Obesity and emotions: Differentiation in emotions felt towards food between obese, overweight and normal-weight adolescents

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A B S T R A C T

The current study examined variations in the emotional intensity felt towards food pictures as a function of the participants’ body mass index (BMI). A total of 111 adolescents were instructed to actually imagine eating 30 food products illustrated in a picture and to rate their emotions on a five-point scale. The results showed that emotional intensity felt towards foods was different between the three BMI groups. The intensity of the positive emotions aroused by palatable foods appeared to be stronger in the normal-weight than in the overweight participants, whereas the evaluation of these emotions did not differ between the obese and the normal-weight participants or between the obese and the overweight participants. The intensity of the negative emotions towards palatable foods was higher in the obese than in the overweight and normal-weight participants. For the non-palatable foods, the overweight participants’ negative emotional experiences were less pronounced than those of the normal-weight and obese participants.

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1. Introduction

There is growing evidence that foods affect mood and emotions. Because eating is pleasurable and rewarding, it produces well-being and positive emotions (Davis et al., 2008; Gibson, 2006; Kelley, 2004). Recently, Canetti, Bachar, and Berry (2002) suggested that the emotional effect of foods on eating behavior is greater in obese than in normal-weight people. According to the externality hypothesis, obese individuals are more likely than normal-weight individuals to be induced to eat by salient external cues such as the sight and smell of well-liked foods (Schachter & Rodin, 1974). Some studies showed that obese participants are highly aroused by the sensory characteristics of food (Braet & Crombez, 2003). Faced with an environment rich in dietary signals, they thus tend to overeat.

According to the emotion regulation strategy (i.e., mood control eating) (Christensen, 1993; Macht, Haupt, & Ellgring, 2005; Macht & Simons, 2000), the individuals’ emotional state per se also affect their eating behavior, in other words, people eat in order to decrease an unpleasant feeling. For example, some people eat ice cream in order to relieve sadness (Booth, 1994). Since obese people often suffer from depressive symptoms (Yanovski, 1993), their food intake could be also explained by a coping strategy used to reduce their negative affects (Bruch, 1973; Kaplan & Kaplan, 1957).

A number of studies have shown that obese people on a diet feel more negative affects related to eating behavior than those who are not on a diet (Canetti et al., 2002). Since obese people are more likely to be chronic dieters (Apfeldorfer, 2004), their negative affects might be due to eating and cognitive restrictions, such as the continual effort to limit food intake in order to control weight gain (Herman & Polivy, 1980). Furthermore, the negative affects in dieting obese people appear to be associated with the disinhibition of eating (Herman & Polivy, 1980). According to some experiments, dieting obese eaters consume more food than normal eaters in response to negative mood states (for a review, see Greeno & Wing, 1994). They experience more negative emotions, lose control of their food intake and revert to overconsumption (Macht, 2008). In obese people, negative affects, i.e., anger (Kenardy, Arnow, & Agras, 1996), boredom (Abraham & Beaumont, 1982), anxiety (Meyer, Waller, & Waters, 1998), stress (Wallis & Hetherington, 2004), depression and loneliness (Ganley, 1989) indeed tend to increase food intake and lead to the overconsumption of food. Unlike in the case of obese eaters, negative emotions are assumed to reduce food intake in normal eaters (Herman & Polivy, 1984; Schachter, Goldman, & Gordon, 1968). Nevertheless, Bellisle et al. (1990) showed that negative emotions can be associated with both increased and decreased motivation to eat in normal-weight...
people: one part of the sample reduced food intake and the other part increased it. To summarize, it is difficult to predict how normal-weight people change their eating behavior in response to emotions. In return, emotions and moods, especially negative ones, seem to lead to overeating in obese people on a diet or not (Foreyt, Brunner, Goodrick, & Cutter, 1995; Gelieber & Aversa, 2003).

There appear to be specific relationships between emotions and eating behavior in obese people. However, until now, research involving obese people has focused only on a small number of basic emotions such as anger, fear, sadness and happiness, and used only a small number of food items defined as disliked or liked, with a negative or positive valence. It was previously believed that these basic emotions represented a physiological reaction to sensory information (Scherer, 1984). However, complex emotions felt towards food products cannot be reduced to this small number of basic emotions (Barret, 2006; Schachter & Singer, 1962). Furthermore, research has focused on obese people without trying to identify differences in food-related emotions between overweight and obese people. Consequently, in our study, we decided to test not only the basic emotions (to like and disgust), but also more complex emotions such as guilt, frustration, embarrassment or doubt, and this in normal-weight, overweight and obese people.

The aim of this study was therefore to further investigate the emotional feelings experienced in relation to food products by testing a large number of these feelings (N = 19) in the participants, using a validated glossary of various emotional words (Rousset, Deiss, Juillard, Schlich, & Droit-Volet, 2005) for 30 different food pictures, both palatable and non-palatable. Furthermore, three groups of participants were tested in terms of their body mass index (BMI); normal-weight, overweight and obese. So far, no study has compared the emotions felt towards food as a function of BMI. However, we have seen that there are grounds for thinking that obese people have an ambivalent perception of food. We therefore assumed that the obese participants would feel both more positive (because they are more sensitive to external stimuli) and more negative emotions (due to eating restrictions, depression and fear of gaining weight) towards foods, and particularly palatable foods, than the overweight and normal-weight participants. We also assumed that we would observe the same phenomenon when comparing the overweight participants with the normal-weight participants. However, since the emotions expressed by the obese group may be mediated by levels of depression (Yanovski, 1993) and eating restrictions (Herman & Polivy, 1980) greater than those found in the other groups, we also assessed the participants’ levels of depression and their restrained eating level.

2. Methods

2.1. Participants

The sample consisted of 111 participants, 67 girls and 44 boys, aged from 12 to 19 years (14.5 ± 1.9). This population was chosen because adolescence is a period when there is a risk of malnutrition. It is characterized by significant energy and nutritional needs, reaching a level never achieved in childhood, and which will never be surpassed in the future. Moreover, during this time, there is a danger of mealtime behaviors becoming increasingly disrupted, the development of obesity and eating behavior pathologies such as anorexia nervosa or bulimia (Apfelbaum & Astier-Dumas, 1989).

The participants were assigned to one of the three groups as a function of their body mass index. BMI was defined on the basis of the 85th and 95th percentile of BMI for each age group and each gender (Cole, Bellizzi, Flegal, & Dietz, 2000). There were 49 normal-weight participants (age = 14.4 ± 1.6, 29 girls, BMI = 18.8 ± 1.5, and 20 boys, BMI = 18.9 ± 1.9), 25 overweight participants (age = 14.5 ± 2.2, 13 girls, BMI = 26.7 ± 1.9, and 12 boys, BMI = 24.9 ± 2), and 37 obese participants (age = 14.5 ± 1.6, 25 girls, BMI = 33.1 ± 4.4, and 12 boys, BMI = 33.9 ± 4.8). All of the participants were students at a secondary school in the suburbs of Clermont–Ferrand (France). Moreover, during the study, the obese and the overweight subjects began weight-loss treatments at the Children’s Medical Center (Centre Médical Infantile) in Clermont–Ferrand. Thus, their schooling was normal, but they took and shared meals prepared by a dietician with a youth worker in this center where they learned to cook healthy food and eat a balanced diet. Moreover, they followed an exercise program supervised by a professional. A nurse measured their body weight every week.

2.2. Materials

A depression symptom score was assessed for each subject using the Center for Epidemiological Studies Depression Scale (CES-D), translated and validated by Fuhrer and Rouillon (1989), and adapted for children by Chabrol, Montovany, Chouicha, and Duconge (2002) (Cronbach’s alpha = 0.85), in order to assess the subject’s emotional distress during the week prior to the test.

For the restrained eating score, the Dutch Eating Behavior Questionnaire (DEBQ) developed by Van Strien, Frijters, Bergers, and Defares (1986) and translated and validated by Lluch et al. (1996) was used (Cronbach’s alpha = 0.93).

For the emotional test, each participant was seated in front of a computer with a file of 30 food pictures all taken from SU.VI.MAX. (1994), a collection of standardized pictures of food products. The pictures consisted of vegetables (salad, French beans, potatoes, cauliflower, spinach), cheeses (Camembert, Roquefort), fruits (pears, bananas), starchy foods (bread, rice, pasta, pizza), sweets (fruit tarts, chocolate, pound cake, cream cake (frosted layer cake with sweet filling), red meat (roast beef, minced meat), white meat (turkey, rabbit, pork chop), fish (fillet, sea-food), offal (tongue, kidneys, black pudding), eggs (omelette), processed pork (dry sausage) and pan baguette (a popular French sandwich with tomato, e.g. lettuce and tuna fish). Nineteen words designating emotions were presented on the computer screen. These 19 key words were presented to reflect the emotions experienced in relation to food consumption. They were selected on the basis of a previous study (Rousset et al., 2005) in which subjects were asked to choose from a glossary of 237 emotion-related words listing all existing emotional terms (Niedenthal et al., 2004) that they might feel towards a food product of any type. Among these words, there were eight words with a positive valence – to like, satisfaction, surprise, seren, amused, thrilled, pride, interest – and 11 with a negative valence – disgust, indifference, guilt, uneasiness, nostalgia, impatience, doubt, frustration, embarrassment, disappointment, lassitude.

2.3. Procedure

The procedure was in compliance with French ethical standards. Parents signed an informed consent form.

Each participant attended a session lasting about 80 min either between 11:00 a.m. and 2:00 p.m. or between 6:00 p.m. and 8:00 p.m. They were instructed not to eat during the two hours before the testing session in order to enable us to evaluate their feelings towards food. The session consisted of emotion-inducing test food pictures and the two questionnaires (DEBQ and CES-D). The order of presentation of the test and the questionnaires was counterbalanced.

In the test, each subject was presented with a picture of a food item and was instructed to imagine being faced with this food and being asked to eat it. The subject then had to indicate the intensity of each emotion-related word on a five-point scale ("0": I do not feel this emotion, "1": I feel it a little, "2": I feel it moderately, "3": I feel it a lot, "4": I feel it very strongly). There were 19 words...
for each food picture, presented in random order, and a series of 30 food products also presented in random order.

2.4. Pre-test of food products: assessment of the most palatable and the most non-palatable foods

In order to focus on the main results, we decided to select the foods judged as the most palatable and the most non-palatable. An initial overall ANOVA was run on the subjects' evaluation of the intensity of the positive emotion “to like”, with the 30 food products as factors. This ANOVA showed an effect of food ($F(29,3300) = 26.9, p < 0.001$). The most palatable foods were chocolate, cream cake, bread, pasta, pizza, potatoes, rice, minced meat and fruit tart (2.9 ± 0.7), and the most non-palatable were kidney, tongue, black pudding, spinach, Roquefort, rabbit, seafood, cauliflower and Camembert (1.4 ± 0.8). A Student t-test showed that the difference between the palatable (mean of the nine palatable foods) and the non-palatable (mean of the nine non-palatable foods) food products was significant ($t(110) = 19.7, p < 0.001$). Subsequent analyses were done on these 18 food products: nine palatable and nine non-palatable.

2.5. Statistical analysis

A univariate analysis of variance was run on the depression scores and on the restrained eating scores with BMI as the between-subject factor. When overall significant effects and interactions were found, post hoc tests were run (Student t-tests).

A principal component analysis (PCA) was conducted with the mean emotion data being evaluated for each BMI category in combination with each of the 18 food items. Thus, the foods were considered as samples (18 foods × 3 BMI = 54 samples) and the emotion-related words as variables (19 variables). This analysis revealed the directions of the emotional vectors that most effectively discriminated between the samples. The PCA also indicated the location of the food items evaluated by the participants in the three BMI groups in this emotional space.

A general repeated-measurement analysis of variance (ANOVA) was carried out with BMI as the between-subject factor, and emotions and food as within-subject factors (19 emotions × 18 foods = 342 dependant variables and 111 participants). The Greenhouse–Geiser adjustment of degrees of freedom was used. The individual depression scores and the restrained eating scores were introduced into the model of the analysis of variance as covariates because of the existence of significant coefficients of correlation between these two variables and the BMI. In contrast, the age of the participants was not correlated with the dependent variables, and this factor was therefore not introduced as a covariate. When overall significant effects and interactions were found, additional analyses of variance were carried out. The first two analyses were run on the palatable foods for the eight positive emotions and the 11 negative emotions, respectively, and the last two analyses of variance were run on the non-palatable foods for the eight positive emotions and the 11 negative emotions, with BMI as the between-subject factor and emotions and food as within-subject factors. Student t-tests were used for comparison of paired observations, and Scheffe tests were used to compare the emotions felt by the three BMI groups. The “sex of participants” variable was removed from the analyses because of its lack of significance.

3. Results

3.1. Depression scores

The ANOVA run on the depression scores, with BMI as the between-subject factor, showed a main effect of BMI ($F(2,105) = 6.7, p < 0.01$). The depression scores were higher for the obese and the overweight participants than for the normal-weight participants ($t(84) = 4.08, p < 0.001$; $t(72) = 2.83$, respectively, $p < 0.01$) (Table 1). However, the depression scores observed in the obese participants did not significantly differ from those of the overweight participants ($t(60) = 0.77, p > 0.05$). As indicated by the Pearson correlation coefficient, there was a positive correlation between the BMI and the depression scores ($r = 0.36, p < 0.01$), i.e., the higher the BMI score was, the stronger the symptoms of depression. Overall, our results showed that the BMI cannot be dissociated from the depressive symptoms. For this reason, the depression scores were entered as a covariate into the subsequent analyses of variance.

3.2. Restrained eating scores

The ANOVA conducted on the restrained eating scores, with BMI as the between-subject factor, revealed a main effect of BMI ($F(2,105) = 14.95, p < 0.001$). The obese and overweight participants had a higher restrained eating score than the normal-weight participants ($t(84) = 4.56, t(72) = 4.53$, respectively, $p < 0.001$). On the other hand, the scores obtained by the obese and overweight participants, respectively, were very similar ($t(60) = 0.81, p > 0.05$) (Table 1). The Pearson correlation coefficient indicated that there was a positive correlation between the BMI and the restrained eating score ($r = 0.39, p < 0.01$), i.e., the higher the BMI score, the more restrained the eating behavior. In light of the BMI effect, the restrained eating scores were entered as a covariate into the subsequent analyses of variance. Finally, the Pearson correlation between restrained eating scores and depression scores was also significant ($r = 0.27, p < 0.01$). The higher the restrained eating scores were, the higher the depression scores.

3.3. Intensity of the emotions generated by food pictures

A principal component analysis (PCA) was run in order to provide a qualitative and overall description of the different food pictures ($N = 18$) (e.g., chocolate, pizza, etc.) as a function of the emotions they aroused in the three BMI groups (Fig. 1). Food pictures assessed by the normal-weight group are preceded by the letter “N” and are written in green, those assessed by the overweight group are preceded by the letter “S” and are written in blue, and those assessed by the obese group are preceded by the letter “O” and are written in red. The first axis of the PCA accounts for 60% of the variance in the emotional assessment of food and is explained by the positive emotions, “to like”, “satisfaction”, “interest”, “serenity”, “impatience”, as opposed to “disgust”, “disappointment”, “lassitude”, “indifference”. Thus, foods located on the right side of the figure aroused the emotion “to like”. The most liked food products were chocolate, cream cake, pasta and pizza, while the least liked food products, located on the left, were kidneys, black pudding, tongue and spinach, regardless of the BMI group. Thus, the ranking of the food items in terms of how much they were liked was the same for all of the participants, regardless of the BMI. The second axis accounts for 20% of the variance. This is explained solely by negative emotions: “guilt”, “frustration”, “embarrassment”, “doubt”, “uneasiness”, “surprise” and “nostalgia”. On this axis, the three BMI groups

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Normal-weight</th>
<th>Overweight</th>
<th>Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>11.14 ± 7.48</td>
<td>17.32 ± 11.2</td>
<td>19.59 ± 11.67</td>
</tr>
<tr>
<td>Restrained eating</td>
<td>2.39 ± 0.78</td>
<td>3.32 ± 0.92</td>
<td>3.15 ± 0.73</td>
</tr>
</tbody>
</table>

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mainly differed in their negative emotions towards foods. The evaluation produced by the obese participants was located at the top of the second axis: these participants expressed stronger negative emotions than either the overweight or the normal-weight participants. However, the most surprising result was the position of the food products assessed by the overweight participants on this second axis. Instead of being located between the obese and the normal-weight participants' evaluation as we had expected, the products evaluated by the overweight participants were located at the bottom of the second axis. Consequently, on the overall food sample, the negative emotions expressed by these participants in terms of nostalgia, guilt, frustration and embarrassment were qualitatively less intense than those of the normal-weight and the obese participants. Finally, the evaluations of the normal-weight participants were located in an intermediate position on the axis, namely between the obese and the overweight participants, since their negative emotions were judged less intense than those of the obese participants and relatively more intense than those of the overweight participants.

An overall ANOVA was then performed on the intensity of the emotions with BMI as the between-subject factor, and emotions ($n = 19$) and food products ($n = 18$) as repeated factors; the depression and the restrained eating scores were considered as covariates. This ANOVA revealed a covariate depression effect ($F(1,106) = 11.7, p < 0.001$), without there being any significant interaction involving depression. At the same time, the restrained eating covariate did not reach statistical significance ($F(1,106) = 0.2, p > 0.05$) and there was no significant interaction involving the restrained eating score. The overall ANOVA also revealed a main effect of BMI ($F(2,106) = 4.0, p < 0.05$), as well as a main effect of emotions ($F(18,1908) = 8.2, p < 0.001$), but no main effect of food ($F(17,1902) = 0.8, p > 0.05$). Moreover, there was a significant emotions × BMI interaction, ($F(36,1908) = 2.0, p < 0.05$), and a food × emotions interaction ($F(306,32436) = 1.7, p < 0.01$).

Concerning the assessment of the palatable foods, Fig. 2 showed a marginal effect of BMI on positive emotions felt towards these palatable foods (Table 2a). The intensity of the positive emotions was stronger in the normal-weight participants than in the overweight participants ($t(72) = 2.39, p < 0.05$). In return, there was no significant difference between the normal-weight participants and the obese participants ($t(84) = 1.66, p > 0.05$), nor between the obese participants and the overweight participants ($t(60) = 0.65, p > 0.05$). The statistical Scheffe tests revealed that the normal-weight participants were more amused and felt more interest towards palatable foods than the overweight participants, all $p < 0.05$.

Fig. 2 also showed a main effect of BMI on negative emotions felt towards the palatable foods (Table 2b). Thus, the intensity of the negative emotions felt towards the palatable foods was greater in the obese participants than in both the overweight ($t(60) = 2.2$,
Table 2
Effects of BMI, palatable foods, emotions and their interactions on the participants’ evaluation

<table>
<thead>
<tr>
<th>Effect</th>
<th>Degree of freedom</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(a)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>(2,108)</td>
<td>2.8</td>
<td>0.064</td>
</tr>
<tr>
<td>Food</td>
<td>(8,864)</td>
<td>7.6</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Positive emotions</td>
<td>(7,756)</td>
<td>118.8</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>BMI × food</td>
<td>(16,864)</td>
<td>1.2</td>
<td>0.244</td>
</tr>
<tr>
<td>BMI × positive emotions</td>
<td>(14,756)</td>
<td>2.0</td>
<td>0.030</td>
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<tr>
<td>Food × positive emotions</td>
<td>(56,6048)</td>
<td>6.8</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Food × positive emotions × BMI</td>
<td>(112,6048)</td>
<td>1.2</td>
<td>0.155</td>
</tr>
<tr>
<td><strong>(b)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>(2,108)</td>
<td>4.8</td>
<td>0.010</td>
</tr>
<tr>
<td>Food</td>
<td>(8,864)</td>
<td>5.3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Negative emotions</td>
<td>(10,1080)</td>
<td>58.8</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>BMI × food</td>
<td>(16,864)</td>
<td>1.5</td>
<td>0.115</td>
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<tr>
<td>BMI × negative emotions</td>
<td>(20,1080)</td>
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<td>0.027</td>
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<tr>
<td>Food × negative emotions</td>
<td>(80,8640)</td>
<td>3.5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Food × negative emotions × BMI</td>
<td>(160,8640)</td>
<td>1.2</td>
<td>0.142</td>
</tr>
</tbody>
</table>

Case of the eight positive emotions (a), and case of the eleven negative emotions (b).

Results of the ANOVA.

p < 0.05) and the normal-weight participants (t(84) = 2.6, p < 0.05). However, and contrary to our hypothesis, there was no difference in the intensity of the negative emotions felt towards the palatable foods exhibited by the normal-weight and the overweight participants (t(72) = 0.4, p > 0.05). The statistical Scheffe tests revealed that the obese participants felt more uneasiness, doubt, disappointment, embarrassment, frustration and guilt than the overweight and/or the normal-weight participants, all p < 0.05, whereas these emotions were similar in the latter two BMI groups, all p > 0.05.

As regards the emotions felt towards the non-palatable foods, Fig. 2 showed that there was only a difference between the three BMI groups on the negative emotions (Tables 3a and b). The assessment of the intensity of the negative emotion experienced towards non-palatable foods was lower in the overweight than in both the obese participants (t(60) = 2.3, p < 0.05) and the normal-weight participants (t(72) = 2.4, p < 0.05). In contrast, this assessment did not differ between the obese and the normal-weight participants (t(84) = 0.6, p > 0.05). The statistical Scheffe tests revealed that the overweight participants felt less disappointment, embarrassment, guilt and uneasiness than the normal-weight participants, and they felt less disappointment, embarrassment, frustration, guilt and uneasiness than the obese participants, all p < 0.05.

Table 3
Effects of BMI, non-palatable foods, emotions and their interactions on the participants’ evaluation

<table>
<thead>
<tr>
<th>Effect</th>
<th>Degree of freedom</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
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<tr>
<td><strong>(a)</strong></td>
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<tr>
<td>BMI</td>
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<td>Food</td>
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<tr>
<td>Positive emotions</td>
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<td>26.0</td>
<td>&lt;0.0001</td>
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<tr>
<td>BMI × food</td>
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<td>BMI × positive emotions</td>
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<td>(56,6048)</td>
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<td>Food × positive emotions × BMI</td>
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<td>1.2</td>
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<tr>
<td><strong>(b)</strong></td>
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<td>BMI</td>
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<tr>
<td>Food</td>
<td>(8,864)</td>
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<td>Negative emotions</td>
<td>(10,1080)</td>
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<tr>
<td>Food × negative emotions × BMI</td>
<td>(160,8640)</td>
<td>1.1</td>
<td>0.329</td>
</tr>
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</table>

Case of the eight positive emotions (a), and case of the eleven negative emotions (b).

Results of the ANOVA.

4. Discussion

The results of the present study revealed that major differences in emotions between the BMI groups were not directly related to basic emotions such as to like and disgust felt towards food, but instead to emotional feelings (e.g., guilt, frustration) related to the cognitive appraisal of food products.

We expected the obese participants to feel both stronger positive and negative emotions than the overweight and normal-weight participants. Our results showed that the intensity of the positive emotions felt towards food products differed only slightly between the three BMI groups. The normal-weight participants were more amused and felt more interest towards the palatable foods than the overweight participants. This result can be explained by the healthy relationship that the normal-weight participants have with food; in other words, they do not feel any negative emotion, a priori, towards these palatable foods. In return, the obese adolescents did not report feeling more positive emotions towards food than the overweight and the normal-weight adolescents. This suggested that consumption in the case of obese participants was not simply related to the fact that they liked food more than the other participants. This is consistent with studies suggesting that food preferences associated with positive emotions are well established at an early age (Chiva, 1995; Soussignan & Schaal, 2005). We may therefore assume that these food-related positive emotions do not vary as a function of an individual’s weight problem. By contrast, the intensity of negative emotions towards food pictures varied considerably according to the BMI groups. The obese participants reported feeling more negative emotions towards palatable foods than the overweight and the normal-weight participants. More precisely, they felt more uneasiness, doubt, disappointment, embarrassment, frustration and guilt than the overweight and/or the normal-weight participants. These last results are in agreement with those reported by Canetti et al. (2002), who found that the influence of the emotional state on food intake is greater in obese people than in other individuals. Finally, the obese participants felt as many positive emotions as the overweight and the normal-weight participants, but they felt more negative emotions towards palatable foods.

Fishbach, Shah, and Kruglanski (2004) have stressed that the way people experience a given activity is influenced by momentarily activated goals. These authors showed that activating the objective of food enjoyment as a prime invests the activity of eating palatable foods with a positive affect, whereas activating the objective of weight-watching as a prime invests the same activity with a negative affect. In our study, the obese adolescents were undergoing a weight-loss treatment, so they were aware of the need to control their food intake, as indicated by their higher restrained eating scores compared to those of the normal-weight adolescents. Consequently, when faced with palatable products (high-fat, high-sugar), the obese subjects might desire to eat these foods, which leads them to feel negative affects such as frustration, doubt or guilt. Moreover, earlier studies have shown that restrained eating exacerbes depression in obese participants (Garner & Woolley, 1991; McFarlane, Polivy, & McCabe, 1999). In line with these results, our data demonstrate that the depression scores increase with restrained eating scores. Consequently, the repetitive effort to limit food intake, combined with depression, could lead to negative feelings towards palatable foods in the obese participants.

Unlike the palatable foods, the results for non-palatable foods (less tasty, less sweet products) showed that the obese participants did not feel more negative emotions than the normal-weight participants. Some studies of disgust suggest that this emotion is related to symptoms of eating disorders (Troop, Murphy, Bramon, & Treasure, 2000). However, in our study, no difference in the dis-
gust felt towards palatable and non-palatable foods was found among the normal-weight and the obese participants. The data from the overweight participants was surprising and difficult to explain due to the absence of emotion-related studies that differentiate between overweight and obese participants. Our results actually showed that the overweight participants ascribed certain positive and negative emotions towards food products less strongly than the normal-weight and/or the obese participants. The overweight participants were less amused and felt less interest towards the palatable food products than the normal-weight participants. Even in the case of the non-palatable food products, the overweight participants felt fewer negative emotions. Finally, while the overweight participants suffered from restrained eating and depression as much as the obese participants, they did not feel the same intensity of emotions towards food products. This might imply that the overweight participants did not state the actual intensity of their emotions towards food pictures. However, in order to test this hypothesis, it will be necessary to employ a different paradigm. Nevertheless, the question that has to be asked is why the overweight participants, unlike the obese participants, should have controlled their emotional responses. Studies in the field of social psychology suggest that the results collected during interviews are sometimes biased by social desirability (Dubois, 2000), that is to say, the tendency to convey a favorable image of one’s self to others by providing responses that reflect a denial of thoughts that are psychologically threatening. It is well known that the social stigmatization of obesity is especially pronounced during adolescence (Sohal, Nicolopooulous, & Lee, 1995; Wardle, Volz, & Golging, 1995). We might therefore suppose that the overweight adolescents did not state the actual intensity of their emotions towards food products (and in particular, positive emotions towards palatable foods) in order to protect their image and self-esteem, and to differentiate themselves from obese adolescents who were perceived as being greedy people who love to eat (Brook & Tepper, 1997). However, the obese adolescents could not adopt the same strategy because their stigma was too visible or because their illness was well established.

Finally, we are aware that the findings presented in this paper should be regarded with care in terms of the interpretation due to the use of verbal responses in participants. However, it is important to pursue the investigation of the emotions experienced in relation to food products and their influence on behavior in greater detail, particularly in overweight and obese people. Consequently, further experiments should be done to test the emotions felt directly towards foods by using physiological measurements.

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