Emotional Openness in Overweight and Normal-Weight Adolescents

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Abstract

Obesity is common in adolescence and associated with medical complications. As maladaptive emotional processing is assumed to influence obesity, this research investigated emotional openness (EO), a general model of emotional processing, in normal-weight versus overweight adolescents, with consideration of gender differences, in order to determine whether a particular EO profile is characteristic of overweight adolescents. This research also explored the psychometric characteristics of the Dimensions of Openness to Emotions Questionnaire (DOE-20), a comprehensive multifactorial instrument that assesses emotional processing. The DOE-20 and the Positive and Negative Affect Schedule (PANAS) short form were completed by 160 adolescents (mean age: 14.36 ± 0.61 years), 39 of which were overweight. A multivariate analysis of variance showed no difference with respect to overweight status, but better ability to recognize and regulate emotions in boys than girls. The original five-factor structure of the DOE-20 was confirmed by confirmatory factor analysis; however, internal consistency was modest. As this research did not replicate the EO profile previously found in obese adults, we discuss the adequacy of the DOE-20 to evaluate EO in adolescents as well as the ability of the construct of EO to assess emotional processing in obesity. Further research should examine the links between EO, problematic eating behaviors, and obesity.

Keywords: emotional processing, emotional openness, overweight, obesity, adolescence, gender

Emotional Openness in Overweight and Normal-Weight Adolescents

Overweight and obesity are common in adolescence, affecting 20% and 5% of adolescents in Switzerland, respectively (Bovet, Chiolero, & Paccaud, 2008). Adolescent obesity is associated with serious medical complications and an increased risk of obesity persisting into adulthood (Doak, Visscher, Renders, & Seidell, 2006). Difficulties in emotional processing seem to be implicated in the development of excess weight, but evidence is sparse. This study therefore investigates emotional processing in overweight and obese adolescents.

Among various psychological dysfunctions in obesity, emotional problems are of particular interest. Reviewing this issue, Canetti, Bachar, and Berry (2002) concluded that, although emotion-induced eating occurs in both normal-weight and obese people, it is more pronounced in the latter. This may be because obese people encounter difficulties in emotional processing, which represents “the self-organization and explication of one’s own emotional experience” (Greenberg, 2006, p. 87) and is usually described as a multi-step process. For example, according to Baker (2001), an emotional experience begins with the cognitive appraisal of an external input. The next steps are the awareness of the emotion and the accompanying sensations, and then the linking to the triggering event, which allow the labelling of the emotion. Then the process includes the expression of the emotion, and finally, the control of the emotional experience and of its expression. In contrast to emotional processing, emotion regulation represents different conscious/controlled or unconscious/automatic ways of acting on emotions in order to regulate them, that is, “dampen, intensify, or simply maintain” them (Gross & Thompson, 2007, p. 8). Emotion regulation is thus an integral part of emotional processing and may actually occur at different steps of this process, acting either on the triggering input, on the emotional experience itself, or on its communication (Baker, 2001).

Maladaptive emotional processing has been assumed to play a role in obesity for a long time. For example, studies on alexithymia (Sifneos, 1973) indicate a greater general deficit in emotional processing (mainly difficulties in identifying and communicating emotions) in obese adults compared to normal-weight adults (Clerici, Albonetti, Papa, Penati, & Invernizzi, 1992; Slochower, 1976; Zijlstra et al., 2011). Other studies document an association between unhealthy emotion regulation and obesity in both women (Zijlstra et al., 2011) and adolescents girls (Rehkopf, Laraia, Segal, Braithwaite, & Epel, 2011) as well as between unhealthy emotion regulation and binge eating in male and female adolescents (Whiteside et al., 2007) and loss-of-control eating in children (Czaja, Rief, & Hilbert, 2009), two eating behaviors likely to lead to excessive weight. Moreover, emotional eating, a maladaptive eating behavior characterized by the tendency to overeat in response to negative affect (Kaplan & Kaplan, 1957), is commonly found in obese people at various ages (Braet et al., 2008; Elfhag & Linné, 2005; Koenders & van Strien, 2011; van Strien, Herman, & Verheijden, 2009; van Strien & Koenders, 2012), presumably representing a way to regulate emotions (Spoor, Bekker, van Strien, & van Heck, 2007; Zijlstra et al., 2011).

As the literature exploring the effects of emotional processing on obesity has focused mainly on emotion regulation, neglecting the other components of affect processing−except a few studies on alexithymia−further research is needed to better understand the exact mechanisms underlying the relationships between emotional processing and obesity, especially in adolescents. Adolescence is indeed a critical period in which physical development linked with puberty increases the risk of obesity (Dietz, 1994). Adolescence, and especially early adolescence (i.e., 10-15 years), is also a period characterized by increased emotionality, both in intensity and frequency (Larson & Lampman-Petraitis, 1989), probably due to the multiple significant biological (i.e., puberty), psychological (e.g., identity construction; Erikson, 1968), and social changes (i.e., shift from attachment to parents to that to peers) occurring at this time (Zimmermann, 2012). Adolescence is thus a critical period for emotional processing, all the more since its development, which begins in early infancy, continues throughout adolescence (Zeman, Cassano, Perry-Parrish, & Stegall, 2006), as suggested by studies examining alexithymia in adolescents, which show that cognitive functioning and emotion regulation increase between age 14 and 19 years (Zimmermann, Quartier, Bernard, Salamin, & Maggiori, 2007) and that the rate of alexithymia decreases during adolescence (Joukamaa et al., 2007; Säkkinen, Kaltiala-Heino, Ranta, Haataja, & Joukamaa, 2007). Moreover, recent affective neuroscience research demonstrates that the maturation of hormonal, neuronal, and cognitive systems−systems contributing to emotion regulation−continues during adolescence (Spear, 2000) and that significant brain development (e.g., increase in the volume of white matter) occurs at this time in regions essential for the regulation of behavior and emotions (Paus, 2005; Steinberg, 2005).

In order to comprehensively study emotional processing in overweight adolescents, this article compares the emotional processing of overweight versus normal-weight adolescents using a multidimensional model called the emotional openness (EO) model (Reicherts, 2007; Reicherts, Genoud, & Zimmermann, 2011), which is more comprehensive than other models, for example, Rachman’s (1980) or Greenberg’s (2006) models. Indeed, EO considers emotions to be complex phenomena, with three levels of processing (bodily, cognitive-experiential, and social) and five dimensions, which can be conceived of as either “states” linked with intra-individual differences (i.e., affectivity) or “traits” describing relatively stable tendencies underlying inter-individual differences (as measured by the DOE-20). The tendencies of an individual on the different dimensions can be described by an EO profile. Several studies have revealed particular profiles linked with mental disorders or problems, including obesity in adults: Obese adults revealed difficulties in recognizing, communicating, and regulating emotions, and have an excessive awareness of both internal and external bodily indicators of emotions (Braunschweig-Spatz, 2006). It remains unclear, however, whether similar difficulties are present in adolescents. Preliminary results in healthy adolescents suggest favorable psychometric properties and have brought gender differences to light, including a higher level of ability to recognize and regulate emotions in boys, and greater awareness of bodily indicators in girls (Zimmermann, 2012). Some research has focused on gender differences in general affect processing during adolescence, mostly in emotion regulation strategies. The results have generally indicated that, from early toddlerhood, girls more frequently tend to seek comfort from others when facing negative emotions, and boys tend to use more self-distraction (e.g., Raver, 1996), those differences continuing until adolescence (Oláh, 1995). Adolescent girls also tend to substitute one emotional display for another, whereas boys tend to neutralize their emotional expressions (Zeman et al., 2006). Concerning other components of affect processing, studies on alexithymia have found no significant differences between adolescent boys and girls (Joukamaa et al., 2007; Säkkinen et al., 2007). Finally, one study demonstrated that boys showed higher skills in global awareness of emotions, in differentiating and verbally sharing emotions, and in bodily awareness (Lahaye, Luminet, Van Broeck, Bodart, & Mikolajczak, 2010). These results are consistent with those of Zimmermann (2012) concerning adolescent boys' higher skills in recognizing emotions, but conflict with those reporting higher awareness of bodily indicators in girls.

In this context, the main objectives of this paper are to compare EO in normal-weight versus overweight or obese adolescents, while considering gender differences as well as the potential influence of covariates, namely, mother tongue, age, and negative and positive affect, and to evaluate the psychometric characteristics of the DOE. We thus hypothesize that overweight or obese adolescents will present a particular EO profile, reflecting difficulties in recognizing, communicating, and regulating emotions, and an excessive awareness of both internal and external bodily indicators of emotions. We also expect that, in the entire sample, girls will exhibit an increased perception of internal and external bodily indicators of their emotions, whereas boys will show higher levels of recognition and regulation of their emotions. Finally, we hypothesize that EO differences by gender and body mass index (BMI) status will be influenced by mother tongue, age, and negative affect and positive affect.

Method

Recruitment and Sample

The sample consisted of adolescents attending the second grade of secondary school (seventh year of school) in Fribourg (French-speaking part of Switzerland). They were recruited through the schools' medical service. During the medical examination, each adolescent was weighed and measured by the school nurse and if he/she consented to take part in the study, his/her weight and height were directly noted by the nurse on the questionnaire that was given to him/her (along with a stamped, self-addressed envelope), so that he/she could complete it at home. In compensation for study participation, participants could win an iPod and cinema tickets. Parental consent was not obtained because the school doctor considered it unnecessary. The study was approved by the ethics committee of the Department of Psychology, University of Fribourg (Switzerland).

Participation in the study was proposed to 400 adolescents. Of these, 320 agreed to complete the questionnaire at home, and 164 completed and returned it (response rate: 41%). In order to avoid invalid data due to comprehension problems, participants who had spoken French for less than three years were excluded ($n = 4$). Among the 160 adolescents remaining, there were 92 girls (58%) and 67 boys (42%), aged 13 to 16 ($M = 14.36 \pm 0.61$) years. Concerning schooling, 22 attended the lowest track (13.8%), 60 the middle track (37.5%), and 78 the highest track (48.8%). Regarding nationality, 109 were Swiss (68.1%) and 51 were of other nationalities (31.9%). Finally, for 115, French was the mother tongue

(71.9%) and 43 had another mother tongue (26.9%). There were no significant gender differences on these sociodemographic data, except for mother tongue, $\chi^2(159) = 3.11$, $p < .10$: having French as one's native language was underrepresented in boys ($n = 44$; 66%) compared to girls ($n = 72$; 78%).

Body mass index (BMI; kg/m^2) was calculated based on measured weight and height, then transformed into *z* scores and BMI percentiles according to norms established by Kromeyer-Hauschild et al. (2001). Regarding BMI status, 10 adolescents (6.3%) were classified as underweight (< 10th percentile), 110 (69.2%) as normal weight (10th - 89th percentiles), and 39 (24.5%) as overweight or obese (≥ 90th percentile), 17 of which were classified as obese (≥ 95th percentiles). There were no significant gender differences concerning BMI and BMI status ($p > .05$).

Measures

The questionnaire included a measurement of weight and height (by the school nurse), a self-evaluation of sociodemographic characteristics (i.e., education level, age, gender, nationality, and mother tongue), and several validated self-report questionnaires for exploring the links between emotional processing and excess weight.

The DOE-20 (Dimensions of Openness to Emotions). To assess emotional processing, the original French version of the DOE-20 (Reicherts, 2007) was used. It contains 20 items assessing the five dimensions of the model (four items per dimension; five-point Likert scale: 0 = *not at all*, 4 = *extremely*; see Table 1): the cognitive-conceptual representation of emotions dimension (REPCOG) focuses on distinct and differentiated representations of emotions, based on mental and bodily states; the communication of emotions dimension (COMEMO) refers to one's capacity to express and share emotions with other people; the perception of internal bodily indicators dimension (PERINT) represents one's awareness of the internal somatic phenomena characterizing or accompanying emotions (e.g., cardiovascular activation); the perception of external bodily indicators dimension (PEREXT) refers to one's awareness of bodily indicators that are visible to others (e.g., facial expression); the regulation of emotions dimension (REGEMO) represents one's capacity to regulate, monitor, or postpone emotions. The factorial validity of the instrument has been confirmed by confirmatory factor analyses (CFA) in two adult samples (Reicherts, 2007) and in one adolescent sample (Zimmermann, 2012). Internal consistency was acceptable for all scales except one in the adult sample (REPCOG: $\alpha = .83$; COMEMO: $\alpha = .77$; PERINT: $\alpha = .74$; PEREX: $\alpha = .78$; REGEMO: $\alpha = .67$). In the adolescent sample, internal consistency coefficients were satisfactory for two scales (COMEMO: $\alpha = .73$; PEREXT: $\alpha = .70$), but fell below the cutoff value of $\alpha \geq .70$ for the other three (REPCOG: $\alpha = .65$; PERINT: $\alpha = .62$; REGEMO: $\alpha = .60$).

Insert Table 1 here

The PANAS (Positive and Negative Affect Schedule). To explore the affective experiences of our sample, we used a shortened (10-item) form of the PANAS questionnaire (Mackinnon et al., 1999). Five items described positive emotions (i.e., inspired, alert, excited, enthusiastic, determined) and five described negative emotions (i.e., afraid, upset, nervous, scared, distressed). The participants were to evaluate the extent to which they had felt each emotion during the past week on a 5-point Likert scale (0 = *not at all*, 4 = *extremely*). A CFA validated the two-factor structure (positive affect, hereafter PA; negative affect, hereafter NA) in the English version of the short form. Additionally, internal consistency was good for both scales (PA: $\alpha = .78$; NA: $\alpha = .87$).

Statistical Analyses

First, the psychometric properties of the DOE-20 were studied: A CFA was conducted using AMOS 16 (the rest of the analyses were carried out using SPSS 19) to examine the five-dimensional structure. The indices used were: the comparative fit index (CFI), which varies between 0 and 1, and should tend toward 1, with a threshold value of .80 (Hu & Bentler, 1999); the root mean square error of approximation (RMSEA), which indicates a close fit if it is below .05, a reasonable fit if between .05 and .08, a poor fit if between .08 and .10, and an unacceptable fit if above .10 (Browne & Cudeck, 1992); and the chi-square/degrees of freedom ratio (χ^2/df), which should not exceed 2 (Tucker & Lewis, 1973). Internal consistency was examined using Cronbach's α, with a cutoff value of .70 (Nunnaly, 1978), and using inter-item correlations, item-total correlations, and subscale intercorrelations. All correlations were interpreted with the values defined by Cohen (1988), a weak correlation being about .10, a moderate one about .30, and a strong one about .50 or more.

Second, in order to examine differences in EO as a function of gender and BMI status, a 2 x 2 multivariate analysis of variance (MANOVA) was conducted, with gender and BMI status as factors and the five EO dimensions as dependent variables. Post-hoc ANOVAs were run for significant variables. For this analysis, overweight and obese participants were grouped together, and underweight participants excluded, so that the BMI status factor had only two modalities (viz., normal weight vs. overweight/obesity). An additional exploratory MANOVA was run to compare normal-weight versus obese participants (without taking overweight and underweight participants into account). The effect sizes were also calculated, using the Cohen's (1988) definition, whereby $\eta^2 \geq .01$ is a small effect size, $\eta^2 \geq .06$ is a moderate effect size, and $\eta^2 \geq .14$ is a large effect size. Finally, a multivariate analysis of covariance (MANCOVA) was run to explore the potential influence of the covariates, namely, mother tongue, age, negative affect (NA), and positive affect (PA), with post-hoc *t*-tests for significant effects. The two-tailed significance level of $\alpha < .05$ was used throughout these analyses.

Results

Psychometric Properties of the DOE-20

Several indices of the CFA indicated an adequate fit of the model to the data: The CFI (.84) was above the cutoff of .80 (Hu & Bentler, 1999) and the RMSEA (.06) was included in the interval between .05 and .08, suggesting a reasonable fit (Browne & Cudeck, 1992). Moreover, although the chi square was significant, χ^2 (157) = 246.77; $p < .001$), the chi-square/degrees of freedom ratio (χ^2/df = 1.54) was below the threshold of 2 (Tucker & Lewis, 1973). Taken together, these results confirm that the five-factor model of the DOE also applies to the adolescent sample tested here.

Internal consistency marginally reached the cutoff value of .70 (Nunnaly, 1978) for COMEMO (α = .68), REPCOG (α = .69), and PEREXT (α = .69), but was under the acceptable limit for PERINT (α = .56) and REGEMO (α = .59). However, when we investigated internal consistency in relation to mother tongue, we found that the α values were higher among participants whose native language was French as compared to another language for the dimensions with the lowest internal consistency (PERINT: α = .59 for French vs. α = .48 for other native languages; REGEMO: α = .63 for French vs. α = .51 for other native languages). Due to a possible influence of mother tongue on item comprehension, mother tongue was considered as a potential covariate in the following MANCOVA.

The inter-item correlation matrix revealed moderate mean intercorrelations per subscale (Cohen, 1988): PERINT: M_r = .24 (.19 < r < .30); REGEMO: M_r = .27 (.13 < r < .57); COMEMO: M_r = .35 (.26 < r < .47); PEREXT: M_r = .36 (.26 < r < .48); REPCOG: M_r = .37 (.29 < r < .44). These results, in line with the modest α scores, suggest a moderately satisfactory homogeneity of dimensions.

The item-total correlation matrix was satisfactory as, for each scale, all correlations were above .30 (Cohen, 1988), suggesting that each item correlated well enough with the dimension it belongs to. As with Cronbach's α and the inter-item correlations, the results were better for COMEMO, PEREXT, and REPCOG than for PERINT and REGEMO (PERINT: $.31 < r < .38$; REGEMO: $.31 < r < .44$; COMEMO: $.40 < r < .53$; PEREXT: $.40 < r < .60$; REPCOG: $.42 < r < .51$).

Finally, the intercorrelations between subscales ($.04 < r < .35$; $M_r = .20$; absolute values) ranged from low to moderate (Cohen, 1988), indicating that the five dimensions of the DOE were not completely independent. To take this into account, we assumed that there were associations between dimensions when the model to be tested in the CFA was created.

Differences in Emotional Openness with Respect to Gender and BMI Status

A 2 X 2 MANOVA was conducted to examine differences in EO with respect to gender and BMI status (normal weight vs. overweight/obese). The analysis revealed a significant main effect of gender, $F(5, 139) = 5.62$, $p < .001$, but no significant main effect of BMI status, $F(5, 139) = 1.40$, $p = .227$, nor any significant interaction between gender and BMI status, $F(5, 139) = .45$, $p = .811$. The effect size was large for gender ($\eta^2 = .17$) and weak for BMI status ($\eta^2 = .05$) and for the interaction ($\eta^2 = .02$). Subsequent ANOVAs for gender yielded significant effects for REGEMO, $F(1, 143) = 14.99$, $p < .001$, and REPCOG, $F(1, 143) = 9.98$, $p = .002$, which were both higher in boys than girls (see Table 2). The effect sizes were small for COMEMO ($\eta^2 = .02$), PERINT ($\eta^2 = .01$), and PEREXT ($\eta^2 = .01$), and moderate for REPCOG ($\eta^2 = .06$) and REGEMO ($\eta^2 = .09$). The additional exploratory MANOVA comparing normal-weight versus obese participants produced similar results: We found a significant effect of gender, $F(5,118) = 4.09$, $p = .002$, but not of BMI status, $F(5,118) = 1.54$, $p = .183$, and no significant interaction, $F(5,118) = .45$, $p = .815$. The effect sizes were large for gender ($\eta^2 = .15$), moderate for BMI status ($\eta^2 = .06$), and weak for the interaction ($\eta^2 = .02$). Again, subsequent ANOVAs revealed significant effects for REGEMO, F(1, 122 = 11.08, p = .001, and REPCOG, F(1, 122 = 9.69, p = .002, again higher in boys than in girls.

Insert Table 2 here

A MANCOVA was conducted to test the potential influence of covariates on the relationship between gender, BMI status, and EO, including mother tongue, age, PA, and NA. As independence between factors and covariates was not given for mother tongue and age, only PA and NA were introduced into the MANCOVA. The analysis revealed that both PA, $F(5, 136) = 3.66$, p =.004, and NA, $F(5, 136) = 7.81$, $p < .001$, significantly influence EO. More precisely, PA had a significant effect on COMEMO, $F(5, 140) = 481$, $p = .030$, on REPCOG, $F(5, 140) = 18.15$, $p = .008$, and on PEREXT, $F(5, 140) = 13.13$, $p < .001$, whereas NA had a significant effect on REGEMO, $F(5, 140) = 18.15$, $p < .001$, and PERINT, $F(5, 140) = 14.93$, $p < .001$. Despite the addition of PA and NA to the model, the effect of BMI status on OE remained non-significant, $F(5, 136) = 1.51$, $p = .254$.

Finally, in order to better understand the influence of PA and NA on EO, post-hoc *t*-tests were conducted, with PA and NA recoded into dichotomous variables using the median split method (PA_L / NA_L = low PA / NA; PA_H / NA_H = high PA / NA). The results permitted us to determine that COMEMO, $t(156) = -3.45$, $p = .001$; $PA_L = 1.78$; $PA_H = 2.22$, REPCOG, $t(156) = -1.69$, $p = .092$; $PA_L = 2.31$; $PA_H = 2.53$, and PEREXT, $t(156) = -3.97$, $p = .000$; $PA_L = 1.49$; $PA_H = 2.01$ were significantly higher when PA was high, whereas REGEMO, $t(156) = 4.60$, $p = .000$; $NA_L = 2.45$; $NA_H = 1.89$ was significantly lower, and PERINT, $t(156) = -3.73$, $p = .000$; $NA_L = 1.44$; $NA_H = 1.91$ higher when NA was high.

Discussion

The analyses did not confirm our hypothesis that overweight or obese adolescents have a particular emotional openness (EO) profile: There were no significant differences with respect to BMI status and the effect size of BMI status was small. When we controlled for sociodemographic characteristics and positive and negative affect in a subsequent MANCOVA, BMI status also did not have a significant effect. When the analyses were replicated with only obese (and not overweight) participants as compared to normal-weight participants, BMI status still did not have a significant effect. However, in that case, the effect size of BMI status was moderate, suggesting a potential influence of this variable, which was not detected because of the limited sample size. However, our not finding any EO differences with respect to BMI status does not mean that affect processing does not influence obesity at all. It is possible that the DOE questionnaire in its present state is not well-adapted to evaluate EO in adolescents. This idea is supported by the limited internal consistency found in two adolescent samples. Moreover, EO dimensions are considered personality variables, and as personality evolves during infancy and adolescence to reach a stable form at adulthood, adolescents may not show fixed EO profiles, which would explain why the differences found in adults were not replicated with adolescents. These considerations lead us to think that other problematic behaviors linked with obesity, such as problematic eating behaviors (e.g., emotional and external eating), may be more specific and suitable to assess the influence of affect processing on excess weight. Some authors postulate that people at risk of obesity may engage more often in problematic eating behaviors because of difficulties in recognizing and understanding their somatic sensations, and especially in distinguishing between the physiological signals of hunger and feelings linked with emotions (Bruch, 1964; van Strien & Ouwens, 2007), which may lead them to overeat in order to reduce discomfort due to negative emotions (emotional eating; Kaplan & Kaplan, 1957;

Koenders & van Strien, 2011) or to rely on external cues (i.e., food-related stimuli, like smell or sight of food) instead of internal cues to initiate and stop eating (external eating; Schachter, Goldman, & Gordon, 1968; Wansink, Payne, & Chandon, 2007). Emotional and external eating may be associated with deficits in emotional openness, since this construct refers to the ability to perceive and understand bodily indicators of emotions, as well as to recognize, communicate, and regulate emotions. It may thus be useful, in future research, to investigate the associations between problematic eating behaviors, EO, and obesity.

The differences in EO with respect to gender were found for two dimensions: In our sample, boys reported having a better ability to recognize and regulate their emotions than girls (REPCOG and REGEMO), which is consistent with Zimmermann (2012). We found the same pattern of results when we only considered obese participants instead of obese and overweight participants. However, we were not able to reproduce the differences previously found concerning the perception of internal and external bodily indicators of emotions (PERINT and PEREXT), which were higher in girls in Zimmermann's (2012) study, but did not differ with respect to gender in our sample. This inconsistency may be due to sample differences: Zimmermann's sample (2012) included adolescents 14 to 18 years of age, divided into three groups (early, mid-, and late adolescents). Our sample, with a mean age of 14, thus corresponded to the first group (early adolescents). In Zimmermann's study (2012), the perception of internal indicators increased with age, as did the difference between boys and girls on that dimension, making early adolescents the group with the smallest gender difference. This may explain why we did not find differences between boys and girls on PERINT in our early adolescent sample. However, this pattern of results was not found for PEREXT, the dimension with the largest gender difference in the early adolescent group. Nevertheless, the gender differences found by Zimmermann (2012) and partially replicated in our study may contribute to a better understanding of the differences in the prevalence of depression in adolescents: Girls, who are twice as likely to be affected by depression as boys, are also much more likely to have a ruminative thought style, which is a mental activity focused on the symptoms, causes, and consequences of emotional events (Ziegert & Kistner, 2002). Zimmermann postulates that this cognitive style may tally with a particular EO profile that includes higher levels of internal and external bodily indicators as well as a reduced capacity to recognize and regulate emotions.

The finding that the boys were better able to recognize emotions is partially consistent with Lahaye et al.'s (2010) finding that adolescent boys had a higher level of ability with respect to the global awareness of emotions, the differentiation between and verbal sharing of emotions, and bodily awareness. Nevertheless, we did not find any difference between boys and girls concerning the communication of emotions, which was more frequent in boys in Lahaye et al.'s study (2010), but which is usually found to be more frequent in girls. We also did not find gender-related differences in awareness of bodily indicators, which was higher in girls in Zimmermann's study (2012) and higher in boys in Lahaye et al.'s study (2010). Our findings are inconsistent with the commonly held belief that girls are more aware of their emotions and communicate them more easily (Lahaye et al., 2010).

The addition of positive affect (PA) and negative affect (NA) to the model revealed that a higher level of PA was associated with a better representation (REPCOG) and a better communication (COMEMO) of one's emotions and with an increased awareness of external bodily indicators of emotions (PEREXT), whereas a higher level of NA was linked with lower abilities to regulate emotions (REGEMO) and with an increased awareness of internal somatic indicators of emotions (PERINT). These results are partially consistent with those of a study examining the links between EO and McCrae & Costa's (2008) five-factor model of personality: Extraversion, which represents the propensity for positive affect, was positively linked with REPCOG, COMEMO, and REGEMO; and neuroticism, which refers to the tendency to often feel negative affect, was negatively correlated with REPCOG and REGEMO, and positively correlated with PERINT and PEREXT (Rossier, Verardi, & Genoud, 2012). If PA is linked with better recognition and communication of emotions, it may be because it is easier to identify positive emotions than negative ones, and also easier to share positive emotions with others. Inversely, it seems obvious that negative emotions are harder to regulate than positive emotions. The link between NA and PERINT may be due to the fact that negative emotions induce more numerous and more painful somatic sensations than positive emotions. On the other hand, being very aware of and focused on one's somatic sensations may also increase NA. This idea is in line with the concept of a ruminative thought style, which has been consistently linked with depressed mood (Brinker & Dozois, 2009). Moreover, the association between high NA and difficulties in regulating emotions is often put forward in the etiology of mood disorders (Zeman et al., 2006).

Finally, the results of the CFA confirmed the validity of the five-factor structure of the DOE-20, which had already been found in two adult (Reicherts, 2007) and one adolescent (Zimmermann, 2012) sample. However, consistent with the results of Zimmermann's study, internal consistency was only found to be moderately satisfactory. This lack of consistency may be due to the small number of items per dimension (n = 4). Moreover, comprehension problems were likely present: For the participants whose mother tongue was not French (27%), the α coefficients for REGEMO and PERINT were even worse than for those who were native speakers of French. This poor internal consistency may have contributed to the absence of a significant effect of BMI status on EO. In future research, it could thus be interesting to develop a version of the DOE that is specifically adapted for adolescents.

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Table 1

Dimensions and Item Examples of the Dimensions of Openness to Emotions (DOE-20)

Dimension	Concept and item example
REPCOG	Cognitive-conceptual representation of emotions "I can accurately name every emotion or mood that I am feeling"
COMEMO	Communication of emotions "I willingly share my feelings with other people, even uncomfortable ones"
PERINT	Perception of internal bodily indicators "My strong feelings are accompanied by internal bodily reactions"
PEREXT	Perception of external bodily indicators "My mood shows through my behavior and my expressions"
REGEMO	Regulation of emotions "I am able to alleviate or postpone the impact of a strong emotion"

Table 2

Mean Differences in Emotional Openness (EO) by Gender and Body Mass Index (BMI) Status

EO variables	Total sample	Gender			BMI status		
		Boys	Girls		NW	OW	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*p*	*M* (*SD*)	*M* (*SD*)	*p*
COMEMO	1.96 (.84)	2.08 (.90)	1.88 (.78)	.105	2.05 (.83)	1.72 (.84)	.043
REGEMO	2.19 (.81)	2.49 (.75)	1.98 (.79)	.001	2.18 (.78)	2.24 (.89)	.713
REPCOG	2.44 (.81)	2.73 (.64)	2.23 (.86)	.002	2.45 (.78)	2.42 (.90)	.697
PERINT	1.65 (.83)	1.59 (.75)	1.69 (.89)	.413	1.66 (.87)	1.62 (.74)	.810
PEREXT	1.73 (.88)	1.83 (.79)	1.65 (.93)	.425	1.81 (.88)	1.5 (.85)	.052

Note. p refers to the MANOVA results; COMEMO = communication of emotions; REGEMO = regulation of emotions; REPCOG = cognitive-conceptual representation of emotions; PERINT = perception of internal bodily indicators of emotions; PEREXT = perception of external bodily indicators of emotions; NW = normal weight; OW = overweight/obese.