Available online at www.sciencedirect.com
ScienceDirect
Journal of Psychiatric Research 43 (2009) 129–137
JOURNAL OF PSYCHIATRIC RESEARCH
www.elsevier.com/locate/jpsychires

Gustatory and olfactory sensitivity in patients with anorexia and bulimia in the course of treatment

Katja Aschenbrenner [a,b,c,d,*], Ninette Scholze [a], Peter Joraschky [a], Thomas Hummel [b]

[a] Department for Psychosomatic Medicine, University of Dresden Medical School, Fetscherstraße 74, 01307 Dresden, Germany
[b] Smell and Taste Clinic, Department of Otorhinolaryngology, University of Dresden Medical School, Fetscherstraße 74, 01307 Dresden, Germany
[c] Affective Sensory Neuroscience Laboratory, The John B. Pierce Laboratory, 290 Congress Avenue, New Haven, CT 06519, USA
[d] Department of Psychiatry, Yale University School of Medicine, New Haven, CT 06519, USA

Received 7 November 2007; received in revised form 26 February 2008; accepted 4 March 2008

Abstract

Background: The majority of studies on taste and smell in eating disorders have revealed several alterations of olfactory or gustatory functions. Aim of this prospective study was to employ detailed olfactory and gustatory testing in female subjects of three homogenous groups – anorexia nervosa, bulimia nervosa and healthy controls – and to look at the effects of treatment on these measures.
Methods: Sixteen hospitalized female patients with anorexia (restricting type, mean age [M] = 24.5 years), 24 female patients with bulimia (purging type, $M = 24.3$ years) as well as 23 healthy controls ($M = 24.5$ years) received olfactory (''Sniffin' Sticks'') and gustatory testing (''Taste Strips''). Group differences in olfactory and gustatory sensitivity, body mass index (BMI), the Beck depression inventory, the eating attitudes test (EAT), and the influence of therapy on gustatory and olfactory function were investigated.
Results: (**1**) Group differences were present for odor discrimination and overall olfactory function with anorexic patients having the lowest scores. (**2**) Regarding taste function, controls scored higher than patients with anorexia. (**3**) At admission small but significant correlations were found between overall olfactory function and body weight ($r_{63} = 0.35$), BMI ($r_{63} = 0.37$), and EAT score ($r_{63} = -0.27$). Similarly, (**4**) the taste test score correlated significantly with body weight ($r_{63} = 0.48$), and BMI ($r_{63} = 0.45$). Finally, (**5**) at discharge overall olfactory and gustatory function were significantly higher compared to admission in anorexic patients.
Conclusions: As compared to healthy controls and bulimic patients our results show lowered olfactory and gustatory sensitivities in anorexic patients that improved with increasing BMI and decreasing eating pathology in the course of treatment.

Keywords: Anorexia; Bulimia; Olfactory sensitivity; Gustatory sensitivity; Body mass index; Taste; Smell; Weight; Starvation

1. Introduction

Eating disorders are severe chronic diseases (Fichter et al., 2006). Treatment turns out to be extremely difficult (Halmi et al., 2005). In anorexia nervosa we find the highest mortality rate of all psychiatric disorders with up to 20% (Neumärker, 1997; Patton, 1988; Sullivan, 1995; Vitiello and Lederhendler, 2000). Although the exact etiology of anorexia and bulimia remains unknown until today many studies provide evidence that biological, genetic, sociocultural, psychological as well as personal factors play an important role in the development and maintenance of eating disorders (Bulik et al., 2005; Bulik et al., 2006). Both anorexia and bulimia nervosa mainly occur in adolescent girls and young adult women. Anorexia nervosa has an average prevalence of 0.3% and is characterized by a persistent pursuit of extreme thinness and morbid fear of fatness, accompanied by a distorted body perception (Hoek and van Hoeken, 2003). Patients refuse to eat, loose extreme

* Corresponding author. Address: Affective Sensory Neuroscience Laboratory, The John B. Pierce Laboratory, 290 Congress Avenue, New Haven, CT 06519, USA. Tel.: +1 203 562 9901; fax: +1 203 624 4950.
E-mail address: kaschenbrenner@jbpierce.org (K. Aschenbrenner).

0022-3956/$ - see front matter © 2008 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jpsychires.2008.03.003

amounts of weight and show all the somatic consequences of severe malnutrition (Fairburn and Harrison, 2003; Halmi and Falk, 1981; Weiner, 1985). Bulimia nervosa has a prevalence of 1% in young women and is an eating disorder in which the subject engages in recurrent binge eating followed by intentional purging (Hoek and van Hoeken, 2003). The reason for purging is to compensate for the excessive intake of food and typically takes the form of vomiting, inappropriate use of laxatives, excessive exercise or fasting (Fairburn and Harrison, 2003; Johnson et al., 1984; Russell, 1979). Bulimic patients are mostly of normal weight or overweight. Considering disturbed eating patterns in both eating disorders as well as the more as difficult re-feeding/weight gain procedures in patients with anorexia nervosa it is of importance to investigate olfactory and gustatory functions in these patients as efforts to better understand underlying pathophysiology and to improve therapeutic approaches.

2. Olfactory function and eating disorders

Very few studies have investigated olfactory function in eating disorders. LeGoff et al. (1988) examined the salivary response to olfactory food stimuli in patients with anorexia, bulimia, and healthy controls ($n = 6$ per group). Before treatment, anorexics salivated less than controls while bulimics salivated more than controls. Following treatment, the salivary response of eating disordered subjects was much closer to controls. In another study (Kopala et al., 1995) the ability to identify odors was investigated in 27 female hospitalized patients with anorexia nervosa and 50 female healthy controls using the University of Pennsylvania Smell Identification Test (UPSIT) (Doty et al., 1984). It was found that even patients with severe eating disorders had an intact olfactory function. On the other hand, Fedoroff et al. (1995), who as well used the UPSIT (15 bulimic, 25 anorexic restricting, 15 anorexic bulimic patients, 16 controls), discovered that very low-weight anorexics showed impairments as for the identification and detection of odors. This did not improve at discharge despite significant weight gain. In another study (Roessner et al., 2005) the "Sniffin' Sticks" Test Battery (Hummel et al., 1997) was used in female anorexic patients. Other than the UPSIT this technique also includes tests for odor thresholds and odor discrimination, as well as odor identification. Anorexic patients ($n = 17$) showed deficits of their olfactory sensitivity which were found to be improved at discharge ($n = 6$). The authors suggested flavor enhancers as a therapeutic strategy in anorexia to increase food intake. Due to diverse methodological approaches and low numbers of subjects, especially at discharge in longitudinal designs, the findings of the above cited studies on olfactory sensitivity and eating disorders are not consistent. Previous results reveal that when detailed olfactory testing was applied anorexic patients were more likely to display deficits of their olfactory function that were eventually reversible with weight restoration.

3. Gustatory function and eating disorders

Considering previous work on taste in eating disorders there are studies investigating hedonic, food or taste preferences, studies on gustatory function or sensitivity and there are studies on brain response to taste (results below are reported in the mentioned order).

Drewnowski et al. (1987, 1988) found that eating disordered subjects did not differ from healthy controls ($n = 16$) as for their sensory estimates of sweetness and fat content of different stimuli. But, both, anorexics (12 anorectic restrictors and 13 anorectic bulimics) and bulimics ($n = 7$) preferred sweeter stimuli and anorexics disliked high fat stimuli. The findings did not change in relation to weight gain. Sunday and Halmi (1990) found as well that eating disordered patients showed an aversion to high fat solutions in comparison to healthy control subjects. Anorectic restrictors demonstrated an aversion to all solutions which contained no sugar. This again was independent from weight restoration and suggests these hedonic profiles to be trait characteristics of anorexia nervosa. In a study of Franko et al. (1994) patients with narrowly defined bulimia nervosa ($n = 15$) showed significantly higher pleasantness ratings for 40% sucrose solutions than controls ($n = 20$) and patients with bulimia that had a history of anorexia nervosa ($n = 5$). Garfinkel et al. (1978) investigated 26 anorexic patients and 16 normal controls towards their body image and the development of a satiety-aversion to sucrose tastes. It was shown that an overestimation of body size was closely related to the failure of developing an aversion to sucrose tastes in anorexic patients.

Casper et al. (1980) evaluated taste function in anorexia nervosa ($n = 30$) using four different taste qualities in five different concentrations to determine the detection and the recognition threshold. Anorexic patients showed hypogeusia with bitter and sour taste being most and sweet least affected. A re-test of seven anorexics at discharge showed a slight improvement but taste function and sensitivity were still subnormal. Another study (Nakai et al., 1987) revealed that 20 of 23 anorexia patients and 11 of 13 bulimic patients showed hypogeusia and further, 12 anorexic and 8 bulimic patients displayed dysgeusia, when examined by a filter paper disc method measuring sensitivity to the four taste qualities. Seven anorexic patients were restudied when treatment produced a weight gain of more than 85% of normal body weight revealing that taste function had improved substantially but was still subnormal. Similarly, Nozoe et al. (1996) investigated taste responsiveness with the same filter paper disc method and found that gustatory sensitivity in nine patients with anorexia was lower at admission in comparison to controls but improved significantly over inpatient treatment. Interestingly, no significant correlation was found between weight gain and improvement of taste responsiveness but those patients who reached to eat 1600 kcal/day earlier showed more rapid improvements of their gustatory function. The results of a study of Jirik-Babb and Katz (1988) showed that there