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Assessment of Fat Taste in Individuals With and Without Anorexia Nervosa

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Abstract

Objective—Avoidance of dietary fat is a highly characteristic eating behavior of individuals with Anorexia Nervosa (AN). To date, no study has determined whether these individuals are better able to perceive the fat content of foods than individuals without AN. The goal of this study was to compare blinded taste ratings of fat free, low fat, and regular cream cheese in patients with AN and in normal controls (NC).

Methods—AN (n=25) and control (NC; n=25) participants were presented with a series of nine cream cheese samples of three differing fat contents and asked to taste and rate each sample from very low to very high fat.

Results—Repeated measures ANOVA found no significant main effect of fat content and no interaction between fat content and diagnosis; however, a significant three-way interaction between fat content, diagnosis, and trial was observed. Post-hoc analysis revealed a significant fat content by trial interaction within the AN group, suggesting a significant trial effect for the fat free samples only with improving ability to detect fat-free samples over repeated trials.

Conclusions—The current study suggests that individuals with AN do not have a markedly greater ability to taste fat than NC, and that; therefore, fat avoidance is likely primarily based on cognitive factors.

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Disclosure of Conflicts

None of the authors have a conflict of interest, financial or otherwise, related to this study or the submitted manuscript.

Keywords

Anorexia nervosa; eating behavior; fat taste

Patients with Anorexia Nervosa (AN) characteristically restrict their intake of dietary fat (1, 2) and generally report a decreased preference for high fat foods (3). During inpatient treatment, patients are typically provided with a balanced diet that includes fat containing foods; nevertheless, these individuals tend to revert to fat restricted diets after weight restoration (4).

The taste of fat has been proposed as the sixth primary taste (5, 6). To our knowledge, no study has determined whether patients with AN are better able to taste fat in foods than people without an eating disorder. The specific aim of this study was to compare blinded ratings of the fat content of fat free, low fat, and regular cream cheese in patients with AN and in normal controls (NC). We hypothesized that the AN group would rate the fat content of differing cream cheese types more accurately than the NC control group.

METHODS

Participants

Patients meeting the *Diagnostic and Statistical Manual of Mental Disorders, 5th edition* (7) criteria for AN, and healthy normal controls, were recruited to participate in a laboratory study conducted by the Eating Disorders Research Unit at the NYSPi, Columbia University Medical Center from May 2011 to February 2013. All participants with AN were female inpatients between the ages of 18 and 45 years. Controls were matched on gender, with a BMI in the range of 19–25 kg/m². Exclusion criteria included current cigarette smoking greater than one pack per day, lactose intolerance, and milk allergy. The New York State Psychiatric Institute (NYSPi)/Columbia University Department of Psychiatry Institutional Review Board approved this study. Written informed consent was obtained from participants prior to study.

Taste Test

The taste test consisted of three trials. Each trial contained a 0.3 g sample of three types of Philadelphia™ brand cream cheese: fat free, low fat, and regular (0, 6, and 9 g fat per wt. oz. respectively); the order of cream cheese types was randomized within each trial. A total of nine samples were presented on small white plastic spoons, side-by-side, on a platter. A pitcher of spring water and a drinking cup were provided. Participants were instructed as follows: “Today you will be asked to taste and rate nine cream cheese samples of varying fat content. Please begin on the left and taste samples one through nine in the order presented. For each sample, place the entire sample in your mouth. Leave the sample in your mouth as long as necessary to rate its fat content. Rate the sample on the designated line scale anywhere from “very low fat” to “very high fat.” Swallow the sample. Thoroughly rinse and spit with spring water before tasting the next sample.” Studies were conducted two hours after lunch, at approximately 3 p.m.

Instruments

A 150 mm visual analogue scale (VAS) rating of fat content, anchored by “very low fat” on the left and “very high fat” on the right, was completed by the participant immediately after tasting each of the nine cream cheese sample. Upon completion of the taste test, participants were queried regarding their perceived accuracy of fat taste ratings.

Statistical Analyses

The primary analysis consisted of an analysis of variance (ANOVA) of VAS ratings of fat content with two within-subjects factors (cream cheese 0 [1, 2, 3]) and one between-subjects factor (diagnosis). To further explore these findings, a secondary (*post-hoc*) ANOVA with two within-subjects factors (cream cheese type and trial) was conducted separately for the AN and NC groups. Finally, three one-way models were constructed for each cream cheese type to examine the effect of trial in the AN group only. Due to their exploratory nature, secondary analyses were not adjusted for multiple comparisons.

The mean and standard deviation (SD) were determined for clinical characteristics and VAS ratings of perceived fat content. Mean and standard error of the mean (SEM) were determined for data presented in graphs. The independent samples (Student's) *t*-test was used to compare differences between the groups; *t*-tests were two-tailed. Statistical significance was set at the $p < 0.05$ level. Statistical analyses were performed by using SPSS for WINDOWS software (version 17.0, 2008; SPSS Inc., Chicago, IL).

RESULTS

Participant characteristics

Fifty participants completed the study. The AN group ($n=25$; 9 restricting and 16 binge-purge type) included two Hispanic and 23 Caucasian participants. The NC participants ($n=25$) were all Caucasian. Because a statistically significant ($p < 0.05$) difference in the mean age of AN (27.2 ± 7.8 yrs.) and NC (23.3 ± 3.5 yrs.) participants was observed, ANOVA was conducted with age as a covariate. No significant effect of age was found ($F[1,48]=0.361$, $p > 0.05$) and age was removed from the statistical model and all subsequent analyses. As expected, mean BMI also differed significantly between the AN and NC groups (17.3 ± 2.0 and 21.1 ± 1.6 respectively, $p < 0.001$).

Taste Test

Mean VAS ratings of fat content by AN and NC participants are illustrated in Figure 1. There was no significant (ns) main effect of fat content ($F[2,96]=2.506$, $p > 0.05$) but a significant main effect of trial ($F[2,96]=3.549$, $p < 0.05$) was observed. However, while ns interactions were found between diagnosis and trial ($F[2,96]=0.393$, $p > 0.05$), diagnosis and fat content ($F[2,96]=0.254$, $p > 0.05$), and fat content by trial ($F[4,192]=1.852$, $p > 0.05$), a significant three-way interaction between fat content, trial, and diagnosis ($F[4,192]=2.81$, $p < 0.05$) was observed. To explore this interaction, a *post hoc* analysis of fat content and trial was conducted separately within the AN and NC groups. In the NC group, there was no effect of fat content ($F[2,48]=0.794$, $p > 0.05$) or trial ($F[2,48]=0.837$, $p > 0.05$), nor was the fat content by trial interaction ($F[4,96]=1.637$, $p > 0.05$) significant. In contrast, a significant interaction between fat content and trial ($F[4,96]=3.073$, $p < 0.05$) was found in the AN group. Upon further exploration, a significant trial effect was observed in AN patients for the fat free samples ($F(2,48)=5.464$, $p < 0.01$) suggesting that individuals with AN improved in their ability to identify a fat free food over multiple trials. A similar finding was not observed for the low fat ($F[2,48]=1.331$, $p > 0.05$) or the regular fat ($F[2,48]=2.64$, $p > 0.05$) cream cheese samples. To further explore the three-way interaction found in our primary analysis, an additional ANOVA was conducted to compare fat content and trial between AN restricting and binge-purge subtypes. Although a significant fat by trial interaction remained, the absence of a fat by trial by diagnostic group interaction suggests that AN subtype did not influence ability to assess fat content (data not shown).

DISCUSSION

Individuals with AN persistently avoid dietary fat. The purpose of this study was to test the hypothesis that, when compared to healthy individuals, patients with AN have an enhanced ability to distinguish between high fat and low fat foods. Results of our primary analysis, however, failed to support this hypothesis.

Post-hoc findings suggest that with repeated exposure (i.e., over three trials), AN patients' ratings of the fat free cream cheese improved. Reasons for this are unclear, but it is conceivable that personal experience with fat free products made it easier for these individuals to recognize some taste or sensory characteristic associated with a fat free food. Of note, despite improved accuracy over the trials, the AN group still rated the presence of fat in fat free cream cheese samples. Furthermore, AN participants performed no better than controls when it came to rating the fat content of regular and low fat cream cheese samples.

Limitations

The ability to detect and gauge the concentration of fats in foods and beverages is influenced by appearance, tactile, olfactory, and taste cues (5, 6). Several approaches have been used to assess human fat perception; however, there is presently no universally accepted method (8). Also using a cream cheese taste test, Mattes (9) conducted a sensory discrimination study in healthy young adults and reported that participants could not distinguish between fat free and regular types when knowledge of fat content was withheld. In contrast, a fat taste discrimination test using salad dressings of differing fat contents was able to classify healthy adult participants as fat taste discriminators or non-discriminators (8). Tactile properties of fats include lubricity, viscosity, greasiness, oiliness, and creaminess (5). In the current study, we used a creamy textured food that was remarkably similar across differing fat contents. The use of a food (e.g., salad dressing) with tactile properties (e.g. liquid and oily) that are less readily masked across fat content may have yielded different findings.

Similar to Mattes' (9) study, our participants had to rely on sensory cues in the absence of cognitive cues, like a nutrition facts labels or ingredients list, to assess fat content of the cream cheese samples. Individuals with AN frequently endorse the avoidance of high fat foods. While specialized instruments, like the Eating Disorder Recovery Self-Efficacy Questionnaire (10) and the Yale-Brown-Cornell Eating Disorder Symptom Checklist (11) can be used to assess concerns about the fat content of foods, to our knowledge there are no published studies that document the extent to which food labels, or similar cognitive cues, vs. taste, are used to categorize foods as either high fat or low fat in individuals with AN.

Conclusion

The current study, while limited, suggests that individuals with AN do not have a markedly greater ability to taste fat than NC, and that; therefore, fat avoidance is likely primarily based on cognitive factors.

Acknowledgments

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All values are mean $\pm$ SEM

Figure 1.

Visual analogue ratings (VAS) of the fat content of fat free, low fat, and regular cream cheese across three trials in individuals with anorexia nervosa (AN) compared to normal control (NC) participants.