

Sweet and fat taste preference in obesity have different associations with personality and eating behavior

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Abstract

The aim of this study was to test associations between self-reported attitudes of sweet and fat taste preferences and psychological constructs of eating behavior and personality in obesity. Sixty obese patients were included. The Three Factor Eating Questionnaire was used for the assessment of psychological constructs of eating behavior, and the Swedish universities Scales of Personality was used for measuring personality traits. A strong sweet taste preference was associated with more neurotic personality traits ($P=.003$), in particular lack of assertiveness ($P=.001$) and embitterment ($P=.002$). Strong fat taste preference was rather related to lower levels of the eating characteristic cognitive restraint ($P=.017$), implying less attempts to restrict and control food intake. Whereas strong sweet taste preference was linked to a personality style in obesity, strong fat preference could be more an aspect of eating behavior. A psychobiological stress model is discussed in relation to the results on sweet preference and hampered personality functioning.

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1. Introduction

Sweet and fat preference in relation to psychological constructs of eating behaviors and personality can illuminate who has a particular likeability for these tastes. Such information on individual patterns in taste preference has an obvious interest in obesity, as the taste preference for palatable foods contributes to the fast growing obesity epidemic [1].

The associations between taste preferences and psychological variables have not been well mapped. In one of the sparse studies on personality and taste preference that has been performed, a preference for salty as well as sweet taste was found in persons with higher neuroticism [2]. The literature search can be extended to a preference for more intense sweetness in experimental designs, as this measure has been suggested to be included in a construct of “sweet tooth” along with a more habitual liking of sweet foods [3]. Such a preference for more intense sweetness in experimental designs did not differ as a

function of the psychological eating construct cognitive restraint [4] but was associated with a more outgoing personality style [5].

Genes mediating the consumption of sweet foods have been suggested [6] and sweet liking has also been linked to alcoholism and a genetic vulnerability to alcoholism [6–8] suggesting a link between sweet taste and the reward system.

We found no studies on fat preference and personality. Higher cognitive restraint has been associated with higher preference ratings for the various combinations of fat and salt in popcorns tested in an experimental design [9]. However, the results were interpreted as a result of the cognitive beliefs with popcorn being considered as a low-fat alternative and thus a less “forbidden” food for a restrained eater, and therefore preferred in its various appearances.

In research on biological links to fat preference, higher levels of the satiety hormone leptin have been associated with a lower preference for fat [10]. In line with this finding, higher levels of the hunger hormone galanin have been associated with a preference for fat [11] and food deprivation increased the preference for fatty flavor over sweet taste in animal studies [12]. According to a review, genetic factors in the preference for

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fat are suggested [6], but environmental factors apart from the genetic have also been demonstrated [13].

We were interested in evaluating the psychological patterns in subjective taste preferences for sweet and fat. The subjective and habitual taste preference concept that we used implied a “liking” as well as “wanting”, as a drive for a specific substance can include both liking and wanting in a biopsychological theory [14]. According to this theory applied to drug craving a distinction between liking and wanting can also be considered, implying different actions of brain systems [15,16]. It is postulated that eventual sensitization of brain systems after repeated exposure will in particular mediate the subcomponent of reward that can be labeled as “wanting”. This theory has also been applied to sweet taste [17], aside from drugs. This would mean that a substance such as sugar can be craved, wanted and sought out, even if it is not considered as pleasurable anymore. Normally, however, liking and wanting go together [14].

A common psychological measure of eating behavior in obesity that could be of interest in relation to taste preference is the Three Factor Eating Questionnaire (TFEQ) [18], which measures cognitive restraint, disinhibited eating and hunger experience. A personality inventory covering personality traits of relevance in healthy as well as more psychopathological samples is the Swedish universities Scales of Personality (SSP) [19]. In prior research using the SSP in relation in obesity, the personality trait lack of assertiveness characterized obese patients with more problematic eating behaviors such as disinhibited eating [20].

Testing the dual aspects of fat and sugar preference can provide differentiating information on these taste preferences. Unique psychological profiles in sweet and fat preference respectively could distinguish these taste preferences from a psychological style that is rather more generally associated with a high appreciation of palatable food. Since body weight as well as gender can imply variations in eating behaviors and food selection [21–23] we will also test these variables in relation to the taste preferences.

2. Methods

2.1. Participants

The participants were 60 patients at the Obesity Unit, Karolinska University Hospital, in Stockholm. There were 44 women and 16 men, with a mean age of 43.5 ± 12.3 years ($m \pm SD$), and an age range of 20 to 65 years. The mean Body Mass Index (BMI) was 40.1 ± 5.4 kg/m², and ranged from 30 to 57 kg/m². The patients were accepted for and awaiting treatment interventions at the unit. All assessments were performed before start of treatment. The local Ethics Committee at the Karolinska Institute approved the study and the patients gave their informed consent to participate.

2.2. Instruments

Sweet preference: The preference for the taste of sweet and fat foods was assessed in structured interviews. The preference for sweet taste was clarified by phrasings such as the taste of sweet being considered important and preferred, and implied a

liking as well as wanting. The answers were categorized in the 3 answer alternatives: a strong preference for sweet taste, a more moderate liking of sweet taste and a dislike of sweet taste. A strong preference for sweet taste was usually accompanied by subjective experiences of a need for sweet foods in the daily life, and a sweet food “addiction” was often described. These patients typically reported need for sweets, chocolate, cookies, pastries, soft drinks etcetera. As only 4 patients reported dislike of sweet taste, the 3 answer alternatives were collapsed into the 2 categories: “a strong preference for sweet taste” and “no strong preference for sweet taste”.

Fat preference: The preference for fat was assessed in a similar way with three corresponding answer alternatives. Patients with a strong preference for fat often described difficulties resisting from the intake of fat, cutting down cream and butter in cooking, and a strong liking of foods like fried foods, fast foods high in fat, cheese, and processed meat like sausages. Low fat alternatives were not considered as tasty alternatives but implied too strong sacrifice of the taste that was considered important. As with sweet preference, a dislike of fat taste was uncommon and reported by only 3 patients. These answer alternatives were therefore also collapsed into 2 categories: “a strong preference for fat taste” and “no strong preference for fat taste”.

The Three Factor Eating Questionnaire (TFEQ) [18] was used to measure eating behavior. The TFEQ consists of 51 items that form the three subscales Cognitive restraint, Disinhibition and Hunger experience. Cognitive restraint over eating implies attempts to resist from eating by conscious determination in order to control body weight. Disinhibited eating shows difficulties in the regulation of food intake and Hunger experience measures the subjective experience of hunger. The psychometric properties including reliability and internal consistency for the TFEQ have been reported by Stunkard and Messick [18]. The TFEQ was completed by 48 of the patients in the prevailing sample. The reason for this data dropping was that the TFEQ was administered only to the patients assigned to a clinical trial.

The Swedish universities Scales of Personality (SSP) [19] was used to assess personality traits. The SSP is a revised and shortened version of the Karolinska Scales of Personality (KSP) [24] with improvements in psychometric quality such as face validity, internal consistency and response differentiation [19]. The SSP comprises 91 items that form 13 different personality scales. The 13 scales further cluster in three main trait factors: Neuroticism, Aggression and Extraversion, according to a factor analysis. The SSP scales constituting the Neuroticism factor are Somatic trait anxiety, Psychic trait anxiety, Stress susceptibility, Lack of assertiveness, Embitterment and Mistrust. The Extraversion factor consists of Impulsiveness, Adventure seeking and Detachment (reversed), and the Aggression factor of Social Desirability (reversed), Trait Irritability, Verbal Trait Aggression and Physical Trait Aggression.

2.3. Procedure

The patients accepted for treatment were invited to a psychological assessment starting with the structured interview containing the items on taste preference. The interviews were

standardized, and the item on preference for sweet taste thus always preceded the item on fat preference. The questionnaires were administered after the interview.

2.4. Statistical methods

The TFEQ and SSP subscales were both found to have an acceptable normal distribution in the prevailing sample, and parametric tests were accordingly used for all analyses. Pearson χ^2 was used for comparing taste preference to gender, and ANOVA was applied for the remaining analyses on differences in taste preference. The main SSP factors were tested and the subscales comprising the main factors were considered for further analyses if a statistical significance was found for the main factor. Two-tailed significance tests were used and the selected level of statistical significance was $P < .05$. In the ANOVA analyses for the demographic variables, TFEQ and SSP, the chosen Post Hoc test for comparisons between groups was Bonferroni that corrects for overall error rate in multiple testing.

For all statistical analyses the Statistical Package for Social Sciences (SPSS for Windows, version 13.0, 2004, Chicago, IL, USA) was used.

3. Results

3.1. General results in sweet and fat taste preference

As some patients had an overlap of strong sweet and fat taste preference, four groups were derived in our sample: 1. Strong sweet preference, 2. Strong fat preference, 3. Strong sweet *and* strong fat taste preference, and 4. No strong taste preference. The results for these groups are shown in Table 1.

A strong preference for sweet taste only was reported by 16 (27%) of the 60 patients, and a strong preference for taste of fat

in specific was reported by 17 (28%). An overlap with strong taste preferences for both sweet and fat taste was found in 6 patients (10%) and 21 patients (35%) reported no strong taste preference for either sweet or fat. As the combined group was very small, consisting of only 6 patients, the results based on comparisons with this group were not considered for interpretation. Considering gender, age and BMI, age was the only variable differing between groups according to the ANOVA. The comparisons between groups did, however, not reach the level of statistical significance in the Bonferroni Post Hoc tests.

3.2. Results for psychological variables in sweet and fat taste preference

For the psychological variables displayed in Table 1, a strong preference for taste of fat was associated with lower levels of cognitive restraint in the TFEQ as compared to the group with no strong taste preference (Mean difference = -5.2 ± 1.6 , $P = .013$). The patients with fat taste preference were thus less prone to restrain their food intake. The TFEQ subscales Disinhibition and Hunger were significant in the overall ANOVA, but the Bonferroni Post Hoc tests correcting for multiple testing did not reach the level of statistical significance across groups. A trend suggests higher hunger scores in fat preference. No significant associations between fat preference and the SSP main personality dimensions were found.

A strong preference for sweet taste was related to higher levels of the personality dimension neuroticism, as compared to no strong taste preference (Mean difference = 3.5 ± 1.1 , $P = .013$). Further analyses were performed to reveal which subscales in the SSP Neuroticism factor that were critical for the strong preference for sweet taste, show higher levels of Lack of assertiveness (Mean difference = $.6 \pm .2$, $P = .006$) and Embitterment (Mean difference = $.7 \pm .2$, $P = .013$) in this group. Sweetness

Table 1
Sweet and fat taste preference in relation to demography, eating behaviors and personality

	1. Strong sweet taste preference	2. Strong fat taste preference	3. Strong sweet <i>and</i> fat taste preference	4. No strong taste preference	F-value	P-value
	N=16	N=17	N=6	N=21		
	m (SD)	m (SD)	m (SD)	m (SD)		
Gender W (%), M (%), χ^2	14 (23%), 2 (3%)	12 (20%), 5 (8%)	6 (10%), 0 (0%)	12 (20%), 9 (15%)	6.7	.082
Age (years)	40.2 (13.1) ^b	49.0 (11.6) ^{a,c}	30.3 (8.8) ^{b,d}	45.3 (10.0) ^c	4.7	.005
BMI (kg/m ²)	40.3 (4.3)	38.4 (3.9)	45.0 (10.2)	40.0 (4.7)	2.4	.073
Cognitive restraint	8.9 (4.7)	7.3 (3.6) ^d	10.7 (8.0)	12.5 (3.8) ^b	3.8	.017
Disinhibited eating	9.6 (4.1)	10.2 (2.5)	12.3 (1.5)	7.0 (3.4)	3.8	.017
Hunger experience	5.9 (3.5)	7.3 (2.4)	9.3 (3.5)	4.4 (2.8)	3.7	.018
SSP Neuroticism	14.4 (3.0) ^d	13.7 (3.8)	15.6 (3.1) ^d	10.9 (3.0) ^{a,c}	5.4	.003
Somatic trait anxiety	2.4 (.7)	2.3 (.8)	2.3 (.7)	1.8 (.7)	2.3	.087
Psychic trait anxiety	2.5 (.8)	2.3 (.9)	2.9 (.7) ^d	1.8 (.7) ^c	4.1	.010
Stress susceptibility	2.4 (.5)	2.3 (.8)	2.9 (.6) ^d	2.0 (.6) ^c	4.0	.013
Lack of assertiveness	2.5 (.6) ^d	2.2 (.5)	2.7 (.6) ^d	1.8 (.5) ^{a,c}	5.9	.001
Embitterment	2.3 (.6) ^d	2.3 (.7) ^d	2.2 (.5)	1.6 (.5) ^{a,b}	5.4	.002
Mistrust	2.4 (.5)	2.4 (.6)	2.5 (.8)	1.9 (.5)	3.5	.019
SSP Extraversion	2.7 (1.0)	2.9 (1.0)	2.3 (1.3)	2.8 (1.0)	-.5	.680
SSP Aggression	3.6 (1.1)	3.9 (1.9)	4.1 (1.7)	3.4 (1.2)	-.6	.628

Post Hoc tests: ^a = differs significantly against group 1, ^b = differs significantly against group 2, ^c = differs significantly against group 3, ^d = differs significantly against group 4.

preference showed no significant associations with the eating characteristics in the TFEQ.

4. Discussion

In this study we were interested in how obese patients with fat and sweet preferences are characterized with regard to eating behaviors and personality. Strong sweet and fat preferences were found in groups of rather equal size consisting of slightly more than a fourth of the patients each.

It should be noted, that the preference for sweet taste often included foods such as pastries, chocolate and ice cream, and could thus be defined more exactly as “lovers of sweet–fat food”. Experimental research has, however, shown that sugar masks the taste of fat [25]. Sweet–high fat dishes are perceived as sweet and carbohydrate rich rather than fat. The perception of sweetness suppresses the oral perception of fat. This means sweet–fat comfort foods are perceived as sweet and not fat, as a perceptual illusion is created by the sucrose [25]. These findings can explain that the literature has persistently focused the attention on the carbohydrates and sweet quality in sweet–high fat treats [25], for example in research on obese persons’ food preferences [26]. This subjective perception of the sweet taste in sweet–fat food suggests that a useful formation of subgroups on taste preferences could be established among the obese patients, that is also in line with earlier literature based on self-reported information.

Sweet preference was associated with a distinct personality profile of neuroticism, agreeing with the prior study we found on this [2]. Lack of assertiveness and embitterment were the major neurotic personality traits explaining sweet preference. Lack of assertiveness implies a lower self-confidence and lower self-esteem, and the hampered behavior can have social implications. Lack of assertiveness has been linked to inhibition of behavioral response in experimental conditions [27]. It is suggested that the persons with low assertiveness are more unclear regarding their own attitudes and priorities, causing a slower cognitive processing. This inhibition of response can contribute to further difficulties in manifesting oneself [27].

The neurotic trait embitterment was also linked to sweet preference. Embitterment can imply externalized blame for difficulties that have been faced in life, and also envy of others. Thus, dissatisfaction in life goes along with the sweet preference profile.

A greater desire for intense sweet taste as well as greater perceived stress has been found in African Americans as compared to European Americans [28]. The authors suggest that the African Americans use sweet taste to compensate for feelings of stress. A compensating function of sweet taste would likewise be a reasonable psychological interpretation of our finding on the neurotic aspects. Socioecologic and psychological stress in the African Americans and the obese patients, respectively, could be associated with a desire for the comfort and reward [29] provided by sweet taste. In the research on African Americans, neurochemical events involving endogenous opioids [30] were suggested in a compensating function.

On the basis of animal and human research, a model implying that sucrose consumption can reduce the effects of chronic stress

by decreasing the activity in the Hypothalamo–Pituitary–Adrenal (HPA) axis has been proposed by Dallman et al. [31,32]. Chronic stress leads to elevated glucocorticoids which in turn stimulates the drive for “comfort food” (sucrose). The sucrose relieves the negative effects of chronic stressors by reducing the metabolic stress with a reduction of the sympathetic activity. At the same time, the raised glucocorticoid levels cause a reorganisation of peripheral energy stores to central adiposity stores [32].

It is proposed that the effects of sucrose are ultimately mediated through opioidergic pathways that reduce the activity in the stressor-activated brain network [31]. According to animal studies, opiates seem to be involved in the pleasantness of sweet taste [33], and also in reducing pain reception and behavioral effects of stress after sweet food consumption [31].

The possibility that the obese with neurotic traits and avoidance behavior use sweets to temporarily relieve stress should be considered. The personality variable stress susceptibility did not differ with strong sweetness preference, it was rather the more depressive and hampered traits in neuroticism that were important. Regarding our result on lack of assertiveness in strong sweet preference, it is worth noting that sweet drinks reduce a stress-induced behavioral impairment such as avoidance behavior in rats [34].

The drive for sucrose likely includes both “wanting” and “liking” [14]. The wanting is the motivational incentive and could be driven by the increased sensitivity of the systems, whereas liking could be the specific hedonic response associated with the sweet taste. We cannot at present time judge if either of these is stronger or they are equally contributing in the preference of sweet taste. They are needed together for a full reward [14]. According to the theory on wanting once the brain reward system has been sensitized [16], it cannot be excluded, however, that a preference for sweet foods could also be perceived as an urgent craving rather than a source of pleasure for the obese patients.

A conflicting personality finding in preference for more intense sweetness reported by others was being more outgoing [5], which is a trait opposite of neuroticism and rather implies being more unconcerned and carefree. More research is needed in the area of how personality relates to sweet preference.

Fat preference showed a different psychological pattern than sweet preference, with no clear links to personality traits but rather an association with lower levels of the eating characteristic restraint over eating according to the TFEQ. This means obese patients who are not prone to make conscious attempts to control and restrict their food intake have more preference for fatty foods. This could be due to a lower ability to resist foods among those who have a strong liking for fat. The alternative interpretation would rather be that obese patients who do not restrain their eating in order to control their body weight develop or maintain a preference for calorie-dense fat foods. These patients could be more prone to allow themselves to harbor a desire for fatty foods.

The former interpretation, implying lower ability to resist food in those who have a desire for fat taste, could be compared to interpretations on biological links to fat preference that were described in earlier literature [10,12]. The association between fat preference and hunger feelings as measured by the TFEQ did not reach the level of statistical significance in the group comparisons,

which would have been expected in a biological interpretation. There was, however, a trend in the expected direction. We can conclude that a preference for fat seems more to be an aspect of eating behavior than of personality features as revealed by the SSP.

A complimentary overall interpretation that can be postulated is that dietary fat does not relieve stress or activate the reward system as efficiently as sucrose. Whether fat relieves stress or not is a controversial issue. In some rat studies dietary fat has been suggested to activate the stress axis [35]. On the other hand, tension–anxiety ratings declined in a group of humans consuming high fat diet during one month, whereas no change in anxiety was observed in a group consuming a low-fat diet [36].

As to activation of the reward system, dietary fat does activate the reward system, although not as efficiently as sucrose seen in animal studies [37]. It is sucrose or sweet tasting food that is suggested as particularly rewarding [38]. The stress-relieving effects of dietary fat thus seem more complex, and fat may not be the first choice of food to relieve stress.

It is a common notion is that the favorite foods of obese men are those high in fat and protein, whereas obese women rather chose foods high in carbohydrate/fat and sugar [39]. According to our study on a rather small sample, there were no significant gender differences in sweet and fat preference. Our results suggest that the psychological factors override gender associations in taste preferences in obesity.

A limitation with our study that could be considered concerns the use of self-reported taste preferences rather than an objective measure such as, for example, PROP tests [40]. However, self-reported attitudes on habitual taste preferences have relevance for our understanding of obese patients in clinical practice, aside from the data generated in experimental designs. A non-obese control group would furthermore have given valuable information concerning the uniqueness or similarity of the data vis-à-vis a non-obese sample. We do not know if normal weight persons have the same types of psychological associations to their taste preferences.

Some clinical implications could be tentatively suggested from our results. For the obese patient with a strong sweet taste preference, there could be reason to focus on the psychosocial situation and the psychological factors in eating. For the patient with a strong fat preference, we rather need to understand more about the link to their eating behavior.

In this study we showed that sweet and fat taste preferences were related to different psychological patterns in obesity. Sweet preference was associated with personality style, whereas fat preference was rather linked to eating behavior. These results can contribute to more understanding about strong taste preferences in obesity.

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