Taste and Smell Perception in Depression

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Introduction

In addition to the disorders of appetite, weight maintenance, or hyperphagia encountered in depressive illness (Hopkinson 1981), some depressed patients may also complain specifically of a diminished ability to taste and to enjoy food, and some report a craving for sweets (Steiner et al. 1969; Harris et al. 1984). Steiner et al. (1969) long ago reported that sucrose taste recognition thresholds were significantly elevated in depressives. We undertook to repeat these observations, and because complaints of taste alteration sometimes arise from olfactory deficiency (cf., Doty and Kimmelman 1986), we also studied smell perception.

Experiment 1: Sucrose Taste Perception

Methods

Subjects. Taste intensity and pleasantness ratings were obtained from 36 depressed patients [17 men with a mean age (±sd) of 47 ± 14

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years and 19 women with a mean age of 41 ± 14 years. All patients met DSM-III criteria for major depressive disorder (MDD), with or without melancholic features, or atypical (bipolar II) depressive disorder, and had moderate to severe depression as indicated by the 21-item Hamilton Depression Rating Scale (HDRS) (Hamilton 1960), with scores ranging from 18 to 37. Patients were in good health and were free of major medical illness and had no clinically significant laboratory abnormalities. Nineteen healthy volunteers (9 men with a mean age of 42 ± 16 years and 10 women with a mean age of 33 ± 12 years), with no personal or family history of major psychiatric disorder, served as control subjects.

Procedures. A 100-mm visual analog scale was used to rate the perceived intensity and pleasantness of seven concentrations of sucrose dissolved in deionized water (0.038, 0.075, 0.15, 0.30, 0.60, 1.2, and 2.4 M), as well as deionized water alone. The intensity scale was anchored at its left and right extremes by the words “extremely weak taste” and “extremely strong taste,” respectively. The pleasantness scale was similarly anchored with the terms “like extremely” on the left and “dislike extremely” on the right. Before rating each taste stimulus, the subject rinsed his/her mouth with deionized water. Subsequently, a 10-ml aliquot of a given taste solution was sipped from a 30-ml plastic cup and orally swished. Following expectoration, the subject rated the intensity and pleasantness of the solutions by placing a vertical line across the 100-mm scale (horizontal line) at the point representing his/her perception of each of these dimensions of the stimulus. The eight stimuli were presented three times, and the means of the three ratings were used for analysis.

Results

Intensity Ratings. The taste intensity ratings were initially analyzed with a three-way Analysis of Covariance, with age as the covariate and gender, subject group (depressed, controls), and stimulus concentration (water and 7 sucrose concentrations) as factors. Depressed and control subjects gave similar ratings to water as well as to the lower sucrose concentrations, whereas patients gave lower intensity ratings than controls to the higher sucrose concentrations, resulting in a significant concentration-by-group interaction effect \( F_{7,364} = 8.65, \text{Huynh-Feldt probability}(p_{HF}) < 0.0001 \) (Figure 1). Overall, depressed patients rated the stimuli as less intense than the controls \( (F_{1,52} = 6.22, p < 0.02) \).

As the depressed patients were a heterogeneous group with respect to various clinical variables, we examined the responses of the two categories of patients for which adequate numbers were available. These were 13 unipolar melancholic and 12 unipolar nonmelancholic patients who were medication-free for at least 7 days preceding testing. A comparison of the nonmelancholic and control groups yielded a significant concentration-by-group effect \( F_{7,196} = 7.64, p_{HF} < 0.0001 \), in which nonmelancholic patients gave lower intensity ratings at higher sucrose concentrations (Figure 2). Overall, the nonmelancholic patients gave lower mean intensity ratings than did controls \( (F_{1,28} = 15.69, p < 0.001) \). Similar results were obtained when the melancholic patients and controls were compared. There was a significant concentration-by-group effect \( F_{7,203} = 5.21, p_{HF} < 0.0001 \), in which melancholic patients gave lower intensity ratings at higher sucrose concentrations compared to controls. Overall, the melancholic patients tended to give lower mean intensity ratings than did controls \( (F_{1,29} = 2.95, p < 0.10) \). Finally, comparisons of melancholic and nonmelancholic patients indicated that there were no significant group \( (F_{1,22} = 1.38, p = 0.25) \) or group-by-concentration effects \( (F_{7,154} = 1.10, p_{HF} = 0.35) \).

Pleasantness Ratings. Overall, depressed patients rated the stimuli as more pleasant than controls \( (F_{1,52} = 4.08, p < 0.05) \). Depressed and control subjects gave similar pleasantness ratings to water and to the lower sucrose concentrations, whereas the patients tended to give
higher pleasantness ratings than did controls to the higher sucrose concentrations ($F_{7,364} = 2.81, p_{HF} < 0.10$) (Figure 3). When depressive subgroups were analyzed, nonmelancholic patients rated the stimuli as more pleasant than did control subjects ($F_{1,28} = 6.85, p < 0.02$) (Figure 4) and tended to rate the stimuli as more pleasant than did melancholic patients ($F_{1,22} = 3.10, p < 0.10$). There was no difference between melancholic patients and controls ($F_{1,29} = 0.47, p = 0.50$).

Experiment 2: Odor Identification

Methods

Subjects. The University of Pennsylvania Smell Identification Test (UPSIT) was administered to 51 depressed patients (17 men with a mean age of 49 $\pm$ 14 years and 34 women with a mean age of 43 $\pm$ 13 years). All patients met the same criteria described in Experiment 1. Fifty-one normal, healthy volunteers, matched to each patient on the basis of gender, age, eth-
nic background, and smoking habits, were randomly selected from a database consisting of more than 5000 subjects who have completed the UPSIT (Doty et al. 1984a).

Procedures. The UPSIT (Sensorics, Inc., Haddonfield, NJ) was self-administered following an initial demonstration. This test is a four-alternative, forced-choice, odor recognition test consisting of 40 “scratch and sniff” odorants (Doty et al. 1984a,b). Scores on this test correlate highly with traditional detection threshold values and are thus sensitive to alterations in both the ability to identify and to detect odorants (Doty et al. 1984b).

Results

The UPSIT test scores of patients and controls were initially analyzed with a two-way Analysis of Covariance, with age as the covariate and gender and subject group (depressed, controls) as factors. Depressed and controls did not differ significantly ($F_{1.97} = 0.70, p = 0.41$), and a subsequent analysis showed no significant effect of melancholic/nonmelancholic subtype ($F_{1.43} = 0.04, p = 0.85$).

Discussion

The present study found that suprathreshold measures of sucrose taste intensity and pleasantness were altered in some patients with MDD compared to healthy volunteers. This finding extends the previous observation of higher recognition thresholds for sucrose in depressed patients compared to nondepressed psychiatric controls (Steiner et al. 1969). In addition, our data showed that the subtype of MDD also influenced sucrose pleasantness ratings, as the nonmelancholic, but not the melancholic, patients rated the stimuli as more pleasant than controls. Furthermore, olfactory testing indicated that depressive illness was not characterized by an alteration in odor identification ability.

One possible explanation for the altered taste intensity perception for sucrose may be the subcarbohydrate intolerance observed in some depressed patients (Wright et al. 1978; Winokur et al. 1985). Although this hypothesis remains to be tested, altered taste sensitivity for some sugars has also been reported in diabetics and their first-degree relatives (Settle 1981, 1986).

Up to 15% of depressed patients show increased appetite and weight gain (Paykel 1977; Mezzich and Raab 1980). Increased appetite is associated with the nonmelancholic subtype of MDD (Davidson and Turnbull 1986), and sweet cravings correlate strongly with increased appetite (Harris et al. 1984). This may explain why nonmelancholic patients rated the sucrose solutions as more pleasant than control subjects.

In summary, both melancholic and nonmelancholic patients rated the higher sucrose concentrations as significantly less intense than controls, and nonmelancholics rated the stimuli significantly more pleasant than controls, whereas melancholics did not differ from controls in their pleasantness ratings. This indicates that differences among the subject groups cannot be attributed entirely to differences in “scaling” behavior per se. In addition, this pattern of results suggests that differences in perceived pleasantness are not solely dependent on differences in intensity perception.

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References


