



Research report

School-based intervention with children. Peer-modeling, reward and repeated exposure reduce food neophobia and increase liking of fruits and vegetables[☆]



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ABSTRACT

This study investigated the effectiveness of the 'Food Dudes' school-based intervention consisting of rewards, peer-modeling and food exposure on food neophobia and the liking of fruits and vegetables (FV) in a large cohort of children. Five-hundred sixty children recruited from three schools were assigned to the experimental or control group. For 16 days, children in the experimental group watched motivational videos, were read letters to encourage them to eat FV and received a small reward for eating one portion of both a fruit and a vegetable. The control group was only provided with FV for the same time period. Food neophobia and liking were measured in both groups of children before and after the intervention, and a follow-up measurement was carried out 6 months later. The intervention was effective in reducing food neophobia and, most importantly, a persistent effect was observed 6 months after the intervention as children of the experimental group showed significantly lower neophobia scores than the control group. Additionally, the program was effective in increasing liking for both FV; however, this effect was maintained only for fruit after 6 months.

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Introduction

Over the past few decades, there has been a steep rise in obesity worldwide, with one-third of children becoming overweight or obese by the time they are 2 years old. Given that child obesity and its health impacts last into adulthood, preventing obesity from an early age has become a major public health priority in the developed world (WHO, World Health Organization, 2012). Data on Italian children show that the prevalence of overweight and obesity is about 30%, indicating an increase of 10–15% in the last 10 years (Italian Ministry of Health, 2012). The origins of obesity are manifold and complex: although there are some genetic causes, most of them are related to lifestyle and the dietary habits of the children and their families. Currently, the everyday environment provides a surfeit of inexpensive, energy-dense foods that humans are biologically predisposed to choose over less caloric options (Ostan, Poljsak, Simcic,

& Tijsskens, 2010). At the same time, lifestyles have become increasingly sedentary.

It is well known that regular consumption of fruits and vegetables (FV) is associated with health benefits (Antova et al., 2003; Kraak, Story, & Swinburn, 2013). Also, emerging evidence suggests that increasing FV consumption is one of the factors which may assist dietary weight management strategies to prevent obesity (Ledoux, Hingle, & Baranowski, 2010). Despite this, children's consumption of FV is far below the five recommended servings per day (Baranowski et al., 2000; Coulthard & Blissett, 2009). Increasing FV consumption has been reported as a global public health nutrition priority (WHO, World Health Organization, 2003). However, minimal progress has been made in developing effective means to ensure an adequate intake of these foods because FV continue to be among the most disliked foods by children (Chapman & Armitage, 2012; Skinner, Carruth, Bounds, Ziegler, & Reidy, 2002).

Over the past 30 years, research on children's food habits has identified several variables that can influence their liking and consumption of different foods. According to the social learning account of Bandura (1977), modeling by significant others can be highly influential in establishing food behavior changes. Models that have been shown to be effective with children include cartoon characters, peers, mothers, unfamiliar adults and teachers. In contexts other than food consumption, research has also shown that children are more likely to imitate a model whose behavior they see is being rewarded, who is of the same age or slightly older than

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themselves or who they like or admire. Children are also more likely to imitate the behavior of multiple rather than single models (Lowe, Horne, Tapper, Bowdery, & Egerton, 2004). Another influential variable for modifying food habits is to induce prolonged exposure to a stimulus. According to Zajonc's "mere exposure" theory (Zajonc, 1968), repeated exposure to a specific food increases the liking and consumption of that food (Cooke, Chambers, Añes, & Wardle, 2011; Wardle, Herrera, Cooke, & Gibson, 2003b). The mechanism by which repeated exposure increases liking is thought to be a "learned safety" behavior (Kalat & Rozin, 1973). This hypothesis proposes that repeated ingestion of an unfamiliar food without negative consequences leads to increased acceptance of that food. The importance of familiarity related to food choices can be explained with reference to Rozin's concept of "neophobia" (Rozin, 1976). Neophobia is a protective mechanism that prevents animals and humans from eating something that could be harmful to them. At the same time, it leads humans to choose familiar and safe foods instead of new and unfamiliar ones (Mustonen, Rantanen, & Tuorila, 2009). Although food neophobia was evolutionarily useful, in a modern society where food safety is guaranteed, it can have a negative effect on food choices, as individuals avoid new food experiences and thus lack dietary variety (Carruth et al., 1998; Nicklaus, Boggio, Chabanet, & Issanchou, 2005). This maladaptive behavior may be of particular relevance for children who show a strong neophobic attitude toward food, especially FV (Cooke, Carnell, & Wardle, 2006; Rubio, Rigal, Boireau-Ducept, Mallet, & Meyer, 2008).

For several years, researchers have been focusing on establishing psycho-educational programs aimed at improving eating habits and lifestyles in children. For example, recent studies reported a positive influence of sensory education on French and Finnish children's food-related behavior (Mustonen et al., 2009; Mustonen & Tuorila, 2010; Reverdy, Chesnel, Schlich, Köster, & Lange, 2008; Reverdy, Schlich, Köster, Ginon, & Lange, 2010).

The program used in the present paper, the 'Food Dudes' program, is based on the previously mentioned core principles derived from the literature on the determinants of children's food preference, namely modeling, reward and repeated exposure, which encourage children to taste FV. The 'Food Dudes' program has been applied in countries such as Ireland, the United Kingdom and the United States (Horne et al., 2009; Lowe et al., 2004; Wengreen, Madden, Aguilar, Smits, & Jones, 2013) with encouraging findings. The results showed a large and lasting increase in children's FV consumption, which can be generalized to the home setting. This intervention has never been tested in Italy, except Sicily (Presti, Cau, & Moderato, 2013). Therefore, in view of the differences in food habits between the Italian population and British and American people, it might be interesting to apply this program to children with a different food cultural heritage.

The present study is part of a larger research program funded by Regione Lombardia aimed at improving healthy food consumption in primary school-aged children. This research project consisted of the application of the 'Food Dudes' intervention in a large cohort of Italian children and the measurement of the impact of such an intervention on several variables, such as FV intake and liking, food neophobia, nutritional status and food behavior. The specific aim of the present study was to verify the effectiveness of the intervention in reducing food neophobia and increasing liking for FV among children who were exposed to the program compared with a control group of children.

Materials and methods

Participants

Parents were asked to read a short study explanation, to complete an informative questionnaire and to sign a consent form. Only

children who returned the consent form completed by one of the parents or a legal guardian were considered for the study. In total 620 consent forms were distributed and 591 were returned, with a response rate of about 90%. Thirty-one children were excluded because their parents reported that their children suffered from food allergies, followed a specific diet or temporarily assumed drugs that may influence taste and smell perception. A total of 560 children (278 girls and 282 boys) aged 6 to 9 years (mean age: 7.9 ± 1.1) were finally recruited to participate in the study. Thirty classes were enrolled: six 1st graders (four for the experimental group), nine 2nd graders (four for the experimental group), eight 3rd graders (four for the experimental group), and seven 4th graders (three for the experimental group). Ninety-five percent of them were Caucasian, 70% were normal-weight, 26% were overweight and the other 4% was obese.

Four schools were initially contacted in the metropolitan area of Milan (Italy). One school was not willing to participate in the study. Of the three schools that agreed to participate in the study, one school was selected to be the experimental group and the other two schools served as the control group. The choice of using separate schools for the experimental and control groups derived from the need of avoiding children from the two groups meeting and exchanging information about the intervention as well as from the ease in the delivery of the intervention (e.g., provision of FV from the supplier). The schools consisted of three separate buildings, which however belonged to the same primary school complex; they shared the same refectory and had the same class schedule. Children from the experimental ($N = 374$) and control ($N = 186$) groups were matched for gender ($\chi^2 = 0.67$; $p = 0.41$), age ($\chi^2 = 3.66$; $p = 0.30$) and BMI ($\chi^2 = 0.54$; $p = 0.55$). The experimental group received the intervention together with the provision of FV; the control group received the FV only. This study adhered to the principles established by the Declaration of Helsinki. The protocol was approved by the Institutional Ethics Committee of the study site.

Provision of food and vegetables

Both the experimental and the control groups received four different combinations: 1) apple and fennel; 2) pear and radish; 3) grapes and broccoli; 4) miyagawa and carrot. FV were selected based on availability in season, ease of handling and storage. In addition, stimuli were chosen in order to have FV that were familiar to Italian children. A portion (approximately 40 g) of each FV was served raw and provided daily during the 16-day intervention phase. FV were served at 10:30 am, immediately prior to the mid-morning break. The FV were fresh and were cut into standardized pieces of uniform size; they were presented to children at room temperature in plastic cups coded with the word "fruit" or "vegetable".

Food neophobia and liking evaluation

Children's food neophobia was evaluated using a questionnaire consisting of eight items: four related to neophilic attitudes and four related to neophobic attitudes. The questionnaire was developed and adapted for Italian children on the basis of the Food Neophobia Scale proposed by Pliner and Hobden in 1992. Specifically, the items "Ethnic food looks too weird to eat", "I like trying new ethnic restaurants" and "I like foods from different countries" were removed and replaced by the item "I like trying new foods and tastes that are unusual and from other countries". This modification was necessary because a preliminary test showed that children did not properly understand the term "ethnic". For each item, children indicated the degree to which they considered the statement to be true for them using a 5-point facial scale (from left to right: "Very false for me", "False for me", "So-so", "True for me", "Very true for me"). Thus, for each child, a neophobia score ranging from 8 to

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