

Executive summary

The effectiveness of public health interventions to improve the nutrition of children aged 2-5 years

Background

A National Diet and Nutrition Survey (NDNS) conducted in 1994 found that 16% of 1.5 to 4.5 year olds in Britain ate more than the daily recommended amount of salt and sugar, and that they did not have enough fruit, vegetables and iron rich foods (Gregory et al, 1995). In the sample of over 1,500 children, 16% were anaemic and 17% had active tooth decay (Gregory et al, 1995; Hinds et al, 1995). A survey (ALSPAC) of 3 year old children in the South West of England in 1996, found that their diets were adequate in most nutrients (Emmett et al, 2001). Observed differences in intake between ALSPAC and NDNS pre-schoolers are probably due socio-economic differences. This indicates the need to focus interventions in socially disadvantaged groups.

Pre-schoolers diets need to improve not only for the sake of their current nutritional status but also to reduce their chances of developing obesity and chronic non-communicable diseases in later life. Factors influencing healthy eating in young children are familial factors, location, and the nature of foods available (Gregory et al, 1995). Food preference, developed during the early years and strongly influenced by family, is an important determinant of healthy eating in young children.

Objectives

To determine which public health interventions delivered in home and community settings are effective in improving nutrition-related health and well-being among 2-5 year old children.

Methods

This review was carried out by the Mother and Infant Research Unit (MIRU) at the University of York between April 2006 and July 2006 and was updated between January and March 2007 by MIRU and NICE. A supplementary review was also commissioned to provide corroborative evidence of interventions among children aged from 6 months to 5 years. This review was conducted by the National Collaborating Centre for Women and Children's Health and is reported separately.

Literature search

Literature searches for this review were conducted by the Centre for Reviews and Dissemination, University of York with input from the MIRU review team. Initially, a scoping search was undertaken in order to direct and refine the final search strategy.

All of the searches were conducted using a stepped approach to identify relevant systematic reviews (SRs), randomised controlled trials (RCTs) and non-randomised studies (cohorts, qualitative studies and surveys). A worldwide search of a number of

databases was conducted to identify relevant systematic reviews (from 1995 onwards). Secondly, a worldwide search for randomised controlled trials (RCTs) was conducted (from 1990 onwards). Finally, the search included any type of study, but this search focused on studies from the UK published from 1990 onwards. Studies not published in English were excluded from the review.

Selection criteria

To be included in the review, the studies had to examine interventions aimed at children aged 2-5 years old, or their parents/carers, or staff at kindergarten, nurseries or day-care centres. Where data were available the review considered areas of deprivation including inner city areas, children from black and minority ethnic groups and children of mothers below the age of 18 years. Studies of children for whom normal care was inappropriate were excluded from the review.

The review included all public health type interventions that aimed to improve nutritional well-being of pre-schoolers, such as: Dietary advice / counselling / education targeting children; interventions to deliver dietary advice / counselling / education / supplementation; media campaigns; interventions to improve relevant nutrition knowledge among parents and practitioners.

Outcomes of interest

Various outcomes were included depending on the intervention examined. These included: Intake of fruit, vegetables, iron rich foods; protein- and calcium-rich foods; nutrient status, for example iron status; incidence of dental decay; incidence of food-related allergies; intake of salt, sugar, artificially sweetened soft drinks; change in weight; development of diabetes, hypertension, heart disease in adult life

Data extraction and quality assessment

Two reviewers independently screened titles and abstracts identified in the literature search. Full paper copies were obtained and independently assessed for inclusion by two reviewers. Any disagreements regarding whether or not a paper met the inclusion criteria was resolved by consulting a third reviewer. Each included study was assessed to determine its applicability to UK settings. All of the studies that met the inclusion criteria were critically appraised by two reviewers in accordance with criteria described in NICE (2006). A study was graded using a code '++', '+' or '-', based on the extent to which the potential sources of bias had been minimised. If there was any discrepancy in a grade given to a study by the two reviewers, the opinion of a third reviewer was sought. Each study was assessed for its applicability to the UK.

Key research questions

The research questions for this review were as follows:

1. What is the effectiveness of public health interventions delivered at home, in nurseries, playschools, crèches and other pre-school settings that aim to promote healthy eating (i.e. increasing fruit and vegetable intake, reducing excess salt intake, and reducing the intake of artificially sweetened soft drinks and chocolates/sweets) in pre-school children?
2. What interventions effectively promote the uptake of recommended vitamin and micronutrient supplements?

3. What is the effectiveness of dietary strategies that aim to reduce the risk of food allergies and intolerance, and the effectiveness of interventions that promote this advice?
4. What is the effectiveness of interventions that aim to prevent diet-related dental caries in pre-school children?
5. What is the effectiveness of dietary strategies that aim to increase the intake of iron rich foods and reducing the rate of iron deficiency anaemia among pre-school children?

Results

A total of 8313 citations were independently screened by two reviewers, and full paper copies of six systematic reviews, 28 randomised controlled trials and six UK studies of any type, were obtained and assessed for inclusion as evidence. Of these, four systematic reviews and six randomised controlled trials (RCT)'s met the inclusion criteria. Five UK studies of other types were used to provide corroborative evidence, but are not reported in this summary.

The main body of evidence identified by this review relates to question 1, concerning interventions delivered at home or in day-care and pre-school settings that promote healthy eating among children of this age group.

No studies were identified in the literature relating to question 2 regarding interventions which are effective in encouraging the uptake of recommended micronutrient supplements in children aged 2-5.

Only one study was identified that related to question 3 concerning dietary strategies to reduce the risk of food allergy and intolerance, and only one poor quality study was identified that related to question 5 concerning dietary strategies to increase the intake of iron rich foods and decrease the rate of iron deficiency anaemia among children in this age group.

In order to address question 4, concerning interventions which are effective in reducing the rates of diet related dental caries in this age group, the evidence was derived from that used by the Scottish Intercollegiate Guidelines Network to produce their 2005 national guidance for pre-school children in Scotland (SIGN 2005). In the evidence table produced for this review, additional data that were not presented in the SIGN document have been added from the original papers. This was done to enable clear linkage of an evidence statement and the source data.

What is the effectiveness of public health interventions delivered at home, in nurseries, playschools, crèches and other pre-school settings that aim to promote healthy eating (i.e. increasing fruit and vegetable intake, reducing excess salt intake, and reducing the intake of artificially sweetened soft drinks and chocolates/sweets) in pre-school children ?

The evidence which relates to this question comes from two types of interventions, those which are delivered primarily to the parents or carers with the intention of improving the child's diet, and those which are delivered directly to the children.

Interventions with parents or carers

A systematic review by Ciliska 1999, reports two relevant RCTs (both 1+ studies) (Cox et al 1996 and Havas et al 1998) and two other relevant studies (both 2+) (Del Tredici et al 1988 and Koblinsky et al 1992. The latter is also reported in a SR by Tedstone et al 1998). These studies evaluated the effectiveness of interventions for mothers with children over 4 years of age. The interventions were multi-faceted and included elements such as: food demonstrations; hands on skills development sessions/workshops in meal planning, shopping and cooking; and the provision of easy to read newsletters; and were delivered by nutrition para-professionals and/or peer supporters. The interventions resulted in significant increases in the consumption of fruit and vegetables by the family and in significant improvements in the quality and diversity of foods consumed by the family. The study by Koblinsky demonstrated that the intervention was less successful with lower active participation.

Evidence statement 1

There is evidence from two RCT's (both 1+) and two other studies (both 2+) reported in two systematic reviews, that nutrition education interventions that focus on skills development in the mothers of young children can be effective in improving the diets of the family in terms of increasing the amount of fruit and vegetables consumed and in improving the quality and diversity of the diet.

Evidence statement 2

There is evidence from two RCT's (both 1+) and two other studies (both 2+) reported in two systematic reviews, that effective nutrition education programmes aimed at the mothers of young children are those which: are multi-faceted; include 'hands on' skills development; are tailored to the educational level and needs of the mothers and to family resources; include strategies for behaviour change; are intensive and ongoing; and are delivered by nutrition paraprofessionals and/or peer supporters.

Two studies reported on interventions which focussed on home visits by health professionals (health visitors) to mothers of young children. Both studies were among low income women. The first , a before and after study (2+) by James et al (1992) reported in the systematic review by Tedstone, evaluated the training of health visitors by dietitians to use the results of 7 day dietary diaries to set realistic objectives for inner city mothers in order to improve the diets of children aged 1-4 years. Mothers were then visited for 16-20 weeks by the health visitor to provide follow up advice, delivering on average 8-9 hours of teaching. The second study, an RCT (1+) by Gutelius et al (1977) reported in a systematic review by Elkan et al (2000) evaluated intensive home visits, each lasting a minimum of one hour to unmarried low income black school girls (aged 15-18 years) from the 7th month of pregnancy to 3 years by a paediatrician or nurse. 19 visits were made in total. Additionally, sixteen discussion groups were held and the child given 8-16 mg/day iron for the first year

Both studies found significant improvements in children's diets. The study by James et al resulted in foods containing iron and protein eaten more frequently and improvements in mother's organisational skills (shopping, meal planning and eating

as a family) were more commonly reported. The study by Gutelius significantly improved daily milk intake, self feeding, intakes of fruit and juice at 24 and 36 months and meat at 6 months.

Evidence Statement 3

There is evidence from two studies among low income mothers, including teenage mothers, (a 1+ RCT and a 2+ before and after study) reported in two systematic reviews, that interventions based on intensive and regular home visits by health professionals delivering tailored advice are effective in improving the diets of pre-school children.

Interventions with children

This review identified a broad range of interventions with children in the 2-5 years age range. Some focused on providing information about healthy eating through various media whereas other involved 'hands on' experiences and the opportunity to taste different foods. Many of the interventions aimed to increase the children's acceptance of fruit and vegetables. Some used single strategies whereas others took multi-faceted approaches.

Interventions providing information alone

In general, interventions which relied solely upon providing information about certain foods, as opposed to handling and tasting foods, were effective in increasing children's knowledge and understanding about healthy eating or their understanding of the relationship between nutrition and health, but did not change their actual eating behaviour. This was the case in three studies reported in a systematic review by Tedstone et al (1998) (2++): Lawatsch et al 1990 (a 1+ RCT) which used children's stories as a medium among children aged 3-5 years in a classroom setting; Peterson et al (1984) (a 1+ RCT) which used 10 specially prepared 20 minute videos shown on consecutive days to 5-6 year old children in class; and Singleton et al (1992) (a 1+ RCT) which evaluated a home-based parent-led intervention among 4-7 year olds which included the use of a picture book, audiotapes and a guide for parents.

Evidence Statement 4

There is evidence from three RCT's (all 1+) reported in one systematic review (2++) that educational interventions which provide information through a variety of different media such as storybooks, videos and audiotapes can be effective in improving children's knowledge and understanding of healthy eating and their understanding of the relationship between nutrition and health. However the provision of information alone, does not appear to change eating behaviour.

Interventions involving 'hands on' and tasting experiences

Two systematic reviews, Tedstone et al (1998) (2++) and Contento et al (1995) (2-), identify 'hands on' food based activities and the tasting foods of foods as elements of

multi- faceted interventions which are successful in improving pre-school children's knowledge and attitudes towards healthy eating and towards certain foods. However, while Tedstone et al notes that such approaches do not always change eating behaviour, Contento et al highlight their importance in changing behaviour. In particular, Contento notes the frequency with which children are exposed to foods as being important in encouraging their acceptance.

Two RCT's investigated the effect of repeated exposure to new or previously disliked foods. The first of these by Birch et al (1987) (1+), which is included within the systematic reviews by both Tedstone and Contento, used repeated exposure (5,10, or 15 times) over 30 days where children could either look at, or taste, certain foods. Increases in intake of the foods were related to the frequency with which they were tasted. Visual exposure to the foods without tasting them had no impact on increasing the acceptance of the food. Another study by Wardle et al (2003) (a 1+ RCT) found a parent-led intervention in which children aged 2-6 were asked to taste a previously disliked vegetable for 14 days, increased children's acceptance of the vegetable

Presenting foods such as vegetables in a positive manner is also highlighted by Contento et al as being important and this is demonstrated by one particular study reported both systematic reviews by both Tedstone et al and Contento et al. This RCT (1+) by Lawatsch et al (1990) used children's stories and compared two approaches: 'threats' of not eating healthily and benefits of eating healthily. While both improved children's knowledge of eating vegetables, the 'benefit' approach was more successful in changing eating behaviour

Evidence Statement 5

There is evidence from two RCT's (both 1+) that the more frequently young children taste new or previously disliked foods, the more likely they are to accept those foods. One RCT (1+) demonstrated that looking at the foods without tasting them was not effective in increasing the acceptance of those foods.

There is evidence from one systematic review (a 2-) and two RCT's (1+) that interventions which provide the opportunity for children to handle and repeatedly taste foods, are more likely to be successful in changing eating behaviour than interventions that provide information alone.

Evidence Statement 6

There is evidence from one RCT (1+) that foods should be positively presented in interventions which aim to encourage young children to eat healthily.

Parental involvement

Two systematic reviews by Contento et al (1995) (2-) and by Tedstone et al (1998) (2++) highlight the importance of parental involvement in interventions aiming to promote healthy eating in pre-school children. Two RCT's by Singleton et al (1992) (1+) (reported in Tedstone) and by Wardle et al 2003 (1+), show that home-based parent-led interventions can be effective in improving children's nutrition knowledge

and eating behaviours. However a study by Lee et al (1984) (a 2++ before and after study included in Tedstone), compared the effectiveness of an 8 week educational intervention for 3-5 year olds delivered at home and in the classroom. While both improved children's knowledge, the teacher led-intervention was more effective. Despite this, reinforcing classroom learning at home, appears to enhance the effectiveness of classroom teaching. An RCT by Essa et al (1+ reported in the systematic review by Tedstone et al) compared a pre-school nutrition education programme with and without parents providing home based activities. The programme was effective in increasing children's nutritional knowledge in both cases, but more so with parental involvement than without. Three out of four of these studies were conducted in white middle class families.

Evidence statement 7

There is evidence from two RCT's (both 1+) that parent- led interventions in isolation, can be effective in improving pre-school children's nutrition knowledge and eating behaviours.

However while there is evidence from one before and after study (2++), that interventions are more effective when delivered by teachers than by parents, there is further evidence (from a 1+ RCT) which demonstrates that parental reinforcement of teacher-led learning enhances the overall effectiveness of the intervention. Three out of four of these studies were conducted in white middle class families.

Classroom based interventions

The large systematic review by Contento et al (1995) (2-) included some studies which related to children attending pre-school, nursery school and day care facilities. This found that nutrition education for pre-school children is more effective when behavioural approaches are used without didactic teaching, when teaching levels are developmentally appropriate and when food based activities are included. A (1+) RCT by Gorelick and Clark (1985) (reported in Tedstone) among 3-5 year old children from a variety of socio-economic backgrounds but whom were mainly white, found that 2 classroom activities per week /6 weeks delivered by their usual teacher who had received extra training, was effective in increasing nutritional knowledge, particularly among the older children. Finally a cohort study (2+ Graves et al 1982 and Shannon et al 1982) reported in a systematic review by Ciliska (1999) which included under fives, found that a 9 week curriculum which included activity sheets and posters in the cafeteria was effective in increasing the consumption of specific vegetables in all children and in improving knowledge about vegetables in younger children.

Evidence statement 8

There is evidence from three systematic reviews, that classroom based interventions can be effective in increasing pre-school children's nutrition knowledge and their consumption of particular foods.

Effective interventions appear to be those which are multi-faceted and which include characteristics such as: teaching based on behavioural approaches; teaching levels

which are developmentally appropriate; training for teachers in delivering the intervention; activity based teaching; opportunities to taste and handle foods; and reinforcement of learning from the classroom in the cafeteria and at home by parents.

What is the effectiveness of dietary strategies that aim to reduce the risk of food allergies and intolerance, and the effectiveness of interventions that promote this advice?

Only one RCT (a 1+ Australian study) was identified that addressed this question. This study by Peat et al (2004) was among children with a family history of atopy and compared a dietary intervention with an intervention designed to reduce exposure to house dust mite. The dietary intervention supplemented the children's diets with omega 3 fatty acids and restricted omega 6 fatty acids from 6 months of age. The allergen avoidance intervention gave advice on: cleaning; ventilation; allergen-impermeable mattresses; and washing bedding in an acaricidal detergent before birth and at three monthly intervals. The dietary intervention significantly reduced atopic cough at 3 years of age. However there was no significant effect on the incidence of asthma, eczema or cough in non-atopic children

Evidence statement 9

There is evidence from one RCT (1+) that supplementing children's diets daily with omega 3 fatty acids and restricting omega 6 fatty acids significantly reduced atopic cough at 3 years of age. However there was no significant effect on the incidence of asthma, eczema or non- atopic cough.

What is the effectiveness of interventions that aim to prevent diet-related dental caries in pre-school children?

The evidence to answer this question was derived from that used by the Scottish Intercollegiate Guidelines Network to produce their 2005 national guidance for pre-school children in Scotland (SIGN 2005).

An intervention study (2++) by Rodrigues and Sheiham (2000) included within the SIGN review investigated the effect of the amount of sugar consumed and the frequency with which sugar is consumed on the rates of dental caries. It found a relationship between the amount of sugar consumed, and the frequency with which it is consumed, and dental caries. A systematic review by Burt and Pai (2+) 2005 notes however that the effect of widespread fluoridation in the modern era has weakened the effect of the relationship between sugar consumption and dental caries. The SIGN review states that the results of this study should not give false reassurance about the role of sugars in dental caries.

Evidence statement 10

Evidence from a Brazilian study (2++) found children attending nurseries which restricted the consumption of sugar and who consumed lower amounts of sugar at lower frequencies, had a substantially lower risk of dental caries.

Evidence statement 11

A systematic review (2+) based on thirty-six studies, found that the relationship between sugar consumption and caries is much weaker in the modern age of fluoride exposure than it used to be, but controlling the consumption of sugar remains a justifiable part of caries prevention.

A trial by Gedalia (2++) investigated the effect of cheese on dental caries and found that it might be protective. Although the children in this study were aged between 7 and 9 years, it is likely that a similar protective effect would occur in children of a younger age range.

Evidence statement 11

A 2+ study in children aged between seven and nine found that cheese eaten after breakfast was shown to reduce the risk of dental caries.

While a systematic review (2+) by Lingstrom et al (2003) of confectionery containing polyols (artificial sweeteners) found that polyols were non-cariogenic, there was insufficient evidence that they prevented caries.

Evidence statement 12

A systematic review examining confectionery containing polyols found that although polyols were non-cariogenic there was insufficient evidence that polyols prevented dental caries.

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