



Food neophobia and liking for fruits and vegetables are not related to Italian children's overweight



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ARTICLE INFO

Article history:

Received 9 May 2014

Received in revised form 8 July 2014

Accepted 22 September 2014

Available online 30 September 2014

Keywords:

Childhood

Willingness to taste

Obesity

Acceptability

Fruits and vegetables

ABSTRACT

Food acceptance and food choice are largely driven by taste preferences and liking, particularly among children. It is often assumed that overweight individuals differ from their normal-weight counterparts in that they prefer foods that are thought implicated in the development of obesity. Despite this, previous findings concerning the relationship between adults' adiposity and food liking are inconclusive, and research in children is limited. The aim of this study was to investigate the relationship among body mass index (BMI), food neophobia and liking of fruits and vegetables (F&V) in a large cohort of Italian children ($n = 528$, aged 6–9 years) in an ecological environment. According to principal component analysis (PCA), the BMI was unrelated to either the food neophobia or the liking values. Food neophobia was negatively correlated with liking of both F&V, but liking of vegetables contributed more in discriminating children according to their neophobia level than fruits liking. This suggests that liking of vegetables is a better indicator of children's food neophobia than liking of fruits. This outcome was further confirmed as low, medium and highly neophobic children differed significantly for their vegetables liking but not for fruits liking. Food neophobia was higher in boys than in girls and decreased systematically with increasing age.

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Introduction

In the past few decades there has been a steep rise in childhood obesity worldwide, with one third of children becoming overweight or obese by the time they are 2 years old (Horne et al., 2011). Childhood obesity can cause social, psychological and health problems and it is linked to obesity later in life (Dietz, 1998; Sandhu, Ben-Shlomo, Cole, Holly, & Smith, 2006). Given that childhood obesity and its health impacts track into adulthood (Van Duyn & Pivonka, 2000), preventing obesity from an early age has become a major public health priority in the developed world (WHO, 2012). To deal effectively with this widespread obesity epidemic, it is important to identify its determinants. The origins and causes 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 (Gortmaker et al., 2011). Food preferences are believed to play a central role in the prediction of human food choices (Drewnowski, 1997; Pilgrim & Kamen, 1963), particularly children's food choices (Birch, 1992). Although adult food and taste preferences have been relatively well documented, there have been few studies on children's preferences in daily life. Understanding the child population's food preferences and their determinants is important for progress in preventing overweight and obesity and improving children's poor food intake.

Food neophobia is one of the main factors influencing the quality of children's diets and the development of food preferences (Russell & Worsley, 2008). Food neophobia literally means "fear of new food". It is manifested in children as a reluctance to eat and/or the avoidance of novel food (Birch & Fisher, 1998; Pliner & Hobden, 1992). Although food neophobia has been evolutionarily useful, in a modern society where food safety is guaranteed, it can have a negative effect on food choices as food neophobic individuals avoid new food experiences and thus lack dietary variety (Cooke, Wardle, & Gibson, 2003). Evidence for a negative relationship between food

Abbreviations: F&V, fruits and vegetables; BMI, body mass index; PCA, principal component analysis.

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neophobia and dietary variety in children has been reported (Falciglia, Couch, Gribble, Pabst, & Frank, 2000; Koivisto-Hursti & Sjöden, 1996; Skinner, Carruth, Bounds, & Ziegler, 2002), being neophobic children less inclined to eat certain types of foods (e.g., fruits, vegetables and foods of animal origin) than their more neophilic peers (Cooke, Carnell, & Wardle, 2006; Galloway, Lee, & Birch, 2003; Nicklaus, Boggio, Chabanet, & Issanchou, 2005). Although the negative effects of food neophobia on children's everyday food intake are increasingly well documented, the role of food neophobia in children nutritional status remains unclear. Falciglia et al. (2000) showed a tendency toward a higher caloric intake in the neophilic children, while Zalilah, Khor, Mirnalini, and Sarina (2005) suggested that neophobic children had a greater prevalence of both overweight and underweight.

To the best of our knowledge, very few studies have investigated the relationships among food neophobia, food preferences and nutritional status in an ecological environment, particularly in children. In this context, Knaapila et al. (2011) conducted a multidisciplinary investigation of the origins of food neophobia and its relationship with a series of variables, among which were personality traits, the pleasantness of the food and the body mass index. However, this study did not involve children and was conducted in a laboratory context. In everyday life, the perceived danger of food may be greater than that in the safety of a laboratory, so that the effects of food neophobia may be underestimated. In addition, a limitation of the research on children that has been conducted to date is that both food neophobia and liking have often been assessed using parent reports. Information about children's food behavior that is obtained from questionnaires provided to the parents may be misleading because it underestimates the role of the children in the process. In addition, parents may sometimes project their own behaviors onto those of their children (Mata, Scheibehenne, & Todd, 2007).

The aim of this study was to obtain a self-reported measurement of food neophobia and liking of F&V involving a representative sample of primary school children in an ecological environment (i.e., at school) and to evaluate how food neophobia and liking are related to the children's nutritional status. We hypothesized that food neophobia is associated with a reduced liking of F&V, and that both food neophobia and liking are related to the children's body mass index (BMI). More specifically, we expect that high acceptance of healthy food, such as F&V, may be associated with a lower prevalence of excess weight among children. Finally, since in previous studies, age (Dovey, Staples, Gibson, & Halford, 2008; Pagliarini, Gabbiadini, & Ratti, 2005) and gender (Dovey et al., 2008; Koivisto-Hursti & Sjöden, 1997) have been reported to play a role in children's food neophobia and liking, age- and gender-related differences were also investigated.

Materials and methods

Participants

Five hundred and twenty-eight (267 boys and 261 girls) children aged between 6 and 9 years (mean age: 7.8 ± 1.1 years) who attended three urban public primary schools participated in this cross-sectional study. The schools were selected in the center and the larger metropolitan area of Milan (Italy). Food neophobia, the liking of F&V and the BMI of all of the participants were assessed at school between October 2011 and February 2012.

The children were selected based on a consent form that was completed by the parents. The parents were asked to read a short explanation of the study and to complete a questionnaire in which they were asked to indicate whether their child had any food allergy or followed a specific diet. All of the children involved in

the study met the following criteria: healthy, not on a specific diet, and not suffering from food allergies. The study was performed in adherence with the principles established by the Declaration of Helsinki. The protocol was approved by the Institutional Ethics Committee at the study site.

Nutritional status evaluation

Anthropometric measurements were taken at the schools by trained technicians according to standardized procedures (Lohman, Roche, & Martorel, 1988). Height was recorded to the nearest 0.1 cm using a stadiometer and weight was measured to the nearest 0.1 kg using a high-precision mechanical scale. The BMI was calculated as the weight (kg) per height² (m²). The gender-specific BMI-for-age percentiles and Z scores were calculated using the 2000 CDC Growth Charts (Centre for Disease Control and Prevention, 2000). In accordance with CDC guidelines, a Z-score below the 5th percentile represented underweight, a score between the 5th and 85th percentile represented a normal weight, a score at or above the 85th percentile and below the 95th percentile represented overweight, and a score at or above the 95th percentile represented obesity (Centre for Disease Control and Prevention, 2000).

Evaluation of food neophobia

The scale used was an Italian adaptation of the original food neophobia scale that was developed by Pliner and Hobden (1992). The original scale was reduced to 8 items, 4 related to neophilic attitudes and 4 related to neophobic attitudes. Specifically, the items "Ethnic food looks too weird to eat", "I like trying new ethnic restaurants" and "I like foods from different countries", which were present in the original food neophobia scale, were removed and replaced by the item "I like trying new food and tastes that are from other countries". The modification was necessary because a preliminary test showed that children ($n = 30$, 16 girls and 14 boys, age range of 6–10 years) did not understand the term "ethnic" properly. Internal consistency was evaluated using Cronbach's alpha test ($\alpha = 0.77$, $n = 8$). The design and validation of the food neophobia scale used in the present study is the subject of another publication (Laureati, Bergamaschi, & Pagliarini, 2015).

The adapted food neophobia scale was presented to the children in the classroom by the teacher and an experimenter who explained to them how to complete the questionnaire. For each item, the children were asked to indicate 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 and so", "True for me", and "Very true for me"). The administration method was the same across all age groups of children, except for 6-year-old children for whom the administration was simplified (e.g., questionnaires administered in small groups of 5–6 children and questions read aloud by the experimenter). A neophobia score ranging from 8 to 40 was calculated for each child (neophilic items scores were reversed).

Evaluation of liking

The liking test was performed one week after the food neophobia evaluation. The children received small portions of F&V (fruit: apple, pear, grapes and miyagawa-citrus fruit; vegetables: fennel, radish, broccoli and carrot). A portion of approximately 40 g of each fruit and vegetable was served raw to the children immediately prior to their mid-morning snack. To increase ecological validity, children were tested in a familiar environment, namely their classroom because at midmorning snack Italian children usually eat there. F&V were selected based on availability in season,

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