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Published version:

DOI:10.1016/j.jad.2020.05.012

The role of alexithymia in social cognition:

Evidence from a non-clinical population

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Abstract

Background

Alexithymia is a personality construct characterised by difficulty in identifying and describing one's emotions. We investigated whether people with alexithymia, who struggle with emotion-processing abilities, have diminished emotion-related social cognitive competencies, where social cognition encompasses the set of abilities that allows one to navigate one's social environment.

Methods

We assessed alexithymia and four components of social cognition: recognition of others' emotions, representation of others' affective and cognitive mental states, empathy, and regulation of one's own feelings. We investigated whether alexithymia could significantly predict each of these components, beyond the effect of other individual difference variables (i.e., anxiety/depressive symptoms), which have been previously associated with both social cognition and alexithymia.

Two hundred six participants were recruited. Multiple hierarchical regression analyses were performed to assess the possible relationships between alexithymia and social cognition skills.

Results

Alexithymia significantly predicted emotion recognition, empathy, and emotional regulation, even after controlling for the effect of potentially competing factors (i.e., anxiety/depressive symptoms). Alexithymia did not predict representation of others' affective and cognitive mental states.

Limitations

The present study adopted a cross-sectional design, which does not permit us to draw firm conclusions about the causality of the emergent relationships.

Conclusions

These data provide support for the argument that recognising others' emotions and feelings relies on the ability to identify correctly one's own feelings. Our results also indicate the importance of taking into consideration individual differences in levels of alexithymia when investigating social cognition in non-clinical populations, as alexithymia appears to be clearly related to social cognitive functioning.

Keywords: Alexithymia; Emotional functioning; Non-clinical population; Social cognition; Theory of Mind.

1. Introduction

Alexithymia is a multidimensional construct, characterised by difficulty in identifying and describing feelings, difficulty in distinguishing between feelings and bodily sensations of emotional arousal, restricted imagination processes, and an externally oriented cognitive style (Sifneos, 1972).

In recent years growing attention has been paid to the assessment and investigation of alexithymia in both clinical and non-clinical populations. Alexithymia has been shown to be associated with several clinical conditions such as depression, schizophrenia, autism spectrum disorder, substance and alcohol abuse, eating disorders, neurodegenerative disorders, and chronic pain conditions (Adenzato et al., 2012; Di Tella and Castelli, 2016; Dorard et al., 2017; Gaigg et al., 2018; Sturm and Levenson, 2011; Taylor and Bagby, 2004; Thorberg et al., 2009; Van't Wout et al., 2007). Within the general population, alexithymia is thought to exist on a continuum, with varying degrees of severity and rates that range from 9% to 17% for men and from 5% to 10% for women (Mattila et al., 2007; Salminen et al., 1999). Neuroimaging task-free studies have shown in the non-clinical population a neurophysiological substrate of core features of alexithymia characterised by a diminished connectivity in brain areas involved in emotional awareness and self-referential processing, and by a stronger functional connectivity in brain areas involved in sensory input and control of emotion (Imperatori et al., 2016; Liemburg et al., 2012).

The available evidence highlights a link between alexithymic traits and deficits in the processing of other people's emotions and mental states, in both healthy individuals and clinical populations (e.g., Grynberg et al., 2012; Moriguchi et al., 2006; Prkachin et al., 2009). The ability to decipher information about the intentions and emotional states of others is part of the so-called social cognition domain. Social cognition skills allow individuals to construct mental representations of the relations that exist between oneself and others and to flexibly use these representations to implement appropriate social interactions (Adolphs, 2001). Examples of these abilities are both the capacity to represent others' intentions and beliefs (i.e., Theory of Mind, ToM; Enrici et al., 2019; Premack and Woodruff, 1978; Tettamanti et al., 2017) and the ability to share and recognise the emotions of other people (Decety and Jackson, 2004; Di Tella et al., 2015; Lieberman, 2007).

Social cognition is a multifaceted construct consisting of different and dissociable, but interrelated processes. Different authors have discussed this issue by adopting complementary levels of analysis that can be useful in identifying the main features that characterise social cognitive processes. For example, Adolphs (2009) pointed out that these processes are grouped into two broad categories, those related to automatic processing driven more by the stimuli and those related to controlled processing driven more by the person's goals and intentions. McDonald (2013) made a distinction between 'hot' processes, including emotion perception and the ability to empathize, and 'cold' processes, which reflect the ability to infer the beliefs, feelings, and intentions of others, whereas Ochsner (2008) proposed a 'social-emotional processing stream' to refer to the set of psychological and neural processes that encode socially and emotionally relevant inputs, represent their meaning, and guide responses to them.

Since social cognition abilities require individuals to think about, recognise, and understand emotions and mental states, it is likely that people who struggle with emotion-processing abilities will perform poorly on social cognition tasks. Indeed, the presence of alexithymia has been found to be associated with reduced social cognition skills, including the recognition of others' emotional facial expressions (Brewer et al., 2015; Di Tella et al., 2018; Pedrosa et al., 2009), representation of other people's mental states (both affective and cognitive; Demers and Koven, 2015; Subic-Wrana et al., 2010), and empathy (Grynberg et al., 2010). For example, individuals with alexithymia have been found to show diminished ability to detect emotional facial expressions, in particular for sadness, anger, and fear (Prkachin et al., 2009; Reker et al., 2010). Similarly, other studies have highlighted negative associations between alexithymia and the recognition of others' affective mental states (Demers and Koven, 2015).

Although there appears to be some convergence of results, several discrepancies regarding emotion processing in alexithymia have also been described, with some authors finding mixed results (e.g., Montebarocci et al., 2011), and others reporting no significant difference between alexithymic and non-alexithymic individuals in the ability to recognise others' emotional facial expressions (e.g., Berenbaum and Prince, 1994; Mayer et al., 1990) or affective mental states (Lane et al., 2015). Given this uncertain evidence, further studies are needed to clarify the social cognitive profile of alexithymic individuals.

One of the major problems in investigating social cognition in alexithymic individuals is a circumscribed approach that does not take into account the different components of social cognition (Enrici et al., 2015; Happé et al., 2017). Indeed, the majority of previous studies have been limited by only considering one aspect of social cognition (e.g. emotion recognition but not mental state understanding). Different components of social cognition might be differentially affected by the presence of alexithymia, so that it is essential to use multiple instruments to assess all areas of social cognition in the same individuals.

What is more, other individual difference variables, such as the presence of anxiety/depressive symptoms, have been extensively associated with both alexithymia (Hendryx et al., 1991; Honkalampi et al., 2000; Mattila et al., 2006; Parker et al., 1991; Picardi et al., 2011) and social cognition abilities (Contardi et al., 2013; Ehring et al., 2010; Garnefski and Kraaij, 2006; Hoffmann et al., 2016; Wolkenstein et al., 2011). Therefore, any associations between alexithymia and social cognition could feasibly be due to these factors and it is essential to control for the effect of these potentially competing predictors, when assessing the relationship between alexithymia and social cognition.

Finally, previous research has investigated the relationships between alexithymia and social cognition by focusing in particular on clinical populations. Despite the attempts to control for the effect of alexithymia alone, it can be difficult to evaluate the unique contribution of alexithymia in explaining the performance on social cognition tasks in such populations, given the role that other comorbid neurological and/or psychological symptoms may play in social cognition ability (Grynberg et al., 2012). Thus, to avoid these possible confounding factors, for the present study we recruited only non-clinical participants, that is, those not diagnosed with clinical disorders.

On these bases, the present study aimed to investigate the relationship between alexithymia and social cognition skills in a sample of non-clinical individuals. In order to achieve this goal, we first assessed alexithymia and four different components of social cognition: (1) recognition of others' emotions; (2) recognition and representation of other people's affective and cognitive mental states; (3) empathy; and (4) regulation of one's own emotions. Second, we investigated whether alexithymia significantly predicted each of these dimensions, beyond the effect of anxiety/depressive symptoms.

2. Methods

2.1. Participants

Three hundred participants were recruited for the present study through advertisements. The exclusion criteria were as follows: less than 18 years old, low educational level (<5 years) or insufficient knowledge of the Italian language, and the presence or history of a neurological or severe psychiatric disorder. Two hundred six participants were eligible for the study and completed the questionnaires. The final sample was equally divided between men (103, 50%)

and women, and was mostly made up of undergraduate students (Communication Science students) and workers. We decided not to include psychology students in order to avoid any possible biases due to their previous knowledge of the measures we administered. The participants did not receive any incentives/payments/course credits in return for participation.

The sample size was determined based on an a priori power analysis, using the software G* Power 3.1 (Faul et al., 2009), with a medium effect size, power of over .80, and an alpha level of .05, as being sufficient for multiple regression analysis with six predictors.

The study was approved by the University of Turin ethics committee (Prot. n. 10036) and was conducted in accordance with the Declaration of Helsinki. All the participants gave their informed consent to participate in the study.

2.2. Procedure

All the measures were administered to the participants through an online survey software (LimeSurvey, GmbH, Germany). An anonymised, individual and unique code to complete the survey was provided to those who gave their agreement to take part in the study. Before filling in the questionnaires, participants were asked to complete self-report questions assessing sociodemographic (i.e., age, educational level, marital status, and occupation) and clinical information (i.e., history or presence of psychiatric or neurological disorders), in order to ascertain their eligibility for the study.

The measures were presented in a counterbalanced order, with one half of participants completing performance-based tests first and self-report questionnaires after, and the other half completing the conditions in the reverse order.

2.3. Measures

Participants completed a battery of measures as part of a wider investigation but only the measures relevant to the current research question will be discussed here.

2.3.1. Alexithymia

Alexithymia was assessed using the Italian version of the Toronto Alexithymia Scale (TAS-20) (Bressi et al., 1996; Taylor et al., 2003). It comprises 20 items, each scored on a 5-point Likert-type scale. The results provide a TAS-20 total score and three subscale scores that assess different aspects of alexithymia: difficulty identifying feelings (DIF), which measures the inability to distinguish specific emotions or between emotions and the bodily sensations of emotional arousal; difficulty describing feelings (DDF), which assesses the inability to verbalize one's emotions to other people; and externally-oriented thinking (EOT), which evaluates the tendency of individuals to focus their attention externally and not on the inner emotional experience (Taylor et al., 2003). The TAS-20 cut-off scores are as follows: ≤ 51 no alexithymia, 52–60 borderline alexithymia, ≥ 61 alexithymia.

The scale has shown good internal consistency (Cronbach's alpha coefficient: ≥ .70) and test-retest reliability (Taylor et al., 2003). In line with these results, in our sample the Cronbach's alpha was good for the TAS-20 ($\alpha = .79$).

2.3.2. Recognition of others' prototypical facial expressions

The Montréal Pain and Affective Face Clips (MPAFC) are standardized stimuli of dynamic, prototypical facial expressions (Simon et al., 2007). The MPAFC is formed by 60 one-second film clips, in which eight actors (four females and four males) display the six basic emotions (viz., anger, disgust, fear, happiness, sadness, and surprise), expressions of pain, and neutral facial expressions. The facial expressions are 'prototypical' and 'natural' insofar as they possess the key features identified by Ekman and Friesen (1976), using the Facial Action

Coding System, as being representative of everyday facial expressions (Simon et al., 2007). The clips were presented one at a time in a random order. A black screen was displayed to the participants at the beginning and end of each clip, in order to avoid a possible facilitating effect in the recognition of the facial expressions, due to the last static frame of the videos. Participants were asked to choose one of eight options displayed below each video, using the criterion of which word best describes the emotion of the person shown in the video. The number of correct answers for each expression was summed to give an overall score (MPAFC emotion recognition total score) for all emotions (all expressions except neutral).

2.3.3. Recognition of other people's affective mental states

The Italian version of the Reading the Mind in the Eyes Test (RMET) was employed to assess the ability to recognise other people's affective mental states (Baron-Cohen et al., 2001; Serafin and Surian, 2004). Participants viewed 36 photographs of the eye region of various human faces and were required to choose one of four words, using the criterion of which word best describes the mental state of the person depicted in the photograph. Participants had unlimited time to decide and a glossary was provided. Participants received a score of 1 for every correct answer, with a maximum possible score of 36.

The Italian version of the scale has shown good internal consistency (Cronbach's alpha coefficient = .61) and test-retest reliability (Vellante et al., 2013).

2.3.4. Representation of other people's cognitive mental states

The Italian translation of the Strange Stories test has been used for the assessment of cognitive ToM (Happé et al., 1999; Liverta Sempio et al., 2005; Mazzola and Camaioni, 2002). It consists of two types of short stories: ToM stories and physical stories. The eight ToM stories require the participants to infer characters' mental states and concern double bluff, mistakes, persuasion, and white lies (two examples for each story type). Conversely, the eight physical control stories do not involve mental states but require participants to make global inferences that go beyond what was explicitly mentioned in the text.

Each story is followed by a question assessing the ability to infer the characters' thoughts and feelings, for ToM passages, while for non-mental-state stories, to understand, for example, physical causation.

The total score for both ToM and physical stories ranges from 0 to 16, with higher scores indicating better performance. For the present study only the ToM Strange Stories score was used.

2.3.5. Empathy

The Italian version of the Interpersonal Reactivity Index (IRI) (Albiero et al., 2006; Davis 1980, 1983) was administered for the assessment of self-reported empathy. The IRI comprises 28 items, rated on a 5-point Likert scale, which explore four dimensions of empathy: 'Fantasy', which refers to the tendency to transpose oneself imaginatively into the feelings and actions of fictitious characters; 'Perspective-Taking', which evaluates the tendency to spontaneously adopt the psychological point of view of others; 'Empathic Concern', which assesses the degree to which one experiences feelings of warmth, compassion and concern for an observed individual; and 'Personal Distress', which evaluates the feelings of fear, apprehension and discomfort at witnessing the negative experiences of others (Davis 1980, 1983).

The scale has shown good internal consistency (Cronbach's α ranging from .70 to .78) and test-retest reliability (Davis 1980; Ingoglia et al., 2016). In line with these results, in our sample the Cronbach's alpha was good for the IRI (α score = .75).

2.3.6. Difficulties in emotion regulation

The Italian adaptation of the brief version of the Difficulties in Emotion Regulation Scale (DERS-16) was employed for the evaluation of difficulties in emotion regulation (Bjureberg et al., 2016). The DERS-16 is formed by 16 items, rated on a 5-point Likert scale, which assesses the following dimensions of emotion regulation difficulties: non-acceptance of negative emotions, inability to engage in goal-directed behaviors when distressed, difficulties controlling impulsive behaviors when experiencing negative emotions, limited access to emotion regulation strategies perceived as effective, and lack of emotional clarity. Higher scores on the DERS-16 reflect greater levels of emotional dysregulation.

The DERS-16 has been found to have excellent internal consistency (Cronbach's α ranging from .92 to .95), good test-retest reliability, and good convergent and discriminant validity (Bjureberg et al., 2016). In line with these results, in our sample the Cronbach's alpha was excellent for the DERS-16 ($\alpha = .89$).

2.3.7. Anxiety symptoms

To assess the presence of anxiety symptoms, Form Y of the State-Trait Anxiety Inventory (STAI-Y) was used (Pedrabissi and Santinello, 1989; Spielberger et al., 1983). It is divided into two sections that can be used independently, each consisting of 20 items that are scored using a 4-point Likert-type scale: the STAI-Y1 assesses current feelings of apprehension and tension (state anxiety), while the STAI-Y2 evaluates persistent anxiety traits (trait anxiety). Each section has a total score ranging from 20 to 80, with higher scores indicating greater anxiety. In the present study, the STAI-Y2 for trait anxiety was administered. The STAI-Y has shown good psychometric properties including adequate internal consistency (Cronbach's $\alpha = .86$ to .95), test-retest reliability and construct validity (Julian, 2011). In line with these results, in our sample the Cronbach's alpha was excellent for the STAI-Y2 ($\alpha = .91$).

2.3.8. Depressive symptoms

The presence of depressive symptoms was assessed using the Beck Depression Inventory-II (BDI-II) (Beck et al., 1996a; Ghisi et al., 2006). It consists of 21 items, each scored using a 4-point Likert-type scale. The total score ranges from 0 (*no depressive symptoms*) to 63 (*severe depression*). The BDI-II has shown good psychometric properties, with good internal consistency (Cronbach's $\alpha = .91$), test-retest reliability and construct validity (Beck et al., 1996b). In line with these results, in our sample the Cronbach's alpha was good for the BDI-II ($\alpha = .87$).

2.4. Statistical analyses

The statistical analyses were carried out with the Statistical Package for Social Science, version 25.0 (IBM SPSS Statistics for Macintosh, Armonk, NY, USA).

Indices of asymmetry and kurtosis were used to test for normality of the data. Values for asymmetry and kurtosis between –1 and +1 were considered acceptable in order to prove normal univariate distribution. All variables included in the analyses were normally distributed according to these criteria.

Hierarchical multiple regression analyses were run to assess whether alexithymia was still a significant predictor of the different measures of social cognition when possible competing predictors (anxiety/depressive symptoms) were controlled for. To reduce the number of analyses run, only the total scores of social cognition measures (MPAFC emotion recognition total score, RMET, ToM Strange Stories score, DERS total score, IRI subscales scores) were used as dependent variables. The predictors were entered into the regression model according to the following schema: sociodemographic variables (age, educational level, and gender), possible competing predictors (anxiety/depressive symptoms), and finally alexithymia. The enter method was used.

Collinearity was assessed through the statistical factor of tolerance and Variance Inflation Factor (VIF).

3. Results

3.1. Descriptive analyses

Sociodemographic characteristics and data on alexithymia, social cognition, and anxiety/depressive symptoms of the total sample are presented in Tables 1 and 2.

Tables 1 and 2 about here

3.2. Multiple regressions

To investigate whether alexithymia was a significant predictor of social cognition measures after controlling for possible competing predictors (anxiety/depressive symptoms), hierarchical multiple regression analyses were performed. Below we report the results of the final model including all predictors for each social cognition measure. The interim results from each stage of each model are presented in Tables 3-6. Moreover, Pearson (r) or point-biserial (r_{pb}) correlations among sociodemographic variables, anxiety/depressive symptoms, alexithymia, and social cognition measures are presented as supplementary material in Appendix A.

As far as the RMET and the ToM Strange Stories are concerned, none of the predictors was found to be a significant contributor to either of these two components of social cognition (Table 3).

Conversely, regarding the MPAFC emotion recognition total score, alexithymia (β = -0.219, p = .005), among all the predictors, was found to be the only significant contributor to the final model (Model 3, Table 4).

Concerning the DERS total score, significant predictors in the final model (Model 3, Table 4), were found to be both anxiety (β = 0.358, p <.001) and depressive (β = 0.250, p <.001) symptoms, as well as alexithymia total score (β = 0.337, p < .001).

Finally, regarding empathy, for the 'Perspective-Taking' subscale of the IRI significant predictors in the final model (Model 3, Table 5) were found to be both anxiety symptoms (β = 0.248, p <.001) and alexithymia total score (β = -0.382, p <.001). Conversely, for the 'Fantasy' subscale of the IRI, significant predictors in the final model (Model 3, Table 5) were found to be both gender (β = -0.175, p = .011), with males reporting lower scores than females, and depressive symptoms (β = 0.199, p = .011), as well as alexithymia total score (β = -0.189, p = .012). Similarly, for the 'Empathic Concern' subscale of the IRI, significant predictors in the final model (Model 3, Table 6) were found to be both anxiety (β = 0.310, p <.001) and depressive (β = 0.176, p = .021) symptoms, as well as alexithymia total score (β = -0.190, p = .009). Lastly, for the 'Personal Distress' subscale of the IRI, significant predictors in the final model (Model 3, Table 6) were found to be both gender (β = -0.243, p <.001) and anxiety symptoms (β = 0.146, p = .023), as well as alexithymia total score (β = 0.330, p <.001).

In all regression analyses, the statistical factor of tolerance and VIF showed that there were no interfering interactions between the variables. Overall, the results of the hierarchical regressions showed a significant predictive role of alexithymia in explaining performance on the majority of the components of social cognition we assessed, with the exception of the recognition of others' affective states and cognitive ToM.

Tables 3, 4, 5 and 6 about here

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4. Discussion

The main aim of the present study was to shed light on the relationship between alexithymia and social cognition skills in a sample of healthy individuals. We assessed a wide range of social cognition dimensions (i.e., both ToM and emotional processing abilities) and investigated, by means of multiple regression analyses, whether alexithymia significantly predicted each of these components, beyond the effect of anxiety/depressive symptoms and standard sociodemographic variables.

From a descriptive point of view, results of the TAS-20 showed that 10.7% of the participants had a total score suggesting the presence of alexithymia, while an additional 35% showed the presence of alexithymic traits at a subclinical borderline level. The available evidence shows that alexithymia has a prevalence of about 10% in the general population (Mattila et al., 2007; Salminen et al., 1999). Therefore, the percentage of alexithymia in our sample is in line with that reported previously.

Going further, as far as the recognition of others' facial expressions is concerned, the regression analysis showed a significant predictive role of alexithymia in explaining the emotion recognition score of the MPAFC. Indeed, alexithymia was found to be the only significant predictor of the recognition of others' facial expressions in the final regression models. These results support the findings of previous studies, which showed the presence of impairments in the recognition of other people's emotional facial expressions in both healthy and clinical populations with alexithymia (Cook et al., 2013; Di Tella et al., 2018; Grynberg et al., 2012; Jongen et al., 2014; Mann et al., 1994; Moriguchi et al., 2006; Parker et al., 1993; Pedrosa et al., 2009; Swart et al., 2009). For instance, the study of Mann et al. (1994), in line with our data, found that healthy participants with high levels of alexithymia reported greater difficulties in labelling emotional facial expressions compared to individuals with low levels of alexithymia. Similarly, Swart et al. (2009) found, in a large group of university students, that individuals high in alexithymia were impaired on both the recognition of micro emotional facial expressions and emotional mentalizing, defined by the authors as the ability to infer what other people feel. Further support derives from the study of Jongen et al. (2014) who compared healthy participants with low degree of alexithymia (LDA) to healthy participants with high degree of alexithymia (HDA) on a facial emotion recognition task, assessing also subjects' neural activity during the execution of the task through functional MRI. The authors found that LDA participants, compared to HDA ones, performed significantly better on the emotion recognition task and showed relatively more activity in brain areas associated with both alexithymia and emotional awareness (i.e., anterior cingulate cortex), as well as with facial perception (i.e., amygdala, insula, and striatum).

Although alexithymic individuals seem to show significant impairments in the recognition of the more prototypical emotions, in our data the same pattern of results did not apply to the recognition of others' affective mental states. Specifically, alexithymia was not found to significantly predict the RMET. The available evidence highlights contrasting results regarding the presence of difficulties in the recognition of others' affective mental states in individuals with alexithymia. Indeed, although some previous studies found significant relationships between alexithymia and impairments in RMET performance (Gökçen et al., 2016; Martinez-Sanchez et al., 2017; Oakley et al., 2016; Swart et al., 2009), others found mixed results (Demers and Koven, 2015). In particular, the study of Demers and Koven (2015) found that only the EOT factor of the TAS-20 significantly predicted impaired performance on the RMET. It is possible that our inconsistent results are related to the sample tested in the present study being more representative of the general population than that of previous studies; for example, Oakley et al. (2016) purposively sampled high-alexithymia participants (one-third of their non-clinical sample had TAS-20 scores above 61). This sampling strategy may have provided them with greater sensitivity to detect an effect of alexithymia on the RMET, but it also means that their sample was less representative of the distribution of alexithymia traits in the general population. In order to shed light on those inconsistent results, future studies may try to parse alexithymia into its subcomponents when exploring its relevance to the recognition of others' affective mental states (but taking into account that Kooiman et al., 2002, have shown the low reliability of the EOT subscale of the TAS-20, and Preece et al., 2018, have demonstrated that while the traditional TAS-20 total score and the DIF and DDF subscales can be used with reasonable confidence, the EOT subscale score should not be use because of its poor internal consistency).

Similarly, none of the variables we included into the regression model significantly predicted the ToM Strange Stories score. These results are in line with the majority of previous studies, which showed an absence of association between alexithymia, specifically, and the representation of others' cognitive mental states (Lane et al., 2015; Pluta et al., 2018; Wastell and Taylor, 2002; Winter et al., 2017) both in clinical and non-clinical populations. For instance, Wastell and Taylor (2002) found no significant difference between alexithymic and non-alexithymic healthy individuals on the ability to resolve false belief scenarios. In the same way, the study of Winter et al. (2017) showed that alexithymia was significantly correlated with empathy and compassion, but not with ToM performance in a group of aggressive offenders.

Regarding the presence of difficulties in emotion regulation, significant predictors in the final model were found to be both anxiety/depressive symptoms and alexithymia. In line with our results, most of previous studies appear to highlight an involvement of emotion regulation processes in the occurrence of alexithymia (Pollatos and Gramann, 2012;

Stasiewicz et al., 2012; Swart et al., 2009; Walker et al., 2011; Wingenfeld et al., 2011). In particular, the available evidence highlights that alexithymic individuals, compared to non-alexithymic ones, use less efficient strategies, such as 'suppression', and rely less on more efficient strategies like 'reappraisal' (Stasiewicz et al., 2012; Swart et al., 2009; Wingenfeld et al., 2011). In the same way, previous studies, which investigated the association between the ability to adequately regulate one's own feelings and the presence of anxiety/depressive symptoms, reported significant associations between these constructs in both non-clinical and clinical populations (Ehring et al., 2010; Garnefski and Kraaij, 2006; Joormann and Gotlib, 2010; Rude and McCarthy, 2003). In particular, the study of Garnefski and Kraaij (2006) showed the presence of significant relationships between different cognitive emotion regulation strategies, such as rumination, catastrophizing, positive reappraisal and self-blame, and depressive symptoms, which were similar among the five groups of participants they assessed (i.e., early and late adolescents, adults, elderly people, and psychiatric patients).

Finally, as far as empathy is concerned, the current results showed that alexithymia was a significant predictor in explaining all the components of empathy evaluated by the IRI. In addition to alexithymia, also the presence of anxiety/depressive symptoms was found to be specifically associated with empathy. In particular, anxiety symptoms were positively related with 'Perspective Taking', 'Empathic Concern', and 'Personal Distress' subscales of the IRI, and depressive symptoms with 'Fantasy' and 'Empathic Concern' subscales. Gender was also found to be a significant predictor in explaining some of the empathic components, in particular the 'Fantasy' and 'Personal Distress' subscales of the IRI.

The association between empathy and psychological distress is well documented, with evidence often showing a positive association between increased empathic abilities and anxiety/depressive symptoms (Gawronski and Privette 1997; Hoffmann et al., 2016; Knight et al., 2019; Schreiter et al., 2013). For example, Gawronski and Privette (1997) found a positive correlation between depressive symptoms and empathic concern in a sample of women working in health care. Going deeper, Knight et al. (2019) tried to explain the indirect relationship between empathy and anxiety through the ruminative tendencies of worry they found in their study, suggesting a twofold relation between anxiety and empathy. In particular, they suggested that anxiety and empathy may be linked by a greater sensitivity to social and emotional information, on the one hand, as well as by a shared propensity to constantly process emotional information through reflection and rumination, on the other hand.

Finally, concerning the main results of interest for the current study, the significant relationships we found between alexithymia and all empathic dimensions, with alexithymia predicting lower scores on all subscales apart from ‘Personal Distress’ where alexithymia instead predicted higher scores, confirm the results of previous studies which showed reduced empathic abilities in individuals with high levels of alexithymia (Al Ain et al., 2013; Bogdanov et al., 2013; Grynberg et al., 2010; Guttman and Laporte, 2002; Moriguchi et al., 2006; Swart et al., 2009). In particular, the study of Guttman and Laporte (2002) found that alexithymic individuals showed lower levels of empathy than non-alexithymic ones, with the former reporting lower scores on the ‘Perspective Taking’ and ‘Empathic Concern’ subscales of the IRI, and higher scores on the ‘Personal Distress’ subscale. The same pattern of results was found by the study of Moriguchi et al. (2006) in a sample of alexithymic students. In a similar way, Swart et al. (2009) found reduced empathic abilities in a group of healthy alexithymic individuals, but using different measures for the assessment of alexithymia and empathy.

4.1. Limitations

The present study has some limitations that should be considered. First, the use of self-report instruments might have led to the underestimation of, for example, the presence of alexithymic traits in individuals falling into borderline cut-off scores. Performance-based instruments or structured interviews, less dependent on the individuals' awareness, should be employed in addition to traditional self-report measures (although broad consensual agreement exists between TAS-20 score and observer ratings of alexithymia, see Taylor et al. 2000, and evidence shows that subjective and objective measures of emotional awareness are reliably correlated, see e.g. Gaigg et al. 2018). Secondly, the present study adopted a cross-sectional design, which does not permit us to draw firm conclusions about the causality of the emergent relationships, and to avoid multicollinearity problems only the TAS-20 total score was considered for the regression analyses. Thirdly, even though we enrolled an adequate number of participants, our study is limited by a relatively small number of participants scoring above cut-off for alexithymia. Finally, the present study examined alexithymia in relation to social cognition abilities only in a sample of young adults. Future studies should be carried out recruiting a larger number of alexithymic participants, with heterogeneous sociodemographic characteristics.

5. Conclusions

To the best of our knowledge, the current study represents one of the few attempts to analyse, in a single sample, the main components of social cognition in relation to alexithymia. The present findings highlighted the presence of specific associations between social cognition skills and alexithymia. In particular, alexithymia was found to be significantly related to increased difficulties in both the recognition of others' facial expressions and emotion regulation abilities, as well as in all the components of empathy we evaluated. Conversely, in our sample of healthy individuals, alexithymia did not appear to be significantly associated with either the recognition of others' affective mental states, or cognitive ToM. We hope that future studies can use longitudinal models to corroborate our findings and can further detail the constructs investigated here, for example by analysing the relationship between social cognition and the different aspects of alexithymia captured by the TAS-20.

Taken together, these data seem to support the idea that recognising emotions and feelings of other people relies on the ability to identify and recognise correctly one's own feelings. More generally, our results show that taking into consideration individual differences in levels of alexithymia is recommended for the investigation of social cognitive processes not only in clinical but also in healthy populations, as alexithymia seems to play an intervening role in social cognitive functioning.

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Table 1. Sociodemographic characteristics of the total sample (*N* = 206).

	Mean (SD)	**n (%)**	**Range**
Age (years)	21.23 (2.06)		18-29
Educational level (years)	13.34 (1.07)		13-18
Gender (M:F)		103:103 (50%)	
Marital status			
Never-married		196 (95.1%)	
Cohabitant		9 (4.4%)	
Married		1 (0.5%)	
Occupation			
Student		193 (93.7%)	
Employed		10 (4.9%)	
Unemployed		3 (1.5%)	

SD = Standard deviation

Table 2. Alexithymia, social cognition, and anxiety/depressive measures scores of the total sample (N = 206).

	Mean (SD)	n (%)	Range
Alexithymia			
TAS-20 DIF	17.89 (5.51)		7-31
TAS-20 DDF	14.50 (4.54)		5-24
TAS-20 EOT	15.49 (4.21)		8-30
TAS-20 Total score	47.88 (10.23)		25-73
Non-alexithymic		112 (54.4%)	
Borderline		72 (35%)	
Alexithymic		22 (10.7%)	
Social cognition measures			
MPAFC – Emotion recognition total score	46.86 (4.15)		34-55
RMET	26.58 (3.15)		14-34
Strange Stories – ToM score	11.86 (2.56)		4-16
DERS Total score	38.60 (11.29)		18-74
IRI - 'Perspective-Taking'	25.06 (4.45)		13-35
IRI - 'Fantasy'	25.87 (4.16)		14-35
IRI - 'Empathic Concern'	23.15 (2.74)		16-34
IRI - 'Personal Distress'	18.61 (4.73)		7-31
Anxiety/depressive symptoms			
BDI	11.30 (7.58)		0-40
STAI Y2	47.67 (4.47)		37-60

SD = Standard deviation; TAS-20 = Twenty-item Toronto Alexithymia Scale; TAS-20 DIF: Difficulty identifying feelings subscale of the Toronto Alexithymia Scale; TAS-20 DDF: Difficulty describing feeling subscale of the Toronto Alexithymia Scale; TAS-20 EOT:

Externally oriented thinking subscale of the Toronto Alexithymia Scale; MPAFC = Montréal Pain and Affective Face Clips; RMET = Reading the Mind in the Eyes Test; ToM = Theory of Mind; DERS = Difficulties in Emotion Regulation Scale; IRI = Interpersonal Reactivity Index; BDI = Beck Depression Inventory; STAI Y2 = State-Trait Anxiety Inventory Form Y2.

Table 3. Hierarchical multiple regressions predicting RMET and ToM Strange Stories scores from sociodemographic variables, anxiety/depressive symptoms, and alexithymia (N = 206).

RMET								
Predictors	**B**	**β**	**t**	**95% CI**	**Adj R^2**	**F**	**ΔR^2**	**ΔF**
Model 1					0.005	1.344	0.020	1.344
Age	0.073	0.048	0.600	-0.168; 0.315				
Educational level	-0.218	-0.074	-0.925	-0.683; 0.247				
Gender	-0.728	-0.116	-1.651	-1.598; 0.142				
Model 2					0.011	1.453	0.015	1.603
Age	0.092	0.060	0.754	-0.149; 0.334				
Educational level	-0.231	-0.079	-0.981	-0.692; 0.233				
Gender	-0.770	-0.123	-1.730	-1.649; 0.108				
BDI	-0.039	-0.94	-1.290	-0.099; 0.021				
STAI Y2	0.078	0.113	1.549	-0.021; 0.176				
Model 3					0.008	1.282	0.002	0.449
Age	0.084	0.055	0.678	-0.160; 0.327				
Educational level	-0.221	-0.075	-0.938	-0.687; 0.244				
Gender	-0.746	-0.119	-1.668	-1.169; 0.136				
BDI	-0.030	-0.071	-0.876	-0.096; 0.037				
STAI Y2	0.077	0.111	1.528	-0.022; 0.176				
TAS-20 Total	-0.016	-0.052	-0.670	-0.063; 0.031				
Strange Stories – ToM score								
Model 1					0.007	1.450	0.021	1.450
Age	-0.142	-0.114	-1.429	-0.338; 0.054				
Educational level	0.172	0.072	0.899	-0.206; 0.551				
Gender	0.503	0.098	1.403	-0.204; 1.210				
Model 2					0.000	0.986	0.003	0.305
Age	-0.146	-0.117	-1.457	-0.344; 0.052				
Educational level	0.176	0.074	0.914	-0.204; 0.556				
Gender	0.538	0.105	1.477	-0.181; 1.257				
BDI	0.019	0.056	0.763	-0.030 0.068				
STAI Y2	-0.015	-0.027	-0.370	-0.096; 0.066				

Model 3					-0.004	0.865	0.001	0.278
Age	-0.152	-0.122	-1.502	-0.351; 0.047				
Educational level	0.182	0.076	0.942	-0.199; 0.563				
Gender	0.554	0.108	1.512	-0.169; 1.276				
BDI	0.025	0.75	0.914	-0.029; 0.080				
STAI Y2	-0.016	-0.025	-0.384	-0.097; 0.065				
TAS-20 Total	-0.010	-0.041	-0.527	-0.049; 0.028				

RMET = Reading the Mind in the Eyes Test; CI = Confidence Interval; ToM = Theory of Mind; BDI = Beck Depression Inventory; STAI Y2 = State-Trait Anxiety Inventory Form Y2; TAS-20 = Twenty-item Toronto Alexithymia Scale.

Table 4. Hierarchical multiple regression predicting MPAFC emotion recognition and DERS total scores from sociodemographic variables, anxiety/depressive symptoms, and alexithymia ($N = 206$).

MPAFC – Emotion recognition total score								
Predictors	**B**	**β**	**t**	**95% CI**	**Adj R^2**	**F**	**ΔR^2**	**ΔF**
Model 1					-0.003	0.771	0.011	0.711
Age	0.103	0.05	0.639	-0.216; 0.422				
Educational level	-0.261	-0.068	-0.837	-0.876; 0.354				
Gender	-0.662	-0.080	-1.134	-1.811; 0.488				
Model 2					-0.005	0.776	0.008	0.787
Age	0.094	0.047	0.578	-0.227; 0.415				
Educational level	-0.260	-0.067	-0.832	-0.876; 0.356				
Gender	-0.772	-0.093	-1.306	-1.938; 0.394				
BDI	-0.035	-0.063	-0.857	-0.114; 0.045				
STAI Y2	-0.043	-0.047	-0.645	-0.174; 0.088				
Model 3					0.029	2.023	0.038	8.117**
Age	0.046	-0.07	0.023	-0.271; 0.363				
Educational level	0.208	0.14	-.054	-0.814; 0.399				
Gender	-0.639	-0.02	-0.077	-1.788; 0.511				
BDI	0.019	0.27	0.035	-0.067; 0.106				
STAI Y2	-0.048	0.05	-0.053	-0.177; 0.081				
TAS-20 Total	-0.089	0.09	-0.219**	-0.150; -0.027				
DERS total score								
Model 1					0.007	1.449	0.021	1.449
Age	-0.598	-0.109	-1.365	-1.463; 0.266				
Educational level	0.822	0.078	0.973	-0.845; 2.489				
Gender	-2.571	-0.114	-1.623	-5.693; 0.552				
Model 2					0.382	26.216**	0.376	62.045**
Age	-0.477	-0.087	-1.372	-1.161; 0.208				
Educational level	0.836	0.080	1.254	-0.479; 2.151				
Gender	-0.334	-0.015	-0.264	-2.831; 2.162				
BDI	0.756	0.509	8.762**	0.586; 0.927				

STAI Y2	0.954	0.241	4.182**	0.314; 0.874				
Model 3					0.473	31.502**	0.091	35.323**
Age	-0.274	-0.050	-0.849	-0.910; 0.362				
Educational level	0.618	0.059	1.001	-0.599; 1.835				
Gender	-0.890	-0.040	-0.759	-3.203; 1.423				
BDI	0.532	0.358	6.029**	0.358; 0.706				
STAI Y2	0.615	0.250	4.884**	0.356; 0.874				
TAS-20 Total	0.372	0.337	5.943**	0.248; 0.495				

MPAFC = Montréal Pain and Affective Face Clips; CI = Confidence Interval; BDI = Beck Depression Inventory; STAI Y2 = State-Trait Anxiety Inventory Form Y2; TAS-20 = Twenty-item Toronto Alexithymia Scale; DERS = Difficulties in Emotion Regulation Scale.

* *p*<.05; ** *p*<.01

Table 5. Hierarchical multiple regressions predicting IRI 'Perspective-Taking' and 'Fantasy' subscales scores from sociodemographic variables, anxiety/depressive symptoms, and alexithymia (*N* = 206).

IRI - 'Perspective-Taking'								
Predictors	**B**	**β**	**t**	**95% CI**	**Adj R^2**	**F**	**ΔR^2**	**ΔF**
Model 1					0.005	1.309	0.019	1.309
Age	-0.084	-0.039	-0.488	-0.426; 0.257				
Educational level	-0.472	-0.114	-1.141	-1.131; 0.186				
Gender	-0.068	-0.008	-0.108	-1.298; 1.163				
Model 2					0.065	3.835**	0.068	7.497**
Age	-0.024	-0.011	-0.140	-0.356; 0.309				
Educational level	-0.510	-0.123	-1.575	-1.149; 0.128				
Gender	-0.127	-0.014	-0.208	-1.336; 1.081				
BDI	-0.095	-0.161	-2.260*	-0.177; -0.012				
STAI Y2	0.251	0.258	3.645**	0.115; 0.387				
Model 3					0.180	8.510**	0.117	29.181**
Age	-0.114	-0.053	-0.720	-0.427; 0.199				
Educational level	-0.412	-0.099	0.213	-1.011; 0.186				
Gender	0.122	0.014	-1.358	-1.013; -1.258				
BDI	0.006	0.10	0.139	-0.079; 0.092				
STAI Y2	0.242	0.248	3.747**	0.115; 0.369				
TAS-20 Total	-0.166	-0.382	-5.402**	-0.227; -0.106				
IRI - 'Fantasy'								
Model 1					0.058	5.224**	0.072	5.224**
Age	-0.268	-0.132	-1.703	-0.578; 0.042				
Educational level	-0.162	-0.042	-0.535	-0.760; 0.436				
Gender	-1.741	-0.210	-3.072**	-2.859; -0.624				
Model 2					0.067	3.942**	0.018	1.946
Age	-0.259	-0.128	-1.649	-0.569; 0.051				
Educational level	-0.161	0.041	-0.532	-0.756; 0.435				
Gender	-1.584	-0.188	-2.737**	-2.691; -0.437				
BDI	0.063	0.114	1.604	-0.014; 0.139				
STAI Y2	0.043	0.047	0.633	-0.084; 0.169				
Model 3					0.092	4.448**	0.029	6.442*
Age	-0.301	-0.149	-1.930	-0.609; 0.007				

Educational level	-0.116	-0.030	-0.387	-0.704; 0.473
Gender	-1.449	-0.175	-2.56*	-2.565; -0.333
BDI	0.109	0.199	2.558*	0.025; 0.193
STAI Y2	0.038	0.042	0.603	-0.087; 0.163
TAS-20 Total	-0.077	-0.189	-2.538*	-0.163; -0.017

IRI = Interpersonal Reactivity Index; CI = Confidence Interval; BDI = Beck Depression Inventory; STAI Y2 = State-Trait Anxiety Inventory Form Y2; TAS-20 = Twenty-item Toronto Alexithymia Scale.

* $p<.05$; ** $p<.01$

Table 6. Hierarchical multiple regressions predicting IRI 'Empathic Concern' and 'Personal Distress' subscales scores from sociodemographic variables, anxiety/depressive symptoms, and alexithymia (*N* = 206).

IRI - 'Empathic Concern'								
Predictors	**B**	**β**	**t**	**95% CI**	**Adj R^2**	**F**	**ΔR^2**	**ΔF**
Model 1					-0.001	0.926	0.014	0.926
Age	-0.015	-0.011	-0.140	-0.226; 0.196				
Educational level	0.168	0.066	-0.816	-0.238; 0.574				
Gender	-0.585	-0.107	-1.519	-1.344; 0.175				
Model 2					0.113	6.217^{**}	0.121	13.973^{**}
Age	0.028	0.021	0.279	-0.171; 0.227				
Educational level	0.150	0.59	0.775	-0.232; 0.533				
Gender	-0.382	-0.70	-1.041	-1.106; 0.342				
BDI	0.033	0.091	1.314	-0.016; 0.082				
STAI Y2	0.188	0.314	4.560^{**}	0.107; 0.082				
Model 3					0.138	6.479^{**}	0.029	6.878^{**}
Age	0.000	0.000	0.004	-0.197; 0.198				
Educational level	0.180	0.071	0.941	-0.197; 0.558				
Gender	-0.306	-0.056	-0.842	-1.022; 0.410				
BDI	0.064	0.176	2.330^{*}	0.010; 0.118				
STAI Y2	0.185	0.310	4.555^{**}	0.105; 0.266				
TAS-20 Total	-0.051	-0.190	-2.623^{**}	-0.089; 0.013				
IRI - 'Personal Distress'								
Model 1					0.077	6.723^{**}	0.091	6.723^{**}
Age	-0.413	-0.179	-2.330^{*}	-0.762; -0.063				
Educational level	0.514	0.117	1.504^{*}	-0.160; 1.187				
Gender	-2.511	-0.226	-3.933^{**}	-3.770; -1.252				
Model 2					0.161	8.886^{**}	0.091	11.121^{**}
Age	-0.383	-0.166	-2.257^{*}	-0.717; -0.048				
Educational level	0.513	0.116	1.574	-0.130; 1.155				
Gender	-2.065	-0.219	-3.349^{**}	-3.281; -0.849				
BDI	0.148	0.237	3.513^{**}	0.065; 0.231				

STAI Y2	0.143	0.138	2.056*	0.006; 0.279				
Model 3					0.247	12.204**	0.087	23.743**
Age	-0.300	-0.130	-1.853	-0.618; 0.019				
Educational level	0.423	0.096	1.368	-0.187; 1.033				
Gender	-2.294	-0.243	3.915**	-3.450; -1.139				
BDI	0.055	0.089	1.256	-0.032; 0.142				
STAI Y2	0.151	0.146	2.300*	0.022; 0.281				
TAS-20 Total	0.153	0.330	4.873**	0.091; 0.214				

IRI = Interpersonal Reactivity Index; CI = Confidence Interval; BDI = Beck Depression Inventory; STAI Y2 = State-Trait Anxiety Inventory Form Y2; TAS-20 = Twenty-item Toronto Alexithymia Scale.

* p<.05; ** p<.01