Food Control 33 (2013) 320–329

Contents lists available at SciVerse ScienceDirect

Food Control

journal homepage: www.elsevier.com/locate/foodcont

What programs work to promote health for children? Exploring beliefs on microorganisms and on food safety control behavior in primary schools

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ARTICLE INFO

Article history:
Received 7 September 2012
Received in revised form
28 February 2013
Accepted 5 March 2013

Keywords:
Foodborne illness prevention
Risk behavior
Children's education
Scientific drawing
Evaluating the effectiveness of health programs

ABSTRACT

Effective food safety interventions implemented in schools should be an important way to reach children and to improve their knowledge and habits in the context of food handling and personal hygiene. However, few intervention programs of this kind have been implemented with young children, as the preferred groups are secondary school children, young adults and adults. Even though introducing children to new hygiene habits and offering them simplified knowledge based on experience might be effective, health intervention programs and evaluation methods must be adapted to the peculiarity of childhood learning abilities.

This study provides an example of a health promotion campaign addressed at primary school students, with the aim of improving children's knowledge, correcting habits in the context of food safety, and enhancing the children's understanding of microorganisms and their functions. Children attending a program based on (1) mostly theoretical knowledge or (2) mostly practical information (with the scientific method of "learn by playing") were evaluated before and after the intervention using drawings and semi structured interviews to test the intervention effectiveness. Data extracted from an analysis of 492 drawings and of 141 interviews showed that practical classes are more effective than theory classes. Data also show that children's drawings could be used to simplify and consolidate the deep learning of scientific topics, and also to evaluate the successfulness of health promotion campaigns targeting young children. This should contribute to the amelioration of children's awareness of hygiene and food contamination-related risks, leading to significant benefits for primary prevention of foodborne illness.

1. Introduction

Children deserve added attention in the frame of microbial foodborne illnesses because they are considered to be at-risk individuals (Marcus, 2008; Okoh & Osode, 2008). The probability of developing foodborne illnesses is relatively higher for children than for other demographic groups due to many reasons (Buzby, 2001): children's still-developing immune systems impede their ability to fight infection; their lower body weight reduces the minimum infective dose of pathogens necessary to cause foodborne illness; children display limited control over their diet and related food safety risks and, finally, their reduced stomach acid production decreases their capacity to kill harmful bacteria (Haffejee, 1995). For these reasons, approximately half of the reported cases of foodborne illnesses occur in children, with the majority of these cases occurring in children under 15 years of age (CDC, 2009; ECDS, 2010). These illnesses can lead to short- and long-term health consequences.

The scientific literature emphasizes the difficulty children face in overcoming risks linked to food contamination as they have limited control over food safety risks, since their meals are usually prepared by others (Buzby, 2001). However, some of the protective behaviors needed to reduce risk factors are certainly available to them, such as washing hands correctly, maintaining good personal hygiene and management of contacts with peers and teachers.

In this context, the development of effective food safety interventions for primary school students could result in children

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http://dx.doi.org/10.1016/j.foodcont.2013.03.005

gaining information about food safety topics and consequently engaging in more suitable protective behaviors. Children are also capable of reporting the information they learned at school about personal hygiene and food safety good practices to their families, thus improving adult and peer knowledge, and inducing adults to adopt new ideas and behaviors.

Knowledge of the mechanisms responsible for microbiological and physical contamination of foods could be the starting point for any individual's risk reduction and protective behaviors gain. According to previous studies (Bruhn & Schutz, 1999; Gettings & Kiernan, 2001; Redmond & Griffith, 2003; Shiferaw, Yang, & Cieslak, 2000), food safety knowledge tends to increase with age, practice, and urbanization. Very little is known about food safety knowledge, perceptions, and practices among younger children, since most health promotion campaigns have been targeted at middle school students, secondary school students, university students, and adults (Gavaravarapu, Vemula, Rao, Mendu, & Polasa, 2009; Haapala & Probert, 2004; Kosa, Cates, Godwin, Ball, & Harrison, 2011; Losasso et al., 2012; Medeiros, Hillers, Kendall, & Mason, 2001; Morrone & Rathbun, 2003; Takeda, Akamatsu, Horiguchi, & Marui, 2011); relatively few researchers have included children attending primary school in their studies (Faccio et al., 2013, in press; Michelman, 1998; Rennie & Jarvis, 1995).

The reasons for choosing young adults or adults instead of young children could include: (1) the desire to obtain objective evidence about the direct adult involvement in food preparation and in the choice of food preservation methods (Buzby, 2001); (2) young children's difficulty in comprehending knowledge about microorganisms and their pathogenic effects or benefits on the human body; (3) researchers' difficulty in carrying out health program effectiveness evaluations with young children, due to their linguistic limitations and uncertainty about children's comprehension of questionnaires. Lexical items have to be very easy, familiar, and concrete to avoid misunderstanding. For example, researchers could not take it for granted that children understand lexical items like "safe foods" and "unsafe foods" (Haapala & Probert, 2004, p. 72). A last, but critical, point is the inconsistency of correct knowledge regarding hygienic food-safety practices in health promotion behavior, which is problematic in adults (Faccio, Romaioli, Dagani & Cipolletta, 2012; Kellar & Abraham, 2005; Milton & Mullan, 2012; Romaioli, Faccio, & Salvini; 2008) and could be even greater in children due to their poor scientific knowledge of food safety topics and to the variability of their reports. Extensive literature in developmental psychology shows that children's responses are strictly dependent on the formulation of questions, and this factor necessitates extreme attention when choosing tools for evaluating behaviors. For these reasons, research into children's behaviors tends to prefer adult observations rather than actual reports generated by children themselves (Bombi & Pinto, 2000). However, many factors suggest childhood to be a proper age for education about primary prevention of foodborne illnesses. Relevant factors include: (1) Childhood is the age in which children are educated by families and teachers about standards of personal hygiene (washing hands before meals, washing fruit, not using glasses and cutlery previously used by other children), and by which these behaviors are defined as good education habits; (2) Childhood usually coincides with the beginning of meal experiences out of the home; (3) Healthy hygienic habits acquired at this age will remain for a long time (Eves et al., 2010) and are relatively independent from level of knowledge; (4) If new habits are introduced in childhood, using not only theoretical but also practical lessons and producing a deep learning level of knowledge, the impact on behaviors could increase, and this could also improve behavioral imitation between peers.

For these reasons, early childhood health promotion intervention could be truly effective, particularly if it is able to offer age-appropriate "experiences" rather than pure knowledge. Early childhood health promotion intervention programs necessitate a complete revision and simplification of information, in order to make it comprehensible and able to be communicated to children as needed, as well as a very active teaching approach. This article presents a portion of the results of major research related to a primary foodborne illness prevention program carried out with children aged 9–11 years.

Quantitative analysis about changes in knowledge and proper behaviors for reducing foodborne disease risks, completed both by students and their parents, has been presented by the same authors in a different paper (manuscript under submission).

The present research investigated some aspects of the development of knowledge associated with the world of microorganisms and the effects microorganisms can have on human beings, by studying the representation of these concepts both graphically and discursively using an innovative instrument which has not yet been used in this context: drawings and semi-structured interviews linked to drawing analysis. Gardner and Boix-Mansilla (1994) have shown that teaching methods based on the mere addition of new information are not able to activate students' previous beliefs, and so these cannot then be compared with the new information. These teaching methods, therefore, result in the acquisition of "superficial knowledge" only. In contrast, the most effective test for deep learning is represented by the ability to apply new data in totally different contexts than those related to the original learning setting (Faccio, Belloni, & Castelnuovo, 2012).

Even though the use of drawings has been recommended in primary schools for facilitating the understanding of science curriculum materials (Bird & Diamond, 1978; Castelnuovo et al., 2008; Schilling, McGuigan, & Quaker, 1993), it has not often been used as a means to probe children's understanding of scientific concepts (Dove, Everett, & Preece, 1999), and for this reason it is likely there has been little systematic research into the processes of making meaning through drawing in the classroom context (Brooks, 2005).

In the scientific literature, drawing activities have been successfully used to investigate children's ideas about abstract concepts, e.g., "technology" (Rennie & Jarvis, 1995), and more specific ideas, e.g., "evaporation" (Schilling et al., 1993) or "light" (Gan, Scardamalia, Hong, & Zhang, 2007).

Aims of the present study were:

- to determine whether analysis of drawings and interviews could be a useful tool in measuring the success of teaching scientific concepts;
- to measure whether the didactic styles of theoretical or practical classes produced different learning depths among children;
- to establish which didactic style would best serve the ultimate purpose of promoting suitable hand hygiene practice, and thus potentially of reducing foodborne illness among children

2. Materials and methods

2.1. Drawing scientific concepts

In order to explain the rationale of the experimental design, the following description of some scientific concepts behind drawing analysis is useful.

Children use drawing as a natural communication means beginning at a very early age. Many children enjoy drawing and are more confident expressing themselves with drawings rather than with words (Brooks, 2005; Goodnow, 1977; Rennie & Jarvis, 1995). Several educators and researchers have emphasized the potential