

Research Report

Food neophobia in the context of a varied diet induced by a weight reduction program in massively obese adolescents

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Abstract

Previous studies in humans have shown that short to middle-term pre-exposure to multiple foods can reduce the negative response to novel foods (neophobia). In order to explore the effects of a long-term exposure to varied foods on food neophobia, we studied a population of obese adolescents observed in a longitudinal protocol in which the multiple food experiences are induced by a residential weight reduction program (WRP) that encourages the consumption of a wide variety of foods. Seventy-two massively obese adolescents (22 boys) filled the food neophobia scale (FNS, [Pliner, P., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite* 19, 105–120]) and an ad hoc food familiarity and liking questionnaire at the beginning and at the end of the program (mean duration: 8.9 months). Their scores were compared to those of a control group of 51 adolescents (14 boys) tested within a similar period. FNS results show a decrease of food neophobia, without significant difference between the control group and the WRP subjects, although only WRP have encountered new foods experiences as attested by the familiarity and liking results. Methodological considerations, concerning the characteristics of the participants, the nature of the multiple food exposure and the food neophobia measurements, will be proposed to explain differences among studies.

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Introduction

Food neophobia, as indicated by several studies using the food neophobia scale (FNS, Pliner & Hobden, 1992), shows large individual variations in human populations. These variations have been partly described through classical demographic variables, mainly age and sex (e.g. Pelchat & Pliner, 1995; Pliner, 1994; Pliner & Loewen, 1997), socio-economic status (Flight, Leppard, & Cox, 2003) and culture (Ritchey, Frank, Hursti, & Tuorila, 2003). They have also been related to variations in temperamental traits, such as sensation seeking, anxiety, emotivity, humeur and neuroticism (Galloway, Lee, & Birch, 2003; Loewen & Pliner, 2000;

MacNicol, Murray, & Austin, 2003; Pliner & Loewen, 1997; Steptoe, Pollard, & Wardle, 1995, respectively). Little systematic attention has been devoted to the impact of food experiences on food neophobia. However some studies have attempted to address the question, using different approaches.

Correlational studies, using FNS scores, indicated that neophobia was negatively related to the number of novel foods sampled (Koivisto & Sjöden, 1996, 1997; Raudenbush, Schroth, Reilly, & Frank, 1998), familiarity with specific novel foods (Pliner & Hobden, 1992; Tuorila, Lähteenmäki, Pohjalainen, & Lotti, 2001), familiarity with foreign cuisines (Pliner & Hobden, 1992) and multiple culinary training (Frank & Kalisewicz, 2000). Altogether, these results indicate modest but significant and repeated links between neophobia and food experiences. Although it is plausible that experiences with foods impact positively the willingness to try new foods, the direction of the causal arrow remains unclear: one could also argue that the more neophilic individuals tend to seek for more experiences with a wider variety of foods. Thus, experimental data were necessary to determine whether neophobia can be reduced by specific food experiences.

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In this vein, Pliner and her colleagues used a short term experimental paradigm (i.e. one day studies) to test the hypothesis that the reluctance to try new foods is underlined by the notion that new foods are unpalatable ('bad-tasting novel food schemas'). They exposed adults (Pliner, Pelchat, & Grabski, 1993) and children aged 7–9 or 10–12 (Loewen & Pliner, 1999) to multiple palatable novel or familiar foods. The prediction that only the novel good tasting condition will decrease the level of subsequent neophobia was confirmed for adults and older children, but not for younger children: their willingness to taste novel foods was only affected by the familiar-good tasting condition. The results of these two studies indicate a positive effect of prior exposure to multiple palatable foods on food neophobia: these foods have to be novel in the case of adults and old children, and familiar in the case of younger children.

The last category of studies, carried out on newborn rats (see for example, Capretta, Petersik, & Stewart, 1975) and on human babies (Gerrish & Mennella, 2001), used middle-term experimental design to evaluate the importance of early flavour variety to enhance later acceptance of new foods. Capretta et al. showed that weanling rats exposed to a variety of different flavoured waters for 12 days were more likely to accept a novel flavour than were rats exposed to a single flavour only. More recently, results from Gerrish and Mennella indicated that infants fed with different vegetables for 9 days ate significantly more of a novel food after the exposure period than before the exposure period, whereas infants fed to a single vegetable did not.

The experimental studies cited above lead finally to the conclusion that pre-exposure to multiple foods increases readiness to accept unfamiliar foods. This effect appears rather general in that it is seen in animals and humans ranging from infants to adults, and is effective in short- and middle-term protocols. However, these studies are in small number, and we do not know yet the conditions necessary to produce this decrease. It seems that the level of familiarity and palatability, as well as the number of foods proposed in the pre-exposure phase and in the test phase, play an important role in the phenomenon. Moreover, the impact of these different factors appears to depend upon age.

Our study provides data allowing to extend the experimental findings of Pliner et al. (1993), Loewen and Pliner (1999) as well as Gerrish and Mennella (2001) by filling gaps concerning the age of the participants, the duration and the nature of the multiple foods pre-exposure. A population of adolescents was observed in a longitudinal protocol in which the multiple food experiences are induced by a residential 9-months weight reduction program (WRP) for massively obese patients. Insofar the program is mainly focused on the proposition of a balanced diet, participants are encouraged to consume a wide variety of foods. So, compared to previous studies, the multiple food exposure is longer and more naturalistic. To evaluate its effectiveness, we assessed the subjects' preferences with the assumption that, because of the well-known exposure effect, the preference for new foods repeatedly served during the cure will increase. Provided that this assumption is satisfied, this

study will allow to test the hypothesis that food neophobia will decrease in the adolescents exposed to the WRP, as a major effect of multiple food exposure, whereas it should remain stable in a group of adolescents not submitted to the WRP.

Methods

Participants

Seventy-two massively obese adolescents (50 girls, 22 boys) mean age 14.7 years (10–17) were examined twice: at the beginning (T1) and at the end (T2) of a weight reduction program (WRP) they followed in 2001 and 2002 at the Margency Clinical Centre near Paris (France).

A sample of 51 control subjects (37 girls, 14 boys) was recruited in two secondary schools in the neighbourhoods of Margency, to form groups with comparable age ($t=0.04$, $p=0.96$) and sex ratio ($\chi^2=0.19$, $p=0.66$). Although demographic data were not collected, most adolescents within the area are known to be under the French median for income and education, which is reflected in our samples. Control subjects were also examined and tested twice, with a delay of 9 months corresponding to the mean duration of the stay of the WRP subjects (8.9 months \pm 3.8).

In both WRP and control subjects, the body height was measured to the nearest millimetre, using a portable stadiometer. The weight of each participant was measured, in light clothing, to the nearest 100 g, using a digital scale. The control sample included 27% overweight subjects (according to the international reference by Cole, Bellizzi, Flegal, and Dietz (2000), representing the current prevalence in the local population.

Design of the weight reduction program

The study was conducted at the Margency Clinical Centre where adolescents of both sexes stayed for 6 months to 1 year for a residential weight loss program. Participants eat all of their meals at the clinical centre during the week. All of them go back home for weekend and short vacations. So, depending on the duration of the cure, the number of meals consumed in the centre may vary but always exceeds 450.

The WRP combines a balanced diet, nutritional courses, and daily physical activities. A major goal is to allow adolescents to get used to a varied diet that meets national recommended allowances (RDAs) for adolescents of the same age. The energy content assigned is based on the French daily recommended allowances for adolescents of the same age and sex with low physical activity level. Patients are served four meals per day. Breakfasts include fruit or fruit juice, cereal (i.e. cornflakes), bread or rusk with butter and marmalade, milk (0 or 20% fat) or dairy products (yoghurt—plain or with fruits-, white cheese 0 or 20% fat), and a hot drink (tea, coffee, or chocolate). A free choice is allowed every day. Lunches and dinners include a starter (a vegetable served with two tea spoons of a French dressing, or a soup), a main course (alternatively starchy foods or vegetables with varied meat, fish or eggs), a dairy food (several varieties of cheese or yoghurt or white

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