The challenge for nutrition education is to understand and change children's ideas about food with the aim of modifying behaviour.

Dr Kathryn Bullen is a Lecturer in the Department of Psychology, University of Wales, Swansea.

For correspondence: K.S. Bullen@swansea.ac.uk

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Kathryn Bullen

Changing Children's Food and Health Concepts: A Challenge for Nutrition Education

This study suggests that children's food classification concepts remain resistant to change despite enhanced exposure to nutrition information.

The development of overweight and obesity in children and the short and long term personal and societal consequences is an urgent and topical problem.

In the UK the Health Select Committee[1] identified education as a key component in the drive to tackle obesity as the development of desirable eating habits in the young may encourage long term health. However, this is not a radical idea, in England and Wales the National Curriculum Council[2] recommended that food and nutrition should be taught across all ages. Nevertheless, despite the determined efforts of education levels of obesity continue to rise[3] and the diets of British children continue to cause concern.[4,5] Numerous factors influence dietary choice in children and adults, one being how individuals think about food.[6] In childhood and adolescence cognitive ability develops over time.[7,8] The challenge for nutrition education is to understand and change children's ideas about food with the aim of modifying behaviour.

Interventions in schools

Two comprehensive reviews[9,10] of 'healthy eating' interventions in schools identified the factors reducing and increasing efficacy. Interventions that were too short and emphasised knowledge did not lead to behavioural change. The authors suggested that interventions should incorporate life skills as well as information and should be underpinned by theory. These recommendations will be recognised by those familiar with the European Network of Health Promoting Schools initiative.[11]

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However, there is evidence that the initiative is only implemented in relatively few schools and that these schools may be atypical.[12] Furthermore, evaluations of nutrition related aspects of the National Curriculum and behaviour change appear to be non-existent, the only evaluation of nutrition knowledge being via paper-based, examination related assessments.

The aim of this small scale study was to investigate how effective a typical experience of nutrition education in UK schools was in changing children's ideas about food.

Research process

Psychological investigations of children's changing ideas about the natural world are well documented.[13] A well established method of investigating children's understanding of nutrition concepts is the ability to categorise foods into groups.[14,15,16]

Children can be presented with a relatively easy "top down" task where they are given a category label, for example "healthy foods" and then asked to identify examples e.g. "apple." A more demanding "bottom up" task asks the child to group foods together and then explain the reasoning for the grouping.

This second task is more effortful because the child would have to know and understand that an apple, in common with other fruits and vegetables, has the properties of being low in fat, high in fibre and cardio-protective leading to the label of a "healthy food".[15]

Children are provided with information categorised into groups and labelled by adults; for example children learn that apples, pears

and bananas are labelled as "fruit". Contento identified labels commonly used in nutrition education such as fruit, proteins, and carbohydrates as "traditional" food group labels.[17] However, evidence suggests that the way in which children spontaneously classify and label foods does not correspond with that of nutritionists.[14,15] Such findings potentially limit the extent to which new information can be integrated into pre-existing knowledge if the labels used lack "meaningfulness" for children.[18]

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Current practice

Carey[19] commented on the intensity of instruction required to bring about conceptual change; such resistance may in turn limit potential changes in behaviour. The apparent failure of current practice to change children's dietary habits suggests that we need to understand whether children's ideas about food are changed by the information they receive with a view to improving methods of teaching nutrition education.

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The study reported below considered two research questions. Firstly, did the nutrition information the participants received change their ideas about food? Secondly, are there any implications in the findings for current teaching practice?

Research method

The participants in this study were 20 Year 4 children, 12 girls and 8 boys, attending a state co-educational primary school in South Wales. Parental occupations ranged from Higher Professionals to Semi-routine occupations.[20] The class was "mixed ability" thus a range of children with different academic and social backgrounds were tested. All the participants were white bar one who was Chinese.

The materials used in the study were a series of 88 colour photographs of frequently consumed food items.[4,21] The images had been validated in a previous study.[16] The photographs were assessed for recognition and familiarity and a sub-set of 43 foods recognised by all the participants was compiled. Figure 1 lists the food photographs used.

Figure 1: 43 Food Items presented to children as photographs

Salt	Wholemeal bread	Carrot	Banana
Sugar	White bread	Weetabix	Coke
Egg	Cornflakes	Fish	Crisps
Butter	Apple	Sweetcorn	Pizza
Digestive biscuits	Cucumber	Spaghetti	Tomato
Jam	Baked beans	Strawberries	Broccoli
Orange	Rice	Ham	Orange juice
Tomato sauce	Fish fingers	Spaghetti hoops	Grapes
Sweets	Chips/French fries	Red pepper	Chicken
Coco-pops	Sausages	Cheese	Milk
Cakes	Pear	Yoghurt	

All items were photographed in the state children would normally eat them, that is cooked not raw. Thus the chicken was a cooked, roast chicken, the fish were two cooked sardines, the chips/French fries, sausages and pizza were cooked. All items were photographed on a plain, white plate of uniform size and against a blue background

Procedure

The 43 food photographs were displayed and the children were given the following instructions:

" I am interested in which foods you think should be in the same groups and why. This is not a test and there are no right or wrong answers, I am just interested in what you think. I will not be telling your teacher your answers. Look at the photographs of different foods, if there are any that you do not recognise I will tell you what they are. I want you to place the foods into different groups, the ones that you think should go together. Then I want you to give me a name for that group and a reason why you put those foods together. Remember, there is no right or wrong way to do this, I am just interested in what you think. Do you understand what you have to do? "

The children were asked to complete the task in their own time.

Initially, the tester (KB) spent the day as a helper in each classroom. The participants were told that did not have to take part if they did not wish to but all took part and the children were interviewed individually in a quiet room away from the classroom.

Two sets of results were obtained T1 and T2. T1 results were collected before the intervention and nutritional instruction. The T2 results were collected by running the same procedure a second time one week later.

Teaching methods and activities

In the intervening time children experienced the following:

1) A series of lessons (total time 3-4 hours) based on National Curriculum Key Stage 2 requirements relating to nutrition and health. Teaching methods and activities were as follows:

- Teacher led instruction about food: the constituents of food, the role of food in health and illness, the relationship between diet, obesity and Coronary Heart Disease, the affect of sugar on teeth.
- Children led activities: discussion and worksheets, looking at food packaging to extract nutrition information, identifying protein, carbohydrate, fat, sugar, fibre, salt, vitamins and minerals. The concept of the "healthy diet", the role of food in maintaining health, devising a healthy menu.

2) Within the lessons the author requested that the teacher (a science graduate) emphasised the following food/health messages. The messages were used as "markers" to investigate whether the information received during the lessons had been incorporated into children's classification of food:

a) Sugar causes tooth decay and obesity
b) Fat causes obesity and Coronary Heart Disease
c) Fibre helps the digestive system to work
d) Carbohydrate provides energy
e) Protein builds muscle

3) A visit to a mobile "Life Education Centre" positioned in the school's grounds. The stated aim of the centre was to "instil within children an awareness of themselves by getting to know how the human body works and how its delicate equilibrium is affected by substance - legal or illegal". The unit designed for 9 year olds considered the digestive system and used the theme "It's great to be me". Electronic modules showed how food is digested and how drugs and other substances change the way the body works.
Audio-visuals, films, games, role-play, a Transparent Anatomical Mannequin and interaction with a facilitator aimed to make "a visit to the centre a stimulating and memorable experience for children and their teachers" The visit lasted between 45 and 60 minutes.

The unit for Key Stage 2 children reflected the requirements that "Pupils should study how microbes and lifestyle can affect health and learn about factors that contribute to good health including the defence systems of the body, diet, personal hygiene, safe handling of food, dental care and exercise." (Council Curriculum for Wales.[2])

Exactly seven days later the procedure was run a second time. Unfortunately, because of illness only 17 of the original sample were able to participate.

Method of analysis

The following analyses were conducted after both assessments.

1. The categories of groups formed and the ability to group all the items. The frequency of use of major food group categories were subject to a McNemar Test for Repeated Dichotomous Variables.
2. The reasons provided by the participants for the criteria they used in forming groups (e.g. a common characteristic identifying the group).
3. Finally, a detailed examination of the marker messages in the data before the interventions (T1) and after the interventions (T2).

Analysis of results

Food Categories

The main categories formed by the children are presented in Table 1.

Table 1: Percentage/numbers of children forming major food categories. (Numbers in parentheses indicate numbers of children).

Groups Formed	T1 (n=20)	T2 (n=17)
Fruit	45% (9)	39% (7)
Drinks	40 % (8)	22% (4)
Vegetables	25% (5)	33% (6)
Fish	0%	5% (1)
Breakfast Cereals	20% (4)	17% (3)
Meat	15% (3)	11% (2)
Breads	15% (3)	17% (3)
Fruit and Vegetables	5% (1)	5% (1)
Meat and Fish	5% (1)	5% (1)
Wheat Products	5% (1)	0%

Nine of the children were unable to complete the task at either T1 or after the intervention (T2). A comparison of the characteristics of the children in terms of intellectual ability or reading level was not made.

The only criterion used was the ability to complete the task on both occasions. At T1 12 participants made groups with traditional food group labels, which were also used by eleven children T2. The most frequently made group at both T1 and T2 was a fruit group. At T1 eight children made a drinks group but this had decreased to half of the sample one week later.

There was a slight increase in the use of a vegetables group label between T1 (five children) to six children at T2. For the other food groups reported in Table 2, although the same groups were made on both occasions there were only marginal differences in the frequency of presentation. The results are more marked in their similarity than in their differences. Analyses of the results using McNemar Tests for repeated dichotomous variables were not significant for any associations between food groups and time of testing (T1 and T2) at $p<0.5$.

Non food group criteria used for classification of food items

The second analysis undertaken was the examination of the non food criteria used to classify and label foods after both assessments. These results are presented in Table 2.

Table 2: Percentage/numbers of Children Using Non-traditional Food Group Criteria at T1 and T2. (Numbers in parentheses indicate numbers of children).

Criteria/classes formed	T1 (n=20)	T2 (n=17)
Nutritional quality (healthy/unhealthy foods)	65% (13)	71% (12)
Functional categories (meals/snacks)	40% (8)	35% (6)
Taste/texture/appearance	35% (7)	35% (6)
Foods not classified	45% (9)	44% (8)
Preference (like/dislike)	0%	0%
Miscellaneous (rewards)	5% (1)	5% (1)

The most frequently occurring non-traditional food criterion used by participants to classify foods was nutritional quality, e.g. healthy/unhealthy, meals, snacks etc. Again the results were very consistent from T1 to T2. Children who were using specific principles for classification at T1 still used them at T2. There were slight changes in the use of the percentage of children using the nutritional quality label, twelve children at T2 as opposed to thirteen at T1. A similar change was observed in the use of the functional (meals/snacks) label, at T1 eight children used this labels compared with six at T2.

Marker Categories

The final analysis considered the use of the marker categories reported by the children at T1 and T2. The results are presented in Table 3 below.

Table 3: Percentage/numbers of children using marker categories at T1 and T2. (Numbers in parentheses indicate numbers of children).

Marker Category	T1 (n=20)	T2 (n=17)
Sugar	38% (7)	17% (3)
Fat	15% (3)	10% (2)
Salt	15% (3)	0%
Fibre	0%	0%
Protein	0%	6% (1)
Carbohydrate	0%	0%
Vitamins/minerals	0%	0%
Tooth decay	15% (3)	6% (1)
Coronary Heart Disease	0%	0%
Obesity	0%	0%

The data from both trials were analysed using the above marker categories. The analysis yielded the following: whilst six of the participants used sugar

as a category label at T1 only three did at T2, fat was used as a label by three children at T1 but by only two at T2, salt was not used by any of the children at T2 although it had been used by three children at T1. There was also a decrease in the numbers of children labelling foods as causing tooth decay at the second trial, only one child, used this label, whereas three had grouped foods in this category on the first trial.

Discussion

A vexatious problem for any teacher is the assessment of what is learnt and how effective their method of teaching is. Nutrition education is particularly difficult to assess in this respect because we have to know what the parameters by which teaching can be considered successful are.

One outcome could be passing examinations, others could include behaviour change; both require knowledge and information. This small-scale study examined the influence of various nutrition education methods on the ideas children have about food, health and illness. Previous evidence suggested that although conceptual reorganisation occurs as a developmental process, engineering change is not easy.[19]

To assess conceptual change a number of food and health related "markers" were emphasised during teaching sessions, if the children had incorporated these markers into their categorisation strategies the marker labels should have been used in the second trial. However, the results suggested that substantial conceptual change did not occur.

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Contento examined the affect of information based interventions.[22] She concluded that whilst children may gain factual knowledge from such approaches they do not develop the skills they need to bring about behavioural change unless interventions are linked to theoretical frameworks such as Social Learning Theory.

The current results suggested that despite the emphasis on nutrition and health, and the range of activities undertaken, the participants conceptual understanding of food, reflected in their performance on the classification task, remained essentially stable.

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Whilst behavioural change was not measured in this study a priori it could be hypothesised from previous studies that such changes were not likely to occur.

This stability is worthy of discussion. In a previous study[17] children aged between 5 and 11 years of age were given the opportunity to re-classify food items in more than one way. This was abandoned when it became clear that having classified the items once, children did not substantially change their criteria when invited to do so for a second time.

Bullen and Benton[16] commented upon the unique nature of the classifications of individual children suggesting a particular "mind-set" dictating responses when classifying foods. A possible criticism of studies using spontaneous classification tasks is the danger of inferring too much from the results with initial groups changing on subsequent trials, however the current results do not support this. Rather, the results emphasised the stability of children's conceptual classification of food despite the range of alternative criteria. This is suggestive of well established individualised conceptual structures which were resistant to change.

Memory alone may be discounted as evidence suggests that it is unlikely that over a period of seven days the children would have remembered exactly how they had classified the items, and what criteria they had used; it also has to be remembered that the children had to classify 43 photographs a considerable cognitive demand.[23]

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The participants had a residual 'pool' of items that could not be grouped with any others, and could not be labelled. Because the author was working with the children on an individual basis she was well aware of the concerns the children had. They often had to be reassured that all answers were acceptable and that there was no right or wrong way to complete the task. Whilst anxiety cannot be discounted as a factor in the children's inability to complete the tasks, every effort was taken to reassure them that they were not being assessed and the children were enthusiastic in their participation and engagement with the task.

Nevertheless, the same children were still unable to complete the task at the second trial despite the extensive instruction they had received. This observation suggested that the participants were still experiencing considerable difficulties in finding the conceptual links between food items.

Conclusion

What then can be concluded from the findings and what are the implications for nutrition education?

Firstly, although intriguing, the results of the study should be treated with caution as the sample size was small making generalisation uncertain. Rather than being considered definitive the study may be thought of as a pilot study warranting further investigation of the affect of curriculum based nutrition education practice on both conceptual understanding and potential behavioural change.

It is acknowledged that with such a small sample changes could have been due to chance variation resulting in a Type 2 error. Unfortunately, three participants were ill for longer than the one week period between T1 and T2 and thus were not tested a second time. Further studies from a range of schools using larger, match-paired samples would have to conducted before firm conclusions could be drawn.

Nevertheless, the study did reflect the "lived" experience of the children as they participated in routine classroom activities which had a value added aspect through a health promotion activity designed to be child friendly.

Yet still in this sample substantial conceptual change did not occur. These findings add weight to the views of Carey[19] who stated that "Restructuring .... is not accomplished by a few hours, or even days of instruction." These statements echoed reservations[9,22] regarding the doubtful use of nutrition education interventions that are solitary and based on short exposure times. The results also reflect the strength of the individual need for meaningfulness in learning and that having constructed a idiosyncratic structure of food classification that made sense to them the children were loathe to relinquish it.

The challenge for nutrition education lies in devising interventions, either those that stand alone or those taught as part of the curriculum, that will work with children's individuality and overcome resistance to conceptual change.

Key to such development is a greater appreciation of the influences on children's food choices and the need to help children develop an understanding of the food/health relationship which has both meaning and ownership for them.

Increasing children's involvement with the design of interventions could be a way forward in this respect, together with the need for education authorities and individual schools to support the development of a 'healthy school' environment.

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