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Alexithymia, a compounding factor for eating and social avoidance symptoms in anorexia nervosa

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Abstract

Socio-affective difficulties, in particular difficulties in representing, communicating and feeling emotions, may play a critical role in anorexia nervosa (AN). The aim of this longitudinal study was to explore the links between alexithymia and two types of difficulties in AN: eating symptoms and social avoidance. Sixty adolescent girls with AN were recruited following hospitalisation in a specialised department. They completed self-administered questionnaires of alexithymia (TAS-20), of central symptoms of the eating disorders (EDI), and of anxious and depressive affects (SCL-90). Anxiety and social avoidance were assessed in the course of a standardised interview (LSAS). These measures were performed at inclusion, and at 6-, 12- and 18-months' follow-up. The relationship between TAS-20 and EDI or LSAS total scale scores across the four time points was assessed using mixed-effects models, including anxiety, depression, BMI, anorexia subtype, and age as co-factors. Partial least square regression was used to refine this multivariate analysis at subscale level, at inclusion and 18 months. Robust associations between TAS-20 and EDI scores were found, independently from anxious and depressive scores, nutritional state and AN subtype. These effects appeared more particularly linked to the implication of the dimensions difficulties identifying and describing feelings, interpersonal mistrust, feelings of inadequacy and interoceptive awareness deficit. There was also a durable association between alexithymia and social anxiety and avoidance, after adjusting for the confounding effects of depression, and anxiety, and the state of starvation. Difficulties in describing feelings appeared particularly involved here. Thus alexithymia does appear as a factor in the persistence of disorders in AN, and difficulties identifying and describing feelings could compound the social difficulties and major the relational isolation of these patients.

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1. Introduction

Anorexia nervosa (AN) involves serious risk for the patients concerned, and in severe cases the condition can be life-threatening. Indeed AN ranks first amongst life-threatening psychiatric pathologies [1]. Numerous factors are implicated in the onset of AN, amongst which socio-affective difficulties are particularly prominent in the most recent aetiological models [2]. As early as the 1960s, Hilde Bruch highlighted the difficulties experienced by anorexic

patients in perceiving or controlling their bodily sensations, and confusion in the identification of their mental states [3,4]. These deficits in interoception and emotional introspection in AN have since been explored further via studies of alexithymia, a multifaceted personality construct that has emerged in line with the idea that deficits in the ability to experience and symbolise emotion can have adverse effects on well-being. The core alexithymia dimensions are: difficulties in identifying feelings and distinguishing between feelings and bodily sensations of emotional arousal; difficulties in describing feelings to other people; reduced daydreaming and constricted imaginal processes; a stimulus-bound, externally oriented, cognitive style [5].

As expected, studies in this area have indeed shown a marked prevalence of alexithymia amongst AN subjects, reporting rates of between 40% and 77% depending on the

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study, whilst the prevalence is approximately 10% amongst the controls of AN patients or in studies on healthy subjects [6–16]. High prevalence of alexithymia is also reported in the two studies that specifically concerned anorexic adolescents [17,18]. However, it is important to note that in some of these studies it is difficult to disentangle the effect of the AN diagnosis from that of comorbid disorders, in particular anxiety and depression, which have also been linked to alexithymia [5,19–23]. This is also the case in many studies that used a dimensional approach [6,10,16,18,24–29]. Across 21 samples of anorexic patients published on this issue to our knowledge, only 8 studies to date have taken account of this possible confounding effect [11,12,30–35]. Four of these studies were able to establish that their AN patients were more alexithymic than the controls after adjusting for the level of depression [11,30,34,35], one of them showed that this was also true after adjusting for both the level of anxiety and depression [31], but three no longer found any difference between AN subjects and controls after adjustment on depression and anxiety scores [12,32,33]. Hence, as for other psychiatric disorders with comorbid depression and/or anxiety, the question remains whether, in anorexia nervosa, alexithymia is a stable trait or a mental state secondary to depression or negative affectivity.

Besides the level of negative affectivity, nutritional status is another issue that might have a critical impact on results. This can be exemplified by a recent study [34] which compared 14 restrictive AN (mean BMI: 17.9, SD: 1.8), 17 bingeing-purging AN (mean BMI: 17.8, SD: 2.0) and 22 controls (mean BMI: 21.8, SD: 2.5). In the overall sample, alexithymia scores (TAS-20) and BMI were significantly and negatively correlated ($-.35$). In addition, when BMI and depression were adjusted for in the group comparisons, the bingeing-purging AN remained significantly more alexithymic than the controls, but the difference between the restrictive AN and the controls disappeared. Another argument suggesting that the patients' nutritional status could account for certain apparently inconsistent results stems from a careful examination of the literature on AN and alexithymia. In fact, in the studies in favour of an independent role for alexithymia in AN (i.e. existing irrespective of dysphoric affects), the nutritional state of the participants was very severe (mean BMI ranging from 14.9 to 15.4 [11,30,35]), whereas in studies where the relationship with alexithymia was no longer observed after adjustment on dysphoric affects, the mean BMI of participants was higher (i.e. respectively 16.6 and 17.2 [12,32]).

Regarding the alexithymia construct, as it is multi-dimensional, comprising both affective and cognitive dimensions, another issue worth investigating is whether it is all its dimensions or only some that have a role in AN. Studies performed in student populations suggest that it might be more specifically the difficulties in identifying feelings (DIF) and in describing feelings (DDF) that are linked to an increased risk of developing eating disorders [36,37]. Amongst anorexic subjects, the DIF dimension

could be associated with poor outcome according to one study [38]. In addition, three studies on clinical populations that explored the links between scores on an alexithymia measure (TAS-20, [39]) and eating symptoms (EDI, [40]) showed that the dimensions DIF and DDF were associated with the severity of the eating disorder. In these studies, associations have been reported with interoceptive awareness deficit, feelings of inadequacy and interpersonal mistrust, these being central symptom domains that are associated with serious forms of AN [7,28,35].

However, some of these studies have serious limitations, not only because the possible effects of dysphoric affects were not taken into account (see [28] for a discussion on this issue), but above all on account of a major psychometric bias [7,35]. Indeed the instruments classically used to assess alexithymia (TAS and TAS-20) and eating symptoms (EDI) partially overlap. Certain items in the Toronto Alexithymia scales (TAS and TAS-20) are directly derived from the EDI interoceptive awareness scale. Thus an adjusted score needs to be calculated for accurate study of the links between alexithymia and eating symptoms using TAS scales and EDI questionnaire (see [28] for further details).

Intriguingly, although alexithymia has been linked to both intrapersonal and interpersonal effects [41,42], the question of whether alexithymia is related to prosocial skills in AN is still poorly understood. It is common to observe difficulties in adapting socially in AN [43,44], which are described in particular in professional or school environments, or in leisure activities [43,45]. High levels of anxiety and social avoidance [46], and a strong prevalence of social phobias [47,48] have also been reported, which might contribute to impairing social adjustment [45]. We believe that alexithymia could be critically linked to these poor social adjustment features in AN. This hypothesis is supported by existing clinical studies amongst individuals with social phobias, which showed that they have difficulties identifying and describing their feelings (as measured on the TAS-20) [49,50]. Another argument is provided by a recent study amongst 319 students [51], which found positive correlations between alexithymia scores (TAS-20) and social anxiety or avoidance (as measured by a self-report version of the Liebowitz social anxiety scale [52]). Regarding the different dimensions of alexithymia, it is the difficulties in describing feelings in particular that were found to be predictive of anxiety and avoidance scores (on the basis of hierarchical linear regression adjusting on depression and anxiety [51]). However to our knowledge, no study to date has formally explored the links between alexithymia and anxiety/social avoidance amongst AN subjects.

The main aim of this research was to take account of the methodological limitations of earlier studies so as to contribute to determining how far alexithymia might be linked to the severity of eating and interpersonal symptoms in AN. To do this we used the data from a large sample of anorexic adolescent girls followed over a period of 18 months after hospitalisation, taking account of the

potentially confounding effect of dysphoric affects (depression and anxiety) and nutritional status, and also allowing for the metric overlap of the instruments used (TAS/EDI). The secondary objective was to determine the contribution of the different dimensions of alexithymia to the severity of eating and interpersonal symptoms in AN.

2. Methods

The data are derived from a randomised controlled trial on the efficacy of family therapy (see [53] for detailed description of the protocol).

2.1. Participants

Inclusion criteria: female subjects aged 13–21 years, with a DSM-IV diagnosis of AN, aged under 19 at illness onset and with an AN duration ≤ 3 years at admission to the hospital, hospitalised in our inpatient unit for AN (Institut Mutualiste Montsouris), and living in the Paris metropolitan area.

Exclusion criteria: inability to speak or read French, and/or understand the interview questions, any metabolic pathology interfering with eating or digestion (e.g. diabetes), or psychotic disorder.

This study received approval from the Ile-de-France III Ethics Committee and is in accordance with the terms of the Helsinki declaration. Participants were asked to provide informed consent after a time lapse for consideration. Written consent was completed by the patients and their parents. Prior to inclusion in the study, all participants were hospitalised in our care unit for life-threatening physical and/or mental states (including BMI below 14 and/or rapid weight loss and/or compromised vital functions, severe depression, high suicide risk, chronic under-nutrition with low weight, and failure of out-patient care). Once the patient was admitted, the objectives of hospitalisation were defined by means of a weight contract establishing a discharge target weight [53]. Although each patient and her parents were informed of the study at admission, the inclusion occurred in the second half of their hospital stay (i.e. half way towards their target weight), at the time when the post-hospitalisation programme is defined.

2.2. Assessment and procedures

The following instruments were used at each assessment period:

Clinical interviews:

- the Mini Neuropsychiatric Interview (MINI [54]) is a semi-structured interview that enables lifetime diagnosis of psychiatric disorders according to DSM-IV criteria. It enabled confirmation of the diagnosis of AN, identification of the sub-type (restrictive AN-R; binge-purging AN-BP), and diagnosis of comorbid disorders.
- the Global Outcome Assessment Scale (GOAS, [55,56]) is a widely used measure of clinical status in anorexia nervosa

that is based on the investigation of the patient's functioning in 5 areas: nutritional status, menstrual function, mental state, sexual adjustment, and socioeconomic status. We used the Russell et al. [57] methodology and defined outcome categories at 18 months [53].

- the Liebowitz Social Anxiety Scale (LSAS [58,59]) is a semi-structured interview enabling the evaluation of social anxiety. Each item corresponds to a given situation for which the levels of social anxiety and avoidance are evaluated. This interview differentiates social situations of interaction and performance. It provides six subscale scores: fear of social interaction (FEAR SOC), fear of performance (FEAR PERF), total fear (FEAR), avoidance of social interaction (AVOID SOC), avoidance of performance (AVOID PERF), and total avoidance (AVOID). An overall total score is calculated by summing the total fear and avoidance scores.

Self-report questionnaires:

- the 20-item Toronto Alexithymia Scale (TAS-20; [39,60,61]) captures three interrelated, core alexithymic features: difficulties identifying feelings (DIF), difficulties describing feelings (DDF), and externally oriented, concrete thinking (EOT). TAS-20 Total scores can be classified into one of three categories [39]: alexithymic (TAS-20 ≥ 61), intermediate ($51 \leq \text{TAS-20} \leq 61$) and non-alexithymic (TAS-20 ≤ 51).
- the Eating Disorder Inventory (EDI, [40,62]) is a self-report questionnaire which comprises 64 questions, divided into eight subscales. Three subscales concern eating disorder symptoms: drive for thinness (THIN), bulimia (BUL) and body dissatisfaction (BODY). Five subscales do not strictly adhere to diagnostic criteria for the eating disorders but assess symptom domains associated with problematic eating behaviours: perfectionism (PERF), interpersonal distrust (DISTRUST), ineffectiveness (INEF), maturity fear (MAT) and interoceptive awareness (INTER). The score on each subscale and the total score are calculated. It should be noted that 4 items of the TAS-20 are directly derived from the EDI interoceptive awareness subscale [28]. To avoid biasing our analyses, we removed these four items and calculated two corrected scores: INTER C and EDI C that were used in all analyses. Original and corrected scale scores were highly correlated (INTER: .935; EDI: .998).
- the Symptom Checklist (SCL-90, [63]) is a self-report questionnaire assessing psychological distress and various psychopathological symptoms. For the purpose of the present analyses, we used only the depression and anxiety scores, which can be derived from this instrument. The SCL-90 Depression subscale (13 items) evaluates most of the typical symptoms of depressive syndromes according to current diagnostic criteria. Symptoms of dysphoric mood

and affect as well as signs of withdrawal of life interest, lack of motivation, and loss of vital energy are represented. Feelings of hopelessness, thoughts of suicide, and cognitive and somatic correlates of depression are also included. The SCL-90 Anxiety subscale (10 items) is composed of an evaluation of symptoms that are associated with manifest anxiety. Nervousness, tension, and trembling as well as feelings of terror and panic are included. Some somatic correlates of anxiety are included as well.

2.3. Statistical methods

For descriptive statistics, numerical scores were summarised as mean and standard deviation for each follow-up period, after preliminary assessment of the shape of their distribution using quantile plots. Comparisons between continuous variables were performed using Wilcoxon tests, and the association between categorical variables were tested using Pearson's chi-square tests.

Mixed-effects models were used to study the relationships between TAS-20 and EDI or LSAS scores across time. Estimations were performed using the unrestricted maximum likelihood method, as implemented in the *lme* R package. Time of evaluation (inclusion, 6, 12 and 18 months) was considered as a categorical fixed effect, and subjects were considered as random effects to account for within-subject correlation for trait measures. Out of the 60 patients included, complete data for 51 participants were available at 6 months, for 46 at 12 months, and for 50 at 18 months. Fixed-effect covariates included: anxiety and depression combined as a sum score, BMI, anorexia subtype, age at onset of treatment, and treatment allocation. Likelihood ratio tests were used to compare the nested models (with and without covariates of interest), and asymptotic 95% confidence intervals were derived for each model term. Marginalised effect sizes were computed for the main predictor of interest (TAS-20).

Multivariate links between TAS-20 and EDI or LSAS were studied using partial least squares (PLS) regression. Three 'blocks' or two-dimensional tables of data were considered, each defined by the same number of subjects (*n*) and different number of variables, arranged in columns. The PLS method allows to build successive orthogonal linear combinations of the original variables in each block such that their covariance is maximal. In other words, it seeks latent variables that account for a maximum of information included in the block of predictors whilst allowing predicting the block of response variables with minimal error. The TAS-20 data were treated as *n*-by-3 block of predictors, whilst EDI and LSAS data were treated as *n*-by-8 (THIN, BUL, BODY, MAT, PERF, DISTRUST, INTER C, INEF) and *n*-by-4 (FEAR SOC, FEAR PERF, AVOID SOC, AVOID PERF) blocks of responses, respectively. All trait scores were first residualised to remove the effects of anxiety/depression and anorexia subtype. For the PLS, data were analysed at baseline and 18 months (complete cases

only, *n* = 50). The number of latent components to retain was chosen according to the mean square error of prediction criterion (MSEP) using leave-one-out cross-validation. The PLS results were analysed on the basis of variable loadings and variable importance in projection, which reflect within-block weighted contributions for each variable and their relative impact in terms of explanatory power in predicting the outcome variables; redundancy measures and correlation between factor scores on the first components were used as summary measures of average links between the two-block data structure.

A fixed Type I error rate of 5% was considered for all analyses, and Bonferroni correction was used where multiple comparisons were involved. All analyses were carried out using R version 2.12.1 [64].

3. Results

3.1. Participant characteristics

The descriptive statistics of the study participants are presented in [Table 1](#).

Sixty patients were included (mean age 16.0 years, SD 1.6, mean illness duration 16.6 months, SD 6.8). These patients had been hospitalised for 21 weeks on average (SD 13.9) and it was the first hospitalisation for AN for 75%.

Regarding AN subtype at inclusion, 87% were restrictive (AN-R, *n* = 52, mean age 15.8 years, SD 1.59) and 13% binge-purging (AN-BP, *n* = 8, mean age 17.3 years, SD 2.4). Between-group comparisons showed that the AN-BP were significantly older (mean difference = 1.46, SD = .65; *p* = .046) and scored higher for EDI Bulimia (mean difference = 5.19, SD = 1.0; *p* = .012).

As regards comorbidities, in our sample of 60 AN subjects 17% (*n* = 10) also presented a current social phobia, and 30% (*n* = 18) reported having experienced phobia in their lifetime. For other current comorbidities on DSM-IV axis 1, we observed 22% of the sample (*n* = 13) had comorbid major depressive disorder, 2% (*n* = 1) panic disorder, 13% (*n* = 8) agoraphobia, 20% (*n* = 12) obsessive-compulsive disorder and 17% (*n* = 10) generalised anxiety disorder. There were no differences between AN-R and AN-BP for observed prevalence of comorbidity.

At inclusion, 48.3% of the sample (*n* = 29) belonged to the alexithymic category, 23.3% (*n* = 14) to the intermediate category, and 28.3% (*n* = 17) to the non-alexithymic category.

Between inclusion and 18-month follow-up, the participants showed significant improvement for all the clinical parameters considered, including menstrual status (see [53] for more details). Nevertheless, amongst the 50 patients with complete data at 18 months, only 22% (*n* = 11) belong to the good or intermediate outcome categories as defined by Russell et al. [57]. The 10 patients lost for the evaluation at 18 months (*N* = 5 in each treatment group) did not show any significant difference regarding age (*p* = .80), current BMI

Table 1
Descriptive statistics: mean (SD) scores and range at each time of assessment.

	Inclusion		6 months		12 months		18 months	
BMI	16.9 (1.1)	[13.7–19.5]	16.8 (1.5)	[12.9–20.1]	17.0 (1.8)	[14.5–22.5]	17.8 (2.3)	[14.2–24.3]
TAS-20 total	58.2 (11.7)	[34–78]	53.4 (13)	[24–79]	51.5 (13.1)	[26–73]	50.7 (12.0)	[24–72]
DIF	21.6 (6.5)	[7–34]	19.2 (6.2)	[7–33]	18.4 (6.3)	[7–30]	17.2 (6.0)	[7–30]
DDF	18.2 (4.9)	[6–25]	15.9 (5.7)	[5–25]	15.0 (5.3)	[5–25]	15.3 (4.6)	[5–24]
EOT	18.4 (4.5)	[9–31]	18.3 (3.9)	[8–30]	17.9 (5.2)	[8–34]	17.7 (4.2)	[10–28]
EDI total	60.7 (35.1)	[7–135]	54.8 (34.7)	[3–161]	50.2 (32.9)	[3–131]	46.1 (27.7)	[4–102]
EDI C total	57.0 (32.9)	[7–130]	52.0 (32.9)	[1–149]	47.8 (31.2)	[3–128]	44.1 (26.4)	[4–98]
THIN	9.6 (6.7)	[0–21]	9.4 (7.1)	[0–21]	8.9 (7.1)	[0–21]	8.3 (6.9)	[0–21]
BODY	13.0 (8.9)	[0–27]	11.9 (8.1)	[0–27]	10.5 (6.9)	[0–27]	11.4 (8.2)	[0–27]
BUL	1.5 (3.2)	[0–15]	1.9 (3.8)	[0–16]	2.0 (4.8)	[0–21]	1.8 (3.6)	[0–14]
MAT	7.4 (6.3)	[0–24]	7.0 (7.0)	[0–24]	5.8 (6.4)	[0–24]	4.4 (4.6)	[0–21]
PERF	5.3 (4.1)	[0–17]	4.9 (4.2)	[0–15]	5.0 (4.4)	[0–14]	4.3 (3.5)	[0–16]
INTER	8.3 (6.2)	[0–23]	7.0 (6.0)	[0–26]	5.9 (5.6)	[0–22]	5.0 (4.2)	[0–15]
INTER C	4.5 (3.5)	[0–14]	3.9 (3.4)	[0–14]	3.5 (3.5)	[0–13]	3.0 (2.8)	[0–10]
DISTRUST	6.2 (1.2)	[0–18]	4.6 (4.3)	[0–18]	4.4 (3.6)	[0–13]	4.3 (3.0)	[0–11]
INEF	9.5 (7.7)	[0–25]	8.3 (6.7)	[0–25]	7.4 (6.6)	[0–24]	6.7 (6.1)	[0–23]
LSAS total	48.3 (31.3)	[6–128]	33.1 (27.9)	[2–125]	33.2 (29.7)	[1–107]	27.2 (26.3)	[0–116]
FEAR total	25.3 (16.1)	[0–65]	18.9 (14.9)	[0–62]	18.3 (16.6)	[1–64]	15.3 (14.0)	[0–65]
FEAR PERF	14.4 (9.4)	[0–36]	11.4 (9.3)	[0–37]	10.6 (9.4)	[0–38]	9.2 (8.4)	[0–38]
FEAR SOC	11.0 (7.3)	[0–29]	8.3 (7.1)	[0–29]	7.7 (7.7)	[0–28]	6.1 (6.2)	[0–27]
AVOID total	22.9 (16.2)	[2–63]	14.1 (13.3)	[0–63]	14.2 (13.4)	[0–46]	11.9 (12.7)	[0–51]
AVOID PERF	12.25 (9.0)	[1–35]	8.1 (8.4)	[0–38]	7.7 (7.7)	[0–27]	6.8 (7.6)	[0–28]
AVOID SOC	10.7 (8.0)	[0–28]	6.7 (6.8)	[0–29]	6.2 (6.6)	[0–23]	5.1 (5.6)	[0–24]
SCL-90 DEP	1.08 (0.9)	[0–3.2]	0.92 (0.8)	[0–3.2]	0.88 (0.9)	[0–3.5]	0.86 (0.9)	[0–3.1]
SCL-90 ANX	0.74 (0.7)	[0–2.9]	0.63 (0.7)	[0–3.7]	0.59 (0.7)	[0–2.3]	0.52 (0.6)	[0–2.4]

($p = .70$), AN subtype ($p = .70$) or illness duration ($p = .80$), EDI scores (e.g. EDI total score $p = .10$), TAS-20 scores (e.g. TAS-20 total score $p = .09$) or LSAS scores (e.g. LSAS total score $p = .60$).

3.2. Evolution of the association between TAS-20 and LSAS and EDI over time

Individual distributions of scores on the EDI or LSAS and TAS-20 questionnaires, for each time of assessment, are shown in Fig. 1 (1a: TAS-20/EDI; 1b: TAS-20/LSAS). An unconditional but time-specific regression line was added on the graphical display to help gauge variations in their relationships across time. As can be seen, over time, there remains a clear positive association between LSAS or EDI scores and TAS-20 scores, even if the relationship tends to be of greater magnitude at baseline than at 18-month follow-up.

Results from the full model with EDI as the response variable are summarised in Table 2a (parameter estimates and standard errors, significance tests and associated 95% confidence intervals). No significant effect of treatment allocation was found ($\chi^2(1) = 0.88$, $p = 0.349$) and the following analysis is based on the reduced model (without treatment group). Anxiety and depression, anorexia subtype, and TAS-20 scores were found to have a significant effect on EDI scores, as confirmed by significant LR tests at the 5% level. No significant interaction was found between time and TAS-20 ($\chi^2(1) = 2.67$, $p = 0.446$). The effect of time was more clearly apparent after 6 months, with a decrease of about 5 points on the EDI at the end of follow-up. Compared

to average unadjusted correlations observed at the four time points (ranging from 0.560 at 18 months) to 0.687 (inclusion), this analysis confirms a clear relationship between EDI and TAS-20, after taking into account anxiety and depression, and anorexia subtype in the model.

Table 2b presents results from the regression of the predictors of interest against the LSAS scale. Again, treatment allocation appeared non-significant ($\chi^2(1) = 0.61$, $p = 0.434$) and was therefore removed from the full model. Anxiety and depression, as well as TAS-20 proved to be significant at the 5% level (LR tests), but not anorexia subtype. Time of visit showed a highly significant effect ($\chi^2(1) = 35.50$, $p < 0.001$), but the interaction between TAS-20 and time appeared non-significant ($\chi^2(1) = 5.77$, $p = 0.124$). The effect of time can be summarised as a monotonous decrease of varying magnitude in LSAS scores (45.1 points at baseline, 28.8 points at 18 months), with a sharper decrease between inclusion and 6 months (–11.7 points, on average). The association between TAS-20 and LSAS was on average of lesser magnitude, as were pairwise correlations at each visit (ranging from 0.380 at 6 months to 0.556 at 18 months).

3.3. Multivariate two-block analyses of EDI or LSAS and TAS-20

Fig. 2a (EDI/TAS-20) and 2b (LSAS/TAS-20) summarise the main findings for the PLS regression. Each block or questionnaire is depicted as a rectangle and associated subscores are shown as ovals connected to them with arrows,

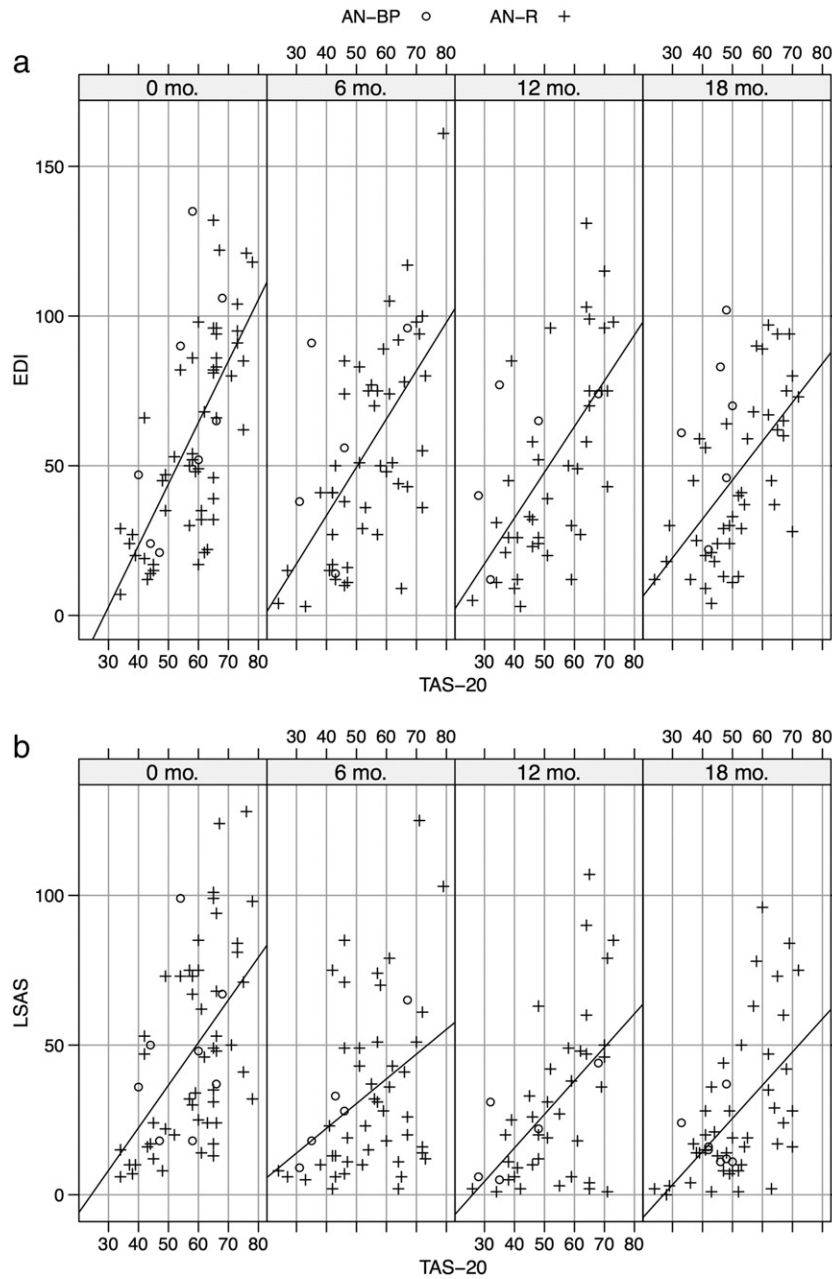


Fig. 1. Joint distribution of TAS-20 and (a) EDI and (b) LSAS scores at each assessment time. AN subtypes are indicated with different symbols (AN-BP: circle; AN-R: cross). An unconditional but time-specific regression line was added on the graphical display to help gauge variations in their relationships across time.

at inclusion (dash and dot arrows) and at 18-month follow-up (plain arrows). Factor loadings between or within blocks are shown on top of each arrow.

At inclusion, the study of TAS-20 and EDI subscore relationships showed that DIF and DDF were the scales contributing the most to explaining their own block when predicting EDI subscores. For the EDI, examination of variable loadings on the first latent component indicated that ineffectiveness (INEF), interoceptive awareness (INTER C), and interpersonal distrust (DISTRUST) were more heavily weighted, in increasing degrees of magnitude (Fig. 2a, dash and dot arrows). The contribution of the variables DIF and

DDF was 0.82 and 1.53, respectively. Overall, TAS-20 subscales explained 43% of their own block whilst accounting for 13% of the EDI block. Canonical correlation between individual factor scores on the two first components was estimated at 0.55.

At 18 months (Fig. 2a, plain arrows), DIF and DDF were again found to considerably contribute to the first latent component, but EOT loadings at 18 months reached 0.40 (compared to -0.02 at inclusion). The pattern of loadings for EDI showed subtle changes too, again with INEF, INTER C, DISTRUST, THIN (drive for thinness) and BODY (body dissatisfaction). The contribution of the variables DIF and

Table 2

Regression coefficients and standard error (SE) with associated p-values (Wald tests) and 95% confidence interval (CI) for models including (a) EDI and (b) LSAS as a response variable.

Term	Estimate (SE)	p-value	95% CI
a)			
Intercept	-5.17 (8.29)	0.534	[-21.57, 11.23]
TAS-20	0.74 (0.15)	<0.001	[0.45, 1.04]
Anxiety/depression	11.46 (1.27)	<0.001	[8.95, 13.98]
Age onset	0.50 (1.22)	0.684	[-1.94, 2.94]
BMI	1.58 (0.84)	0.062	[-0.08, 3.23]
Anorexia subtype	14.81 (6.38)	0.024	[2.04, 27.6]
time: 6 mo	1.44 (2.86)	0.615	[-4.22, 7.11]
time: 12 mo	-2.16 (3.11)	0.49	[-8.31, 3.40]
time: 18 mo	-3.99 (3.00)	0.187	[-9.93, 1.95]
SD subject, 95% CI (ICC)	13.65 [10.44,17.85]	(-0.477)	N = 199
AIC	1694.47		
b)			
Intercept	7.11 (8.79)	0.42	[-10.27, 24.48]
TAS-20	0.60 (0.15)	0.001	[0.30, 0.91]
Anxiety/depression	3.53 (1.33)	0.009	[0.90, 6.17]
Age onset	0.42 (1.63)	0.795	[-2.83, 3.68]
BMI	1.18 (0.86)	0.172	[-0.52, 2.89]
Anorexia subtype	-2.33 (8.44)	0.784	[-19.24, 14.58]
time: 6 mo	-11.75 (2.72)	0.001	[-17.12, -6.37]
time: 12 mo	-14.53 (2.99)	0.001	[-20.45, -8.61]
time: 18 mo	-16.35 (2.88)	0.001	[-22.04, -10.65]
SD subject, 95% CI (ICC)	19.69 [15.75,24.61]	(-0.680)	N = 200
AIC	1720.04		

Standard deviation for random effects (Subject) and 95% CI for intra-class correlations are reported at the bottom of each table.

DDF was 1.06 and 1.18, respectively. Redundancy analysis showed that TAS-20 subscales explained 60% of their own block whilst accounting for 18% of the EDI block, with a similar first canonical correlation of 0.55.

At inclusion, the study of TAS-20 and LSAS subscore relationships showed that DDF was the scale contributing most to explaining its own block when predicting LSAS subscores; DIF and EOT loadings were found to be above 0.30 in contrast to the preceding instance (TAS-20 and EDI) where EOT loading was almost zero (Fig. 2b, dash and dot arrows). For the LSAS, examination of variable loadings on the first latent component indicated that no subscore was particularly prominent, and that all contributed equally to the model. Redundancy analysis showed that TAS-20 subscales explained 44% of their own block whilst accounting for 7% of the LSAS block. Canonical correlation between individual factor scores on the two first components was estimated at 0.41.

At 18 months (Fig. 2b, plain arrows), study of TAS-20 and LSAS subscore relationships showed a similar pattern to that observed at inclusion. Redundancy analysis showed that TAS-20 subscales explained 59% of their own block whilst accounting for 13% of the LSAS block. Canonical correlation between individual factor scores on the two first components was estimated at 0.50.

4. Discussion

This prospective study on a homogeneous sample of AN adolescent girls (see inclusion criteria) was intended to clarify links between alexithymia and two major characteristics in AN: the level of eating symptoms and social anxiety. The initial psychometric and clinical data show that the study sample was representative of severe forms of AN (i.e. requiring hospitalisation for life-threatening physical and/or mental states, including BMI below 14 and/or rapid weight loss and/or compromised vital functions, severe depression, high suicide risk, chronic under-nutrition with low weight, and failure of out-patient care) and this could account for the fact the follow-up data show that less than a quarter of the sample achieved good or intermediate medium-term outcome (18 months in this instance, using Russell et al. [57] categories) (see [53] and [65] for further discussion on similar outcome categories at 1 and 2 years of follow up in AN adolescents). In line with reports in the literature on the presence of AN subtypes in relation to age [66], our sample of adolescent girls for the large majority comprised patients with restrictive-type AN, and these subjects were younger than the AN-BP subjects.

As expected, at inclusion, the mean score for alexithymia in this population was in the average range of those reported in other studies (range between 53.3 and 64.1 in [12,25,28,30,33]), and very close to the scores reported in the two studies using the TAS-20 that specifically concerned a population of adolescent girls with AN [17,18], but which did not however distinguish AN subtypes (range [51.5–56.4]). From a categorical viewpoint, using the original threshold scores (rather than those recommended in the French language version of the TAS-20, which are lower [60]), almost half the patients belonged to the alexithymic category.

Regarding follow-up, despite the relative drop in alexithymia scores at 18 months, the mean score on the TAS-20 was still well above means scores found for control populations (range between 36.8 and 46.6 in [8,12,18,25,30,33,38]). Moreover, the EOT scores were relatively stable over time, with no more than 1 point of variation from the baseline (mean, 18.4, SD, 4.5) to 18-month follow up (mean, 17.7, SD, 4.2). This temporal stability was confirmed by the absence of association between EOT scores and time using a mixed-effect model ($p = .252$) and is consistent with other studies in other clinical groups (e.g. [67]). Of an important note, our statistical approach enabled to show that these results cannot be attributable to changes in depression and anxiety scores. Hence, this study adds to the literature suggesting that alexithymia could be a vulnerability factor in certain mental disorders (e.g. alcohol dependent patients [67]), and is in favour of an alexithymic trait in anorexia nervosa.

However these results do not enable the conclusion that alexithymia is linked to the severity of eating and interpersonal symptoms in AN. Thus an approach using mixed-effects models included in the present study enabled

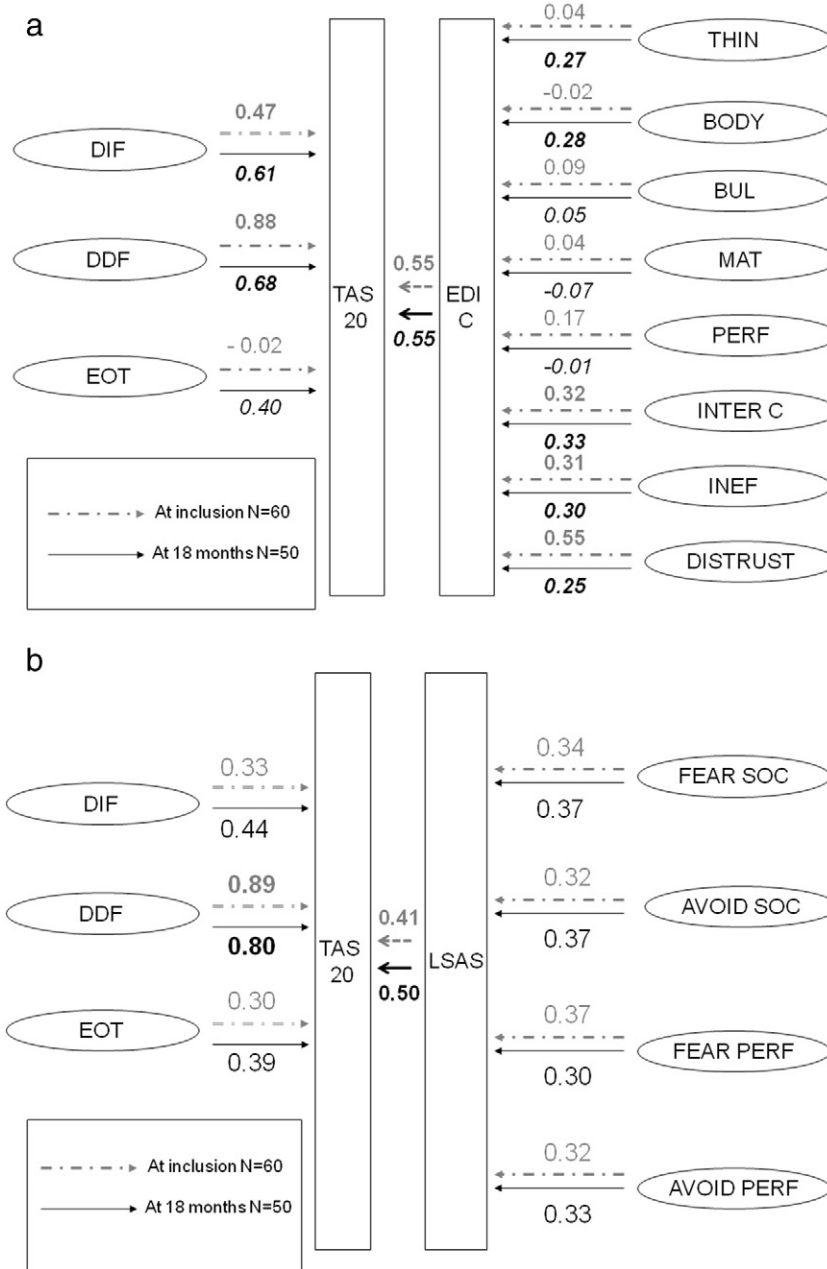


Fig. 2. Variable loadings for PLS regressions with TAS-20 and (a) EDI or (b) LSAS. Each block or questionnaire is depicted as a rectangle and associated subscores are shown as ovals connected to them with arrows, at inclusion (dash and dot arrows) and at 18-month follow-up (plain arrows).

this link to be highlighted. There is indeed a close association between alexithymia and clinical severity in AN, persisting over time, and independent from the impact of dysphoric affects and nutritional status. It is important to note that this type of difficulty in interoception and emotional introspection, which characterises alexithymia, appears to be implicated not only in the symptoms specifically related to food and eating, but also in the social difficulties of anorexic adolescent girls.

At this stage of the analyses, we were unable to determine whether it is specifically certain dimensions of alexithymia that are involved. This issue was then clarified by way of

multivariate regressions (PLS in this case). Compared to simple correlation approaches, PLS regression aims to construct linear combinations of subscale scores (subjected to a constraint of maximising covariance), enabling in turn the assessment of their relative contributions to the overall association across composite scores. In the present analyses, taking depression and anxiety (as measured by the SCL-90) into account, a reliable association was found between TAS-20 and EDI linear composites, where difficulties identifying and describing feelings on the one hand, and interoceptive awareness, feelings of ineffectiveness and of interpersonal distrust on the other were the main contributors of this

association. These results back up those reported by other studies using the same measure, but that did not take account of the potentially confounding effects of depression [7,28], nor of the partial overlap of TAS-20 and the interoceptive awareness subscale [7,35].

Moreover, we were able to show that this association is lasting, with the same patterns of association at 18 months, with an additional contribution from two dimensions that are directly linked to eating symptoms: drive for thinness and body dissatisfaction. Our study in a clinical population is the first to have evidenced a direct link between dimensions related to eating disorders (as measured with the EDI) and alexithymia at a distance from the severe AN episode. Using another measure of eating symptoms (EAT [68]), a study on 151 individuals with a current eating disorder (including 69 AN in acute phase) found a positive correlation between the global alexithymia score (TAS-20) and the total score for eating symptoms, but this correlation did not remain once the effects of depression and anxiety were taken into account [12]. It would be interesting to replicate the results of our follow-up study in a larger population to confirm the stable association of alexithymia with eating symptoms.

Whilst the analyses using the EDI provided arguments in favour of the impact of the interpersonal effects of alexithymia on the difficulties reported by AN subjects, one of the specific features of this study is that it went further in the exploration of this issue by using an instrument assessing social anxiety and avoidance. Overall, the multivariate regression (PLS) showed a reliable association between TAS-20 and LSAS linear composites, whereby, on the one hand, all the TAS-20 dimensions appeared to play a part (but more particularly difficulties describing feelings) and on the other, all the LSAS dimensions of anxiety and avoidance, independently from the type of situation encountered (interpersonal or performance). The same pattern of association was observed at 18 months, apparently with a stronger alexithymia/social anxiety relationship (as shown by canonical correlations and redundancy analyses), this being so independently from the overall relative decrease in scores on the LSAS. This result is consistent with recent literature according to which alexithymia, seen as a deficit in emotional regulation, can critically influence social behaviours [41,42]. Our results are also in line with a study on a sample of students [51], which pinpointed the dimension difficulties describing feelings in relation to levels of social anxiety and avoidance of the situations that cause it. Of interest too, a recent study in adolescent girls at risk for excessive weight gain and binge eating disorder established that interpersonal deficit characteristics of eating disorders are related to the level of alexithymia, which in turn are related to the level of depression [69].

H. Bruch considered AN as a means for a subject of bringing order to his or her own universe, and an attempt to “freeze” time and relationships [3]. Personal mistrust has been identified as a vulnerability factor for AN [70], and appears associated with poor prognosis [71], in the same

manner as anxiety and social phobia [72]. Bagby and Taylor have suggested that “lacking knowledge of their own emotional experiences, alexithymic individuals cannot readily imagine themselves in another person’s situation and are consequently unempathetic and ineffective in modulating the emotional states of others” [5]. In the present study, alexithymia, interpersonal distrust, social anxiety and avoidance were related. Interestingly, Ridout et al. [73] reported an association between vulnerability towards disordered eating, alexithymia and emotional labelling abilities amongst non-clinical participants. There are still too few studies on this topic, but results as a whole suggest that in AN, alexithymia could lead patients to withdraw from others and thus deprive themselves of the interpersonal relationships that could provide resources to help them overcome their illness.

4.1. Limitations and conclusion

A major limitation of the present study is the use of the TAS-20 to measure alexithymia. First, although this instrument is increasingly used in samples of adolescents [74–76] and despite the fact the French version of the TAS-20 has been suggested to have sufficient construct validity in a non-clinical Swiss adolescent sample [77], a more recent study concluded its use with teenage respondents is not recommended without appropriate adaptation [78]. Moreover, though this scale is the most widely used self-reports of alexithymia (and it was the one internationally recommended and the only one available for French speaking samples when our study was initiated at the end of the 90’s; see [53]), it accounts for only three of the core alexithymia dimensions [79]. This is an important issue since the different dimensions of alexithymia can act differently compared with the measure as a whole, as exemplified again in the present study. Moreover, numerous research findings raise the question whether it measures negative affects rather than alexithymia itself in mental disorders (see [22,41] for a recent discussion on this issue). To overcome these limitations and confirm our results, future studies could be conducted using the Bermond–Vorst Alexithymia Questionnaire (a self-report assessing five core alexithymia dimensions and which has been found to be less sensitive to negative affects [80]) or observer-rated alexithymia measures, such as the Observer Alexithymia Scale that has been found psychometrically valid in adolescents and young adults with an eating disorder or with a cannabis use disorder [8]. Regarding the evaluation of negative affects, their potential confounding effects were accounted for in the present study using the corresponding SCL-90 Depression and Anxiety scores only. Hence, our results need to be replicated using other assessments of negative affects. Other studies are also required to confirm that the difficulties in recognising and communicating emotions do contribute to the poor emotional/interpersonal skills in less severe AN patients (e.g. outpatients and sub-threshold AN), and to determine whether these difficulties should constitute particular therapeutic targets. Finally, despite the fact longitudinal studies can help to understand whether

alexithymia is a core factor in the maintenance of the disorder, only prospective developmental cohorts could ascertain it is indeed involved in the onset of the disorder.

With these limitations in mind, in this longitudinal study conducted amongst adolescents with severe forms of AN that required hospitalisation, alexithymia proved to be closely linked to characteristics of the illness that are both intra- and inter-personal, this being so even at a distance from the acute episode. The results corroborate the implication of alexithymia in the severity of a number of the essential eating disorder domains. This study fosters to look beyond ‘spotty’ symptoms in AN (such as severe emaciation or body image distortions) and to encourage clinicians to identify patients who particularly struggle with emotional introspection and regulation. Unlike the EDI, most of the instruments (self-reports or semi-structured interviews) used for the assessment of the psychopathology associated with an eating disorder do not investigate these difficulties. We suggest it may be clinically relevant to train clinicians to probe AN patients emotional skills, for instance by using an evaluation grid such as the Observer Alexithymia Scale which covers different facets of alexithymia. As regards therapeutic interventions, there are indeed psycho-educational methods [81] that can help patients understand and solve their communication difficulties, enabling them to gain confidence in their abilities to interact with others. Moreover, independently from nutritional aspects, treatment programmes favouring the understanding and expression of emotions as well as communicating with others effectively (see for instance [82–84]) could contribute to gaining emotion regulation skills and avoiding relational isolation and chronic forms of severe AN.

References

- [1] Arcelus J, Mitchell A, Wales J, Nielsen S. Mortality rates in patients with anorexia nervosa and others eating disorders. *Arch Gen Psychiatry* 2011;68:724-31.
- [2] Schmidt U, Treasure J. Anorexia nervosa: valued and visible. A cognitive-interpersonal maintenance model and its implications for research and practice. *Br J Clin Psychol* 2006;45(Pt 3):343-66.
- [3] Bruch H. *Eating disorders: obesity, anorexia nervosa, and the person within*. New York: Basic Books; 1973.
- [4] Skarderud F. Bruch revisited and revised. *Eur Eat Disord Rev* 2009;17(2):83-8.
- [5] Taylor GJ, Bagby RM, Parker JDA. *Disorders of affect regulation: alexithymia in medical and psychiatric illness*. New York, NY, USA: Cambridge University Press; 1997.
- [6] Abbate-Daga G, Delsedime N, Nicotra B, Giovannone C, Marzola E, Amianto F, et al. Psychosomatic syndromes and anorexia nervosa. *BMC Psychiatry* 2013;13(1):14.
- [7] Beales DL, Dolton R. Eating disordered patients: personality, alexithymia, and implications for primary care. *Br J Gen Pract* 2000;50(450):21-6.
- [8] Berthoz S, Perdereau F, Godart N, Corcos M, Haviland MG. Observer- and self-rated alexithymia in eating disorder patients: levels and correspondence among three measures. *J Psychosom Res* 2007;62(3):341-7.
- [9] Bydlowski S, Corcos M, Jeammet P, Paterniti S, Berthoz S, Laurier C, et al. Emotion-processing deficits in eating disorders. *Int J Eat Disord* 2005;37(4):321-9.
- [10] Bourke MP, Taylor GJ, Parker JD, Bagby RM. Alexithymia in women with anorexia nervosa. A preliminary investigation. *Br J Psychiatry* 1992;161:240-3.
- [11] Corcos M, Guilbaud O, Speranza M, Paterniti S, Loas G, Stephan P, et al. Alexithymia and depression in eating disorders. *Psychiatry Res* 2000;93(3):263-6.
- [12] Espina A, Ortego A, Ochoa de Alda I, Olariaga LJ, Juaniz M. Alexithymia and its relationships with anxiety and depression in eating disorders. *PAID* 2004;36:321-31.
- [13] Franz M, Popp K, Schaefer R, Sitte W, Schneider C, Hardt J, et al. Alexithymia in the German general population. *Soc Psychiatry Psychiatr Epidemiol* 2008;43(1):54-62.
- [14] Mattila AK, Salminen JK, Nummi T, Joukamaa M. Age is strongly associated with alexithymia in the general population. *J Psychosom Res* 2006;61(5):629-35.
- [15] Salminen JK, Saarijarvi S, Aarela E, Toikka T, Kauhanen J. Prevalence of alexithymia and its association with sociodemographic variables in the general population of Finland. *J Psychosom Res* 1999;46(1):75-82.
- [16] Schmidt U, Jiwany A, Treasure J. A controlled study of alexithymia in eating disorders. *Compr Psychiatry* 1993;34(1):54-8.
- [17] Lule D, Schulze UM, Bauer K, Scholl F, Muller S, Fladung AK, et al. Anorexia nervosa and its relation to depression, anxiety, alexithymia and emotional processing deficits. *Eat Weight Disord* 2014;19(2):209-16.
- [18] Zonneville-Bender MJ, van Goozen SH, Cohen-Kettenis PT, van Elburg A, van Engeland H. Do adolescent anorexia nervosa patients have deficits in emotional functioning? *Eur Child Adolesc Psychiatry* 2002;11(1):38-42.
- [19] Honkalampi K, Hintikka J, Tanskanen A, Lehtonen J, Viinamaki H. Depression is strongly associated with alexithymia in the general population. *J Psychosom Res* 2000;48(1):99-104.
- [20] Kim J, Lee S, Rim H, Kim H, Bae G, Chang S. The relationship between alexithymia and general symptoms of patients with depressive disorders. *Psychiatry Invest* 2008;5(3):179-85.
- [21] Marchesi C, Brusamonti E, Maggini C. Are alexithymia, depression, and anxiety distinct constructs in affective disorders? *J Psychosom Res* 2000;49(1):43-9.
- [22] Marchesi C, Ossola P, Tonna M, De Panfilis C. The TAS-20 more likely measures negative affects rather than alexithymia itself in patients with major depression, panic disorder, eating disorders and substance use disorders. *Compr Psychiatry* 2014;55(4):778-84.
- [23] Vanheule S, Desmet M, Verhaeghe P, Bogaerts S. Alexithymic depression: evidence for a depression subtype? *Psychother Psychosom* 2007;76(5):315-6.
- [24] Deborde AS, Berthoz S, Wallier JM, Fermanian J, Falissard B, Jeammet P, et al. The Bermond-Vorst Alexithymia Questionnaire cutoff scores: a study in eating-disordered and control subjects. *Psychopathology* 2008;41(1):43-9.
- [25] Guttman H, Laporte L. Alexithymia, empathy, and psychological symptoms in a family context. *Compr Psychiatry* 2002;43(6):448-55.
- [26] Kessler H, Schwarze M, Filipic S, Traue HC, von Wietersheim J. Alexithymia and facial emotion recognition in patients with eating disorders. *Int J Eat Disord* 2006;39(3):245-51.
- [27] Pascual A, Etxebarria I, Soledad Cruz M. Emotional differences between women with different types of eating disorders. *Int J Psychol Psychol Ther* 2011;11(1):1-11.
- [28] Taylor GJ, Parker JD, Bagby RM, Bourke MP. Relationships between alexithymia and psychological characteristics associated with eating disorders. *J Psychosom Res* 1996;41(6):561-8.
- [29] Zonneville-Bender MJ, van Goozen SH, Cohen-Kettenis PT, van Elburg A, de Wildt M, Stevelmans E, et al. Emotional functioning in anorexia nervosa patients: adolescents compared to adults. *Depress Anxiety* 2004;19(1):35-42.
- [30] de Zwaan M, Biener D, Bach M, Wiesnagrotzki S, Stacher G. Pain sensitivity, alexithymia, and depression in patients with eating disorders: are they related? *J Psychosom Res* 1996;41(1):65-70.

- [31] Deborde AS, Berthoz S, Godart N, Perdereau F, Corcos M, Jeammet P. Relations between alexithymia and anhedonia: a study in eating disordered and control subjects. *Encéphale* 2006;32:83-91.
- [32] Gilboa-Schechtman E, Aynon L, Zubery E, Jeczmiern P. Emotional processing in eating disorders: specific impairment or general distress related deficiency? *Depress Anxiety* 2006;23(6):331-9.
- [33] Parling T, Mortazavi M, Ghaderi A. Alexithymia and emotional awareness in anorexia nervosa: time for a shift in the measurement of the concept? *Eat Behav* 2010;11(4):205-10.
- [34] Rozenstein MH, Latzer Y, Stein D, Eviatar Z. Perception of emotion and bilateral advantage in women with eating disorders, their healthy sisters, and nonrelated healthy controls. *J Affect Disord* 2011;134(1–3):386-95.
- [35] Sexton M, Sunday S, Hurt S, H KA. The relationship between alexithymia, depression, and axis II psychopathology in eating disorder inpatients. *Int J Eat Disord* 1998;23(3):277-86.
- [36] De Berardis D, Carano A, Gambi F, Campanella D, Giannetti P, Ceci A, et al. Alexithymia and its relationships with body checking and body image in a non-clinical female sample. *Eat Behav* 2007;8(3):296-304.
- [37] Quinton S, Wagner HL. Emotional expression, alexithymia and characteristics associated with eating psychopathology in nonclinical women. *PAID* 2005;38:1163-73.
- [38] Speranza M, Loas G, Wallier J, Corcos M. Predictive value of alexithymia in patients with eating disorders: a 3-year prospective study. *J Psychosom Res* 2007;63(4):365-71.
- [39] Bagby RM, Parker JD, Taylor GJ. The twenty-item Toronto Alexithymia Scale—I. Item selection and cross-validation of the factor structure. *J Psychosom Res* 1994;38(1):23-32.
- [40] Garner D, Olmsted M, Polivy J. Development and validation of a multidimensional eating disorder inventory for anorexia nervosa and bulimia. *Int J Eat Disord* 1983;2:15-34.
- [41] Berthoz S, Pouga L, Wessa M. Alexithymia from the Social Neuroscience Perspective. In: Decety J, & Cacioppo J, editors. *Handbook of Social Neuroscience*. Cambridge: CUP; 2011. p. 906-34.
- [42] Grynberg D, Chang B, Corneille O, Mauraige P, Vermeulen N, Berthoz S, et al. Alexithymia and the processing of emotional facial expressions (EFEs): systematic review, unanswered questions and further perspectives. *PLoS One* 2012;7(8):e42429.
- [43] Godart NT, Perdereau F, Curt F, Lang F, Venisse JL, Halfon O, et al. Predictive factors of social disability in anorexic and bulimic patients. *Eat Weight Disord* 2004;9(4):249-57.
- [44] Zucker NL, Losh M, Bulik CM, LaBar KS, Piven J, Pelphrey KA. Anorexia nervosa and autism spectrum disorders: guided investigation of social cognitive endophenotypes. *Psychol Bull* 2007;133(6):976-1006.
- [45] Tchanturia K, Davies H, Harrison A, Fox JR, Treasure J, Schmidt U. Altered social hedonic processing in eating disorders. *Int J Eat Disord* 2012;45(8):962-9.
- [46] Godart NT, Flament MF, Lecrubier Y, Jeammet P. Anxiety disorders in anorexia nervosa and bulimia nervosa: co-morbidity and chronology of appearance. *Eur Psychiatry* 2000;15(1):38-45.
- [47] Godart NT, Flament MF, Curt F, Perdereau F, Lang F, Venisse JL, et al. Anxiety disorders in subjects seeking treatment for eating disorders: a DSM-IV controlled study. *Psychiatry Res* 2003;117(3):245-58.
- [48] Kaye WH, Bulik CM, Thornton L, Barbarich N, Masters K. Comorbidity of anxiety disorders with anorexia and bulimia nervosa. *Am J Psychiatry* 2004 Dec;161(12):2215-21.
- [49] Cox BJ, Swinson RP, Shulman ID, Bourdeau D. Alexithymia in panic disorder and social phobia. *Compr Psychiatry* 1995;36(3):195-8.
- [50] Fukunishi I, Kikuchi M, Wogan J, Takubo M. Secondary alexithymia as a state reaction in panic disorder and social phobia. *Compr Psychiatry* 1997;38(3):166-70.
- [51] Dalbudak E, Evren C, Aldemir S, Coskun KS, Yildirim FG, Ugurlu H. Alexithymia and personality in relation to social anxiety among university students. *Psychiatry Res* 2013;209(2):167-72.
- [52] Soykan C, Ozguven HD, Gencoz T. Liebowitz Social Anxiety Scale: the Turkish version. *Psychol Rep* 2003;93(3 Pt 2):1059-69.
- [53] Godart N, Berthoz S, Curt F, Perdereau F, Rein Z, Wallier J, et al. A randomized controlled trial of adjunctive family therapy and treatment as usual following inpatient treatment for anorexia nervosa adolescents. *PLoS One* 2012;7(1):e28249.
- [54] Lecrubier Y, Sheehan D, Weiller E, Amorin P, Bonora I, Janavs J, et al. The MINI International Neuropsychiatric Interview (MINI) a short diagnostic structured interview: reliability and validity according to the CIDI. *Eur Psychiatry* 1999;12:224-31.
- [55] Jeammet P, Brechon G, Payan C, Gorge A, Fermanian J. The outcome of anorexia nervosa: a prospective study of 129 patients evaluated at least 4 years after their first admission. *Psychiatr Infant* 1991;34:381-442.
- [56] Morgan HG, Hayward AE. Clinical assessment of anorexia nervosa. The Morgan-Russell outcome assessment schedule. *Br J Psychiatry* 1988;152:367-71.
- [57] Russell G, Szmukler G, Dare C, Eisler I. An evaluation of family therapy in anorexia nervosa and bulimia nervosa. *Arch Gen Psychiatry* 1987;44:1047-56.
- [58] Liebowitz MR. Social phobia. *Mod Probl Pharmacopsychiatry* 1987;22:141-73.
- [59] Yao SN, Note I, Fanget F, Albuissou E, Bouvard M, Jalenques I, et al. Social anxiety in patients with social phobia: validation of the Liebowitz social anxiety scale: the French version. *Encéphale* 1999;25(5):429-35.
- [60] Loas G, Otmani O, Fremaux D, Lecercle C, Dufloy M, Delahousse J. External validity, reliability and basic score determination of the Toronto Alexithymia Scales (TAS and TAS-20) in a group of alcoholic patients. *Encéphale* 1996;22(1):35-40.
- [61] Loas G, Otmani O, Verrier A, Fremaux D, Marchand MP. Factor analysis of the French version of the 20-Item Toronto Alexithymia Scale (TAS-20). *Psychopathology* 1996;29(2):139-44.
- [62] Criquillon-Doulet S, Divac S, Dardennes R, Guelfi J. Le Eating Disorder Inventory (EDI). In: Guelfi J, Gaillac V, & Dardennes R, editors. *Psychopathologie quantitative*. Paris: Masson; 1995. p. 249-60.
- [63] Derogatis LR, Lipman RS, Covi L. SCL-90: an outpatient psychiatric rating scale—preliminary report. *Psychopharmacol Bull* 1973;9(1):13-28.
- [64] R Development Core Team. R: a language and environment for statistical computing. Vienna: R Foundation for Statistical Computing; 2010.
- [65] Gowers SG, Clark AF, Roberts C, Byford S, Barrett B, Griffiths A, et al. A randomised controlled multicenter trial of treatments for adolescent anorexia nervosa including assessment of cost-effectiveness and patient acceptability—the TOuCAN trial. *Health Technol Assess* 2010;14(15):1-98.
- [66] Laessle RG, Wittchen HU, Fichter MM, Pirke KM. The significance of subgroups of bulimia and anorexia nervosa: life time frequency of psychiatric disorders. *Int J Eat Disord* 1989;8:569-74.
- [67] de Timary P, Luts A, Hers D, Luminet O. Absolute and relative stability of alexithymia in alcoholic inpatients undergoing alcohol withdrawal: relationship to depression and anxiety. *Psychiatry Res* 2008;157(1–3):105-13.
- [68] Garner D, Garfinkel P. The Eating Attitudes Test: an index of the symptoms of anorexia nervosa. *Psychol Med* 1979;9(2):273-9.
- [69] Berger SS, Elliott C, Ranzenhofer LM, Shomaker LB, Hannallah L, Field SE, et al. Interpersonal problem areas and alexithymia in adolescent girls with loss of control eating. *Compr Psychiatry* 2014;55(1):170-8.
- [70] Strober M. Personality factors in anorexia nervosa. *Pediatrician* 1983;12(2–3):134-8.
- [71] Rigaud D, Pennacchio H, Bizeul C, Reveillard V, Verges B. Outcome in AN adult patients: a 13-year follow-up in 484 patients. *Diabetes Metab* 2011;37(4):305-11.
- [72] Keel PK, Dorer DJ, Franko DL, Jackson SC, Herzog DB. Postremission predictors of relapse in women with eating disorders. *Am J Psychiatry* 2005;162(12):2263-8.

- [73] Ridout N, Thom C, Wallis DJ. Emotion recognition and alexithymia in females with non-clinical disordered eating. *Eat Behav* 2009;11(1):1-5.
- [74] Burba B, Oswald R, Grigaliunien V, Neverauskiene S, Jankuviene O, Chue P. A controlled study of alexithymia in adolescent patients with persistent somatoform pain disorder. *Can J Psychiatry* 2006;51(7):468-71.
- [75] Karukivi M, Hautala L, Korpelainen J, Haapasalo-Pesu KM, Liuksila PR, Joukamaa M, et al. Alexithymia and eating disorder symptoms in adolescents. *Eat Disord* 2010;18(3):226-38.
- [76] Karukivi M, Hautala L, Kaleva O, Haapasalo-Pesu KM, Liuksila PR, Joukamaa M, et al. Alexithymia is associated with anxiety among adolescents. *J Affect Disord* 2010;125(1–3):383-7.
- [77] Zimmermann G, Quartier V, Bernard M, Salamin V, Maggiori C. The 20-item Toronto alexithymia scale: structural validity, internal consistency and prevalence of alexithymia in a Swiss adolescent sample. *Encéphale* 2007;33(6):941-6.
- [78] Parker JD, Eastabrook JM, Keefer KV, Wood LM. Can alexithymia be assessed in adolescents? Psychometric properties of the 20-item Toronto Alexithymia Scale in younger, middle, and older adolescents. *Psychol Assess* 2010;22(4):798-808.
- [79] Sifneos PE. Alexithymia: past and present. *Am J Psychiatry* 1996;153(7 Suppl):137-42.
- [80] Vorst HCM, Bermond B. Validity and reliability of the Bermond & Vorst Alexithymia Questionnaire. *PAID* 2001;30(3):413-34.
- [81] Storch M, Keller F, Weber J, Spindler A, Milos G. Psychoeducation in affect regulation for patients with eating disorders: a randomized controlled feasibility study. *Am J Psychother* 2011;65(1):81-93.
- [82] Money C, Genders R, Treasure J, Schmidt U, Tchanturia K. A brief emotion focused intervention for inpatients with anorexia nervosa: a qualitative study. *J Health Psychol* 2011;16(6):947-58.
- [83] Wildes J-E, Marcus M-D. Development of emotion acceptance behavior therapy for anorexia nervosa: a case series. *Int J Eat Disord* 2011;44(5):421-7.
- [84] Murphy R, Straebler S, Basden S, Cooper Z, Fairburn CG. Interpersonal psychotherapy for eating disorders. *Clin Psychol Psychother* 2012;19:150-8.