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Research Report

Taste acuity of obese adolescents and changes in food neophobia and food preferences during a weight reduction session

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Abstract

The relationship between taste acuity and food neophobia, food familiarity and liking has been studied in the context of a residential weight reduction session (WRS; mean duration: 10 months) in 39 obese adolescents. Taste acuity was assessed using recognition thresholds for sucrose, citric acid, sodium chloride and 6-*n* propylthiouracil (PROP) and supra-threshold perceived intensities for sucrose, sodium chloride and PROP. Food neophobia was assessed by using the food neophobia scale at the beginning and at the end of the WRS. At these time points we used also a food familiarity and liking questionnaire to assess changes in food familiarity and likes or dislikes for different food categories. Taste acuity appeared to mediate behavioural food-related changes during the WRS. High taste acuity was associated with limited reductions in food neophobia; less sensitive subjects showed greater increases in the acceptability of healthy foods, especially fruits and vegetables. Therefore, taste perception (and particularly PROP perception) appears to be a predictor of the magnitude of food-related behavioural change achieved during a WRS.

Keywords: Taste recognition threshold; Taste perceived intensity; PROP; Obesity; Adolescent; Weight reduction program; Neophobia; Food liking; Fruits and vegetables

Introduction

It has been suggested that taste sensitivity is related to food neophobia (the reluctance to taste novel foods). Carter et al. (2000) observed an association with the genetically determined sensitivity to the bitter tasting substance phenylthiocarbamide (PTC), with food neophobic subjects exhibiting greater sensitivity than neophilic ones. In the same vein, some of us (Pasquet, Oberti, El Ati, & Hladik, 2002) reported that adult subjects significantly differ in food preferences as a function of PROP (6-*n* propylthiouracil) sensitivity; the subjects with the highest sensitivity used a limited set of foods and were assumed to have difficulties overcoming an inherent food neophobia. In addition to sensory factors, it has been proposed that body weight, among other physiological factors, could be related to food neophobia (Raudenbush, Corley, Flower, Kozlowski, & Meyer, 2003).

We recently reported (Rigal et al., 2006) that in obese adolescents the food repertoire and preferences for some food categories, such as fruits and vegetables, breakfast foods or calorie-reduced foods, can be significantly increased as a result of an educational program during a residential weight reduction session (WRS). During such a session, the food neophobia score, as evaluated by the food neophobia scale (FNS; Pliner & Hobden, 1992), also decreases with exposure to a food variety wider than that obese adolescents may usually obtain at home. Nevertheless, neophobia appears to be an individual

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temperament trait whose expression changes little throughout the lifetime. To what extent could taste perception mediate the dynamics of such attitudinal changes induced by a change in dietary experience?

In this communication, we present the results of a study of the relationship between taste acuity and changes in behavioural traits vis-à-vis food during this WRS.

Subjects and methods

Study context and ethics

The study was carried out at the Margency Clinical Centre, near Paris (France), where massively obese adolescents stayed for the WRS. Together with their school training, they followed an educational program combining a balanced diet that included a wide variety of foods, nutritional lectures and daily physical activities, with the goal of substantially reducing their excess body weight. Details on WRS and results concerning food neophobia in adolescents tested in 2000 and 2001 ($n = 72$) are presented in Rigal et al. (2006). In the present study, we consider exclusively the 39 subjects followed in 2001, in whom taste acuity was assessed. Measurements were carried out at the beginning (T1) and before the end (T2) of the WRS, with a mean time interval of 10.4 ± 4.4 months between T1 and T2.

This study was conducted in accordance with the Helsinki II declaration. Oral consent was required for all subjects after the parents were informed of our goals and methods, and a consent form was signed by all subjects and/or their parents.

Participants

Adolescents of both sexes participated, 28 girls and 11 boys, aged 10.5–17.5 years (mean 14.7 years). All girls were post-menarcheal, whereas among boys, four were sexually mature, following stages for genital and pubic development (Tanner, 1962). Mean body mass index (BMI) was 39.5 kg/m^2 (ranging from 30.9 to 51.6) at T1 and 29.7 kg/m^2 (ranging from 22.1 to 42.1) at T2. BMI for age was expressed in terms of Z-scores using the sex-specific CDC BMI for age reference curves (Centre for Disease Control, 2000). The figures are 2.47 (ranging from 2.02 to 2.99) at T1, and 1.75 (ranging from 0.48 to 2.59) at T2.

Most adolescents under investigation were members of families with a low income relative to the French average. All attended secondary school.

Measurement of taste acuity

Taste acuity was assessed via taste recognition thresholds and supra-threshold perceived intensity ratings.

Recognition thresholds

Determination of taste recognition thresholds was carried out using series of four pure chemicals in solution in a commercial drinking water selected for its low mineral content. Sucrose (10 solutions: 2.0–1000 mM) and citric acid (8 solutions: 0.20–25 mM) were diluted in binary step series (0.3 log-step), whereas the solution series of sodium chloride (12 solutions: 1.77–1000 mM) and PROP (6-*n* prophylthiouracyl) (15 solutions: 0.001–3.2 mM) were created using 0.25 log-steps. The testing procedure was the staircase-method modified from Cornsweet (1962) as follows: each subject was first informed of the taste categories he or she could be faced with (water, salty, sweet, bitter or acid). The four series of solutions were presented one after another, in a random order to which the subject was blind. Within each series, the solutions were presented in order of ascending concentrations, and sipped by the assessor from a 2-ml plastic teaspoon. They were not swallowed, and the mouth was rinsed between solutions with the same water as was used to prepare the test solutions. The assessor had to correctly name the taste in each series. Once the taste of two successive concentrations was recognised successfully, the subject was given the highest previously unrecognised concentration (first reversal). This up-and-down procedure was performed twice until the taste of two increasing stimuli was correctly named. The actual recognition threshold was calculated as the mean of the lowest concentrations recognised in each ascending run (Pasquet, Monneuse, Simmen, Marez, & Hladik, 2006).

Supra-threshold perceived intensities

Two series of four solutions of sodium chloride (32, 100, 320 and 1000 mM), two series of four sucrose solutions (121, 242, 485 and 970 mM), and two series of four PROP solutions (0.1, 0.32, 1.0 and 3.2 mM) were provided in a random order, with two water rinses between each trial (citric acid was not tested). The perceived intensity of each solution was marked by the subject on a nine-point scale labelled at the extremities with no taste [1] and extremely intense taste [9], and the intensity values obtained for the four concentrations of each taste were then added; thus, the possible range for these scores was 8–72. According to these scores, the study sample was divided into three groups of increasing taste perceived intensity, for each tested substance.

Global taste acuity score

We determined an individual global taste acuity score (GTAS) by grouping threshold data for each tested substance into terciles and attributing, respectively, score 3, 2, and 1, for the first, the second and the third tercile. The GTAS was then calculated as the sum of the score values. Thus, in contrast to threshold concentrations, lower GTAS scores reflect poorer taste acuity. The study sample was also divided into three groups of increasing GTAS.