protect all citizens who are vulnerable to the harmful effects of hunger. Several key programs focus directly on ensuring that the most vulnerable children do not go hungry as a way to protect their healthy development and later productivity as adults. Four of the major nutrition programs targeted to children are listed below. Research findings suggest that each program has significant potential to safeguard cognitive development, and to help ensure good health in early years.

The Special Supplemental Food Program for Women, Infants, and Children (WIC) safeguards the health of pregnant, postpartum and breastfeeding women, infants, and children under five years of age. Household income must be below the eligibility level (no more than 185 percent of the poverty level), and participants must be at nutritional risk, based on abnormal weight gain during pregnancy, iron-deficiency anaemia or related health risks. About 60 percent of those eligible for WIC receive its benefits.

Research indicates that WIC is highly cost-effective. Data from several studies has demonstrated that by decreasing the number of low birthweight babies born and the need for hospital care for these infants, medical costs are reduced. In 1992, a government study found that the prenatal benefits of WIC resulted in cost savings to other federal, state and local programs over the first 18 years of the lives of children. The study concluded that for every \$1.00 spent on WIC, \$3.50 is saved by averting medical and other related expenditures. This demonstrates how the prevention of problems through provision of adequate childhood nutrition is a sound investment for the nation.

The School Breakfast Program provides federal funds to schools and residential child care institutions to offer nutritious meals to students. Children from households with incomes between 130 and 185 percent of the poverty level receive meals at reduced rates; students from households with incomes 130 percent of poverty and below receive meals free.

Although the School Breakfast Program is an entitlement program (meaning federal funds are available to pay its costs), it is not accessible to many children who need it because most school districts are not required to offer it. Under two-thirds of the nation's schools that offer lunch also offer breakfast.

Research findings have shown that participation in the School Breakfast Program is associated with significant improvements in academic functioning among low-income elementary school children. The reported academic improvements have been attributed to the effects of a morning meal and to the longer term benefit of an improved dietary intake.

The National School Lunch Program is an entitlement program open to all public and non-profit private schools and all residential child care institutions. Lunch is available to all children at participating schools, and the meals must meet specific nutritional requirements in order to qualify for federal funds.

Household income is used to determine whether a child will pay a substantial part of the cost for their lunch or will receive a reduced-price or free meal. To receive a reduced-price meal, household income must be below 185 percent of the federal poverty level. For free meals, household income must fall below 130 percent of poverty. Children in food stamp households are automatically eligible for free meals.

Research has shown that children who participate in school lunch have superior nutritional intake compared to those who do not. Studies also show that low-income children depend on the School Lunch Program for one-third to one-half of their nutritional intake each day. These findings indicate that this program is highly significant insofar as protecting the nutritional status of most participating low-income children.

The Food Stamp Program, established in 1964, is America's first line of defence against acute hunger. The fundamental mission of the Program is to help low-income people buy food to improve their diets. More than half of all food stamp participants are children and 87 percent are children, the elderly or women. To qualify, households must have gross incomes below 130 percent of the official poverty level, and meet stringent requirements which limit the value of assets such as automobiles. In 1996, new restrictions were added as part of the welfare policy changes brought about by the Congress and the President.

A sizeable body of research establishes the Food Stamp program as a central component in helping low-income households achieve better nutritional intake. Recipient households – most notably children – attain a significantly larger proportion of recommended dietary allowances than do eligible non-participants. Nevertheless there are weaknesses in the system in terms of

bureaucratic obstacles which prevent program uptake, and recent significant policy changes will need substantial evaluation in the future.

Conclusion

Data on the threat posed by childhood undernutrition has never been so definitive. This knowledge suggests that new approaches may provide even greater protection from the peril of undernutrition associated with poverty. Scientific understanding of this relationship will continue to improve. But we now know enough to formulate more effective ways to protect our children and, in so doing, strengthen this nation and its future.

Key references

Brown J. L. and Pollitt E., Malnutrition, Poverty and Intellectual Development, *Scientific American*, 274(2):26-31, 1996.

Gorman K. S., Malnutrition and Cognitive Development: Evidence from Experimental/Quasi-Experimental Studies among Mild-to-Moderately Malnourished. *Journal of Nutrition*. 125:2239-44 (suppl), 1995.

Morely R., and Lucas A., Nutrition and cognitive development. *British Medical Bulletin* 53(1):123-34, 1997.

Pollitt E. and Mathews R., Breakfast and cognition: an integrative summary, *American Journal of Clinical Nutrition*. 67:804-12 (suppl), 1998.

Full references can be found at www.tufts.edu/nutrition/CenterOnHunger/ where the full statement on *The Link Between Nutrition and Cognitive Development in Children* can be found.

ABOUT THE AUTHORS

Dr. Cornelius Ani is a Senior House Officer in Paediatrics working with Professor McGregor for a Ph.D. in Child Health at the Institute of Child Health, London.

Dr. J. Larry Brown is Director of the Center on Hunger, Poverty and Nutrition Policy at Tufts University, USA. He is the Alexander McFarlane Professor of Nutrition and Health Policy.

Dr. Wynnie Chan is a Nutrition Scientist at the British Nutrition Foundation. She studied at King's College London where she obtained both her BSc (first class honours) and PhD degrees. Wynnie previously worked for the Ministry of Agriculture, Fisheries and Food, and the Royal Society of Chemistry where she was responsible for updating and maintaining the official UK food composition tables.

Nick Donovan is a research officer at the New Policy Institute. He is co-author of *Second Chances: Exclusion from School and Equality of Opportunity*.

Dr. Elizabeth Dowler is a senior lecturer in the Public Health Nutrition Unit, Department of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine (University of London). Her recent work has been on the nutritional consequences of poverty, influences on food choice, and potential for policy interventions at local and national level. She is the author of, amongst other publications, *Nutrition and Diet in Lone Parent Families in London* (with Claire Calvert).

Professor Sally Grantham-McGregor. Professor of International Child Health, at the Centre for International Child Health, Institute of Child Health, University College London. She has conducted many studies on the effects of nutrition on children's development and educational achievement. Technical editor of *Nutrition, Health and Child Development: Recent advances in research and policy implications*.

Dr. Cathy Street is a Research Associate at the New Policy Institute, and one of the authors of the Institute's recent report *Monitoring Poverty and Social Exclusion, Labour's Inheritance*, which was published by the Joseph Rowntree Foundation in December 1998.

Maggie Walker is Head of Operations for Kids' Clubs Network. She is responsible for a team of training, development and consultancy staff who work closely with local Early Years Development and Childcare Partnerships in England. She is also a Sure Start adviser, advising on services for 0-3 years in local authority areas.

ENDNOTES

¹ DfEE, *Ingredients for Success: a consultation paper on nutritional standards for school lunches*, DfEE, London, 1998. This reintroduces nutritional standards which had been in force in various forms since 1955 but which were abolished by the Education Act 1980. The 1980 Act also ended the universal availability of school meals at fixed prices and restricted free school meals to children of parents receiving Supplementary Benefit and Family Income Supplement. See Woodroffe, C., Glickman, M., Barker, M. and Power, C. *Children, Teenagers and Health: the Key Data*, Open University Press, Buckingham, 1993, page 169. Both of these policies have been identified as contributing to the unhealthy diets eaten by many children, especially those growing up in lower income families.

² DfEE, *Fair Funding: Improving Delegation to Schools*, Consultation Paper, DfEE, 1998, paragraph 40, page 14.

³ Gardner Merchant, *What are today's children eating?*, Gardner Merchant, 1998.

⁴ Carvel, J. 1998, Children spending £1 a day on junk food, survey shows, *The Guardian*, 23rd September, G2, page 12.

⁵ Woodroffe et al, *Children, Teenagers and Health*, 1993, page 171. See also Church. S. and Doyle, P. 1997 'Eat Your Words! Helping children to choose wisely', in *Children UK*, Issue 13, p.3, National Children's Bureau 1993: in 1997, it was estimated that over £500 million would be spent on promoting food and soft drinks – 100 times more than the government funded Health Education Authority had to spend on healthy eating advice, with much of this commercial advertising focused on the child population.

⁶ DfEE, *Meeting the Childcare Challenge*, DfEE, London, 1998, page 10.

⁷ Kids' Clubs Network, *Home Alone Too? Latchkey Kids- The Solution*, London, 1996.

⁸ Department of Health Low Income Task Force, *Low income, food, nutrition and health: strategies for improvement*, London, 1996. See also *Save the Children Out of the frying pan; the true cost of feeding a family on a low income*, London, 1997.

⁹ Cited in Rehman, U., *The Big Breakfast Club Evaluation Report*, Health Promotion Department Greater Glasgow Health Board, 1998, page 10.

¹⁰ Bull, N. Dietary habits of 15-25 year olds. *Human Nutrition: Applied Nutrition* 39A Supplement, 1985. Department of Health and Social Services, *The Diets of British Schoolchildren*. Report on Health and Social Subjects No 36. HMSO, London, 1989. Crawley, H. The energy, nutrient and food intakes of teenagers aged 16/17 years in Britain. *British Journal of Nutrition*, 1993. Whincup, personal communication, 1992.

¹¹ Hackett, A. F., Rugg-Gunn, A.J., Appleton, D. R., Eastoe, J. E., and Jenkins, G. N. A 2 year longitudinal study nutritional survey of 405 Northumberland children initially aged 11.5 years. *British Journal of Nutrition*, 51: 67-75, 1984. Nelson, M., Naismith, D. J., Burley, V., Gatenby, S., and Geddes, N., Nutrient intakes, vitamin/mineral supplementation, and intelligence in British schoolchildren. *British Journal of Nutrition*, 64: 13-22, 1990. McNeill, G., Davidson, L., Morrison, D. C., Crombie, I. K., Keigran, J., and Todman, J., Nutrient intake in schoolchildren: some practical considerations. *Proceedings of the Nutrition Society*, 50: 37-43, 1991. Adamson, A., Rugg-Gunn, A., Butler, T., Appleton, D., and Hackett, A., Nutritional intake, height and weight of 11-12 year old Northumberland children in 1990 compared with information obtained in 1980. *British Journal of Nutrition*, 68: 543-563, 1992.

¹² Crawley, H. The energy, nutrient and food intakes of teenagers aged 16/17 years in Britain. *British Journal of Nutrition*, 1993. The study was carried out in 1986.

¹³ Department of Health, *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom*. Report on Health and Social Subjects No. 41 London: HMSO, 1991.

¹⁴ Berenson, G. S., Srinivasan, S. R., and Webber, L. S. *Cardiovascular risk in early life: The Bogalusa Heart Study*. Upjohn Company, Michigan, 1991. Black, D., James, W. P. T., Besser, G. M. et al. *Obesity: A report of the Royal College of Physicians*. London: Royal College of Physicians, 1983. Garrow, J. S., *Obesity and related Diseases*. Churchill Livingstone, Edinburgh, 1988.

¹⁵ Hackett et al, A 2 year longitudinal study, *BJN*, 1984. Adamson et al, Nutritional intake, *BJN*, 1992.

¹⁶ Whincup, personal communication, 1992

¹⁷ Department of Health, *Dietary Reference Values*, 1991.

¹⁸ Bull, N. Dietary habits, *Human Nutrition: Applied Nutrition*, 1985.

* Lower Reference Nutrient Intake is similar to (and has replaced) the more widely known Recommended Daily Allowance (RDA).

¹⁹ Nelson et al, Nutrient intakes, *BJN*, 1990.

²⁰ DHSS, *The Diets of British Schoolchildren*, 1989. Nelson et al, Nutrient intakes, *BJN*, 1990. McNeill et al, Nutrient intake in schoolchildren, *Proceedings of the Nutrition Society*, 1991. Hackett et al, A 2 year longitudinal study, *BJN*, 1984. Adamson et al, Nutritional intake, *BJN*, 1992.

²¹ Bull, N., Dietary habits, *Human Nutrition: Applied Nutrition*, 1985.

²² Morgan, K. J., Zabik, M. E., and Stampley, G. L., Breakfast consumption patterns of US children and adolescents. *Nutrition Research*, 6: 635-646, 1986. Meyers, A. F., Sampson, A. E., Weitzman, M., Rogers, B. L., and Kayne, H., School breakfast program and school performance. *American Journal of Diseases in Children*, 143: 1234-1239, 1989. Albertson, A. M. and Tobelmann, R. C., Impact of ready-to-eat cereal consumption on the diets of children 7-12 years old. *Cereal Foods World*, 38: 428-434, 1993. Ruxton, C. H. S., O'Sullivan, K. R., Kirk, T. R. and Belton, N. R. The contribution of breakfast to the diets of a sample of 136 primary schoolchildren in Edinburgh. *British Journal of Nutrition*, 75:419-431, 1996.

²³ Calculations based on data from McCance and Widdowson, *The Composition of Foods*, 5th edition, Royal Science of Chemistry, Cambridge, 1991 and Department of Health, *Dietary Reference Values*, 1991.

²⁴ Doyle, W., Jenkins, S., Crawford, M. A., and Puvandendran, K. Nutritional status of school children in an inner city area, *Archives of Diseases in Childhood* 70:376-381, 1994.

²⁵ Nelson, M., Children's diets - problems and solutions. In (eds) Buttriss, J. and Hyman, K., *Children in Focus*, National Dairy Council, 1995, pp. 9-26.

²⁶ Hoagland, G. W., *The impact of federal child nutrition programs on the nutritional status of children*. (Paper presented at the Southern Economic Association Meeting, Washington DC.), 1978.

²⁷ Emmons, L., Hayes, M., and Call, D. C. A study of school feeding programs. I. Economic eligibility and nutritional need, *Journal of the American Dietetic Association* 61:262-8, 1972. Ruxton, C. H., Kirk, T. R., Belton, N. R., and Holmes, M. A. Relationships between social class, nutrient intake and dietary patterns in Edinburgh schoolchildren, *International Journal of Food Science and Nutrition*. 47:341-9, 1996. Somerville, S.M., Rona, R. J., Chinn, S., and Qureshi, S. Family credit and uptake of school meals in primary schools, *Journal of Public Health Medicine* 18:98-106, 1996.

²⁸ Carroll, J., A model of school learning, *Teachers College Record*, 64:801-14, 1963.

²⁹ Pollitt, E. *Malnutrition and infection in the classroom*, UNESCO, Paris, 1990.

³⁰ Pollitt, E., Leibel, R. L., and Greenfield, D., Brief fasting, stress and cognition in children, *American Journal of Clinical Nutrition* 34:1526-1533, 1981. Pollitt, E., Lewis, N., Garcia, C., and Shulman, R., Fasting and cognitive function. *Journal of Psychiatric Research* 17:169-174, 1983.

³¹ Simeon, D. T., and Grantham-McGregor, S., Effect of missing breakfast on the cognitive functions of school children of different nutritional status, *American Journal of Clinical Nutrition* 49:646-653, 1989.

³² Pollitt, E., and Cueto, S., School breakfast and cognition among nutritionally at-risk children in the Peruvian Andes., *Nutrition Review* 54:S22-S26, 1996.

- ³³ Lopez, I., de Andraca, I., Perales, C. G., Heresi, E., Castillo, M., and Colombo, M., Breakfast omission and cognitive performance of normal, wasted and stunted school children, *European Journal of Clinical Nutrition* 47:533-542, 1993. Upadhyay, S. K., Agarwal, D. K., Agarwal, K. N., Srivastava, K. B., and Adhikari, G. S. Brief fasting and cognitive functions in rural school children. *Indian Paediatrics* 25:288-289, 1988.
- ³⁴ Chandler, A. K., Walker, S. P., Connolly, K., and Grantham-McGregor, S. M., School breakfast improves verbal fluency in undernourished Jamaican children., *Journal of Nutrition*, 125:894-900, 1995.
- ³⁵ Pollitt, E., and Cueto, S., School breakfast and cognition among nutritionally at-risk children in the Peruvian Andes, *Nutrition Review* 54:S22-S26, 1996.
- ³⁶ Wyon, D. P., Abrahamsson, L., Jartelius, M., and Fletcher, R. J., An experimental study of the effects of energy intake at breakfast on the test performance of 10-year-old children in school, *International Journal of Food Science and Nutrition* 48:5-12, 1997.
- ³⁷ Benton, D., and Parker, P. Y. Breakfast, blood glucose, and cognition. *American Journal Clinical Nutrition* 67:772S-778S, 1998.
- ³⁸ Benton, D., Brett, V., and Brain, P., Glucose improves attention and reaction to frustration in children. *Biological Psychology* 24:95-100, 1987.
- ³⁹ Richter, L. M., Rose, C., and Griesel, R. D., Cognitive and behavioural effects of a school breakfast, *South African Medical Journal* 87:93-100, 1997.
- ⁴⁰ Chang, S. M., Walker, S. P., Himes, J., and Grantham-McGregor, S. M., Effects of breakfast on classroom behaviour in rural Jamaican school children, *Food Nutrition Bulletin* 17:248-257, 1996.
- ⁴¹ Bro, R. T., Shank, L. L., McLaughlin, T. F., and Williams, R. L., Effects of a breakfast programme on on-task behaviours of vocational high school students, *Journal of Educational Research*. 90:111-115, 1996.
- ⁴² Jacoby, E., Cueto, S., and Pollitt, E., Benefits of a school breakfast program among Andean children in Huaraz, Peru, *Food Nutrition Bulletin* 17:54-64, 1996.
- ⁴³ Meyers, A., Sampson, A., Weitzman, M., Rogers, B., and Kayne, H., School breakfast programme and school performance, *American Journal of Diseases in Childhood*, 143:1234-9, 1989.
- ⁴⁴ Kennedy, E. and Davis, C., US Department of Agriculture School Breakfast Program, *American Journal of Clinical Nutrition* 67:798S-803S, 1998.
- ⁴⁵ Powell, C., Grantham McGregor, S., and Elston, M., An evaluation of giving the Jamaican government school meal to a class of children, *Human Nutrition: Clinical Nutrition* 37(5):381-388, 1983.

- ⁴⁶ Powell, C., Walker, S. P., Chang, S. M., and Grantham-McGregor S. M., Nutrition and education: a randomised trial of the effects of breakfast in rural primary school children, *American Journal of Clinical Nutrition* 68:873-9, 1998.
- ⁴⁷ Meyers, A., Sampson, A., Weitzman, M., Rogers, B., and Kayne, H. School breakfast programme and school performance, *American Journal of Diseases in Childhood*, 143:1234-9, 1989.
- ⁴⁸ Powell, C., Grantham McGregor, S., and Elston, M., An evaluation of giving the Jamaican government school meal to a class of children, *Human Nutrition: Clinical Nutrition* 37(5):381-388, 1983.
- ⁴⁹ Jacoby, E., Cueto, S., and Pollitt, E., Benefits of a school breakfast program among Andean children in Huaraz, Peru, *Food and Nutrition Bulletin* 17:54-64, 1996.
- ⁵⁰ Powell, C., Walker, S. P., Chang, S. M., and Grantham-McGregor S. M., Nutrition and education: a randomised trial of the effects of breakfast in rural primary school children, *American Journal of Clinical Nutrition* 68:873-9, 1998.
- ⁵¹ Kids' Clubs Network, *Home Alone Too? Latchkey Kids - The Solution*, London, 1997.
- ⁵² Smith, F., Barker, J., *Profile of Provision: The Expansion of Out-of-School Care*, Brunel University for Kids' Clubs Network, Brunel, 1997.
- ⁵³ Smith, F., Barker, J., *Profile of Provision: The Expansion of Out-of-School Care*, Brunel University for Kids' Clubs Network, Brunel, 1998.
- ⁵⁴ Department for Education and Employment and the Department of Health, *Consultation Paper on the Regulation of Early Education and Day Care*, TSO, London 1998.
- ⁵⁵ HM Treasury, *The Working Families Tax Credit and work incentives*, The Modernisation of Britain's Tax and Benefit System no. 3., London 1998.
- ⁵⁶ Department for Education and Employment, Social Security and Ministers for Women, *Meeting the Childcare Challenge, A Framework Consultation Document*, London, 1998.
- ⁵⁷ Howarth, C., Kenway, P., Palmer, G. and Street, C., *Monitoring poverty and social exclusion: Labour's inheritance*. New Policy Institute with the Joseph Rowntree Foundation, York, 1998., p.41.
- ⁵⁸ Department of Social Security, *Households Below Average Income, 1979-1996/7*, HMSO, Leeds, 1998. Figures are after housing costs. Kempson, E. *Life on a Low Income*, Joseph Rowntree Foundation, York, 1996.
- ⁵⁹ Howarth et al, *Monitoring poverty and social exclusion*, 1998, page 97.
- ⁶⁰ Howarth et al, *Monitoring poverty and social exclusion*, 1998.
- ⁶¹ Ford, R. and Millar, J., *Private lives and public responses: lone parenthood and future policy*. Policy Studies Institute, London, 1998.

⁶² MacDermott, T., Garnham, A. and Holtermann, S., *Real Choices – for lone parents and their children*. Child Poverty Action Group, London, 1998.

⁶³ See, for instance, i) Office for National Statistics, *Family Spending: A report on the 1996-97 Family Expenditure Survey*, The Stationery Office, London, 1997; ii) Dowler, E. and Calvert, C., *Nutrition and Diet in Lone-parent Families in London*, Family Policy Studies Centre with the Joseph Rowntree Foundation, London, 1995.

⁶⁴ Parker, H. (ed), *Low Cost but Acceptable. A minimum income standard for the UK: families with young children*. The Policy Press and the Zacchaeus Trust for the Family Budget Unit, Bristol, 1998.

⁶⁵ ONS, *Family Spending*, 1997.

⁶⁶ see references 1, 3, 5 (ii) above; also Dobson, B., Beardsworth, A., Keil, T. and Walker, R., *Diet, Choice and Poverty: social, cultural and nutritional aspects of food consumption among low income families*. Family Policy Studies Centre with the Joseph Rowntree Foundation, London, 1994.

⁶⁷ Female lone parent over 50, on income Support with two dependent and two non-dependent, unemployed children living at home. Cited in Dowler and Calvert, *Nutrition and Diet*, 1995.

⁶⁸ Department of Health, *Low Income, Food, Nutrition and Health: Strategies for Improvement. A Report from the Low Income Project Team to the Nutrition Task Force*, Department of Health, London, 1996.

⁶⁹ Piachaud, D. & Webb, J., *The price of food: missing out on mass consumption*, Suntory and Toyota International Centre for Economics and Related Disciplines, London School of Economics, London, 1996.

⁷⁰ Dowler and Calvert, *Nutrition and Diet*, 1995.

⁷¹ MAFF currently plans to commission such a study in the future.

⁷² See references 6 and 7 above; also Leather, S., *The making of modern malnutrition: an overview of food poverty in the UK*, The Caroline Walker Trust (6, Aldridge Villas, London, W11 1BP), 1996.

⁷³ Dowler, E. and Leather, S., Intake of micronutrients in Britain's poorest fifth has declined, *British Medical Journal*, 9th May 1997.

⁷⁴ Gregory, J., Foster, K., Tyler, H. & Wiseman, M. *The Dietary and Nutritional Survey of British Adults*, HMSO, London, 1990. Gregory, J. R., Collins, D.L., Davies, P. S. W., Hughes, J. M. & Clarke, P. C. *National Diet and Nutrition Survey: children aged 1.5 to 4.5 years*, HMSO, London, 1995.

⁷⁵ Department of Health and Social Security, *The Diets of British Schoolchildren*, HMSO, London, 1989.

⁷⁶ “Worst deprivation” here refers to those who are long term unemployed, council tenants, no holiday, and whose rent/fuel is directly deducted from a benefit. See Dowler and Calvert, *Nutrition and Diet*, 1995.