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Increased psychiatric symptoms in university students with autism spectrum disorder are associated with reduced adaptive behavior

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ABSTRACT

High variability in adaptive behavior in cognitively-able adults with autism spectrum disorder has been previously reported, and may be caused by the high prevalence of psychiatric comorbidity in this population. This study's goals were to examine self-reported psychiatric symptoms in students with ASD, and to identify their relative contribution to the variance in adaptive behaviors. The study population included 95 students: 55 diagnosed with ASD (4 females; age range 18–34) who participated in a university integration program (ASD group), and 40 regularly matriculated students (non-ASD group, 7 females; age range 20–36). The ASD group showed a lower adaptive skill level than the non-ASD group as measured by the Adaptive Behavior Assessment System (GAC-ABAS). Significantly higher scores for the ASD group were found for social anxiety, trait anxiety, obsessive-compulsive symptoms, and depression symptoms. The level of adaptive skills correlated negatively and significantly with the severity of social anxiety symptoms in both groups and with severity of obsessive-compulsive symptoms only in the ASD group. Additionally, in a regression model, significant contributions of having an ASD diagnosis and severity of social anxiety explained 41.7% of the variance in adaptive skills. Adequate evaluation and treatment, if needed, are recommended in this population.

1. Introduction

Autism spectrum disorder (ASD) is considered a heterogeneous condition with a spectrum of severity (Georgiades et al., 2013; Ingram et al., 2008; Wiggins et al., 2012), and includes a wide range of impairments in cognitive abilities (Ben-Itzchak et al., 2008, 2014; Grzadzinski et al., 2013; Lord et al., 2006) and verbal abilities (Boucher, 2012; Tager-Flusberg et al., 2001), as well as a high frequency of mental health comorbidity among children (Simonoff et al., 2008) and adults (Howlin and Magiati, 2017).

In the last three decades, a vast amount of research has been published on outcomes and their predictors for young children with ASD (e.g., Magiati et al., 2012; Zwaigenbaum et al., 2015). Nevertheless, the high prevalence of ASD in the population, the aging of the ASD cohorts that were examined as children, and the growing recognition of psychological and social costs of ASD to society have led to an increase in adult-focused research. Most of those studies describe impaired functioning in adults with ASD as expressed by less independence, lower levels of employment, and reduced social activity, even in comparison to adults with other developmental or intellectual disabilities (Roux et al., 2013). A systematic review (Steinhausen et al., 2016) summarized 12 studies published from 1967 to 2013 (n = 828), revealing that 48% of participants were rated as having a 'poor'/'very poor' outcome (i.e. severely handicapped or dependent social and daily functioning), while only 20% were rated as having a 'good' or 'very good' outcome (near normal or normal functioning). Since cognitive ability is one of the strongest predictors of better outcome (Anderson et al., 2014; Magiati et al., 2014) the poor outcomes found in studies with participants spanning a wide cognitive range might at least partially be related to intellectual disability as well as impairments related to ASD (Billstedt et al., 2005; Howlin et al., 2004). However, even studies that examined only cognitively-able (usually IQ > 70) participants reported a high frequency of unemployment, and social and economic dependence (Gotham et al., 2015; Roy et al., 2015). Thus, it appears that the reported decrement in social and daily functioning in ASD cannot be explained solely by cognitive impairment.

Another possible contributing factor affecting outcomes seen in adults with ASD is psychiatric comorbidity. Several studies that have examined mental health among cognitively-able adults with ASD using either self-report inventories, such as the Symptoms Checklist (SCL-90-R; Derogatis, 1977; Lever and Geurts, 2016) or semi-structured interviews such as the Yale-Brown Obsessive Compulsive Scale (Y-BOCS II;

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Goodman et al., 1989) reported a high frequency of psychiatric disorders as well (Gillberg et al., 2016; Lever and Geurts, 2016; Moss et al., 2015). In their review, Howlin and Magiati (2017) indicated that the most often reported psychiatric disorders in the literature included depressive disorder (20–58%), anxiety disorder (22–39%), attention deficit disorder (10–28%), and obsessive-compulsive disorder (OCD) (8–28%). In another review, high rates of anxiety disorders (42–56%), depression (17–70%) and attention deficit and hyperactivity disorder (ADHD) (28–65%) were reported in the Asperger syndrome/high functioning autism population (Mazzone et al., 2012). Of the anxiety disorders, social anxiety has been reported as the most frequently occurring among cognitively-able adults with ASD (Bellini, 2004; Kuusikko et al., 2008).

One of the most important outcome measures in ASD is adaptive skills or behavior. Adaptive behavior, comprised of behaviors that are essential to independent living – daily living skills, social skills, and communication abilities – is usually measured in adult populations by standardized behavior checklist/interviews such as the Vineland Adaptive Behavior Scales (VABS, Sparrow et al., 2005) or the Adaptive Behavior Assessment System (ABAS, Harrison and Oakland, 2003). These measures have been used in several ASD studies (Kenworthy et al., 2010; Lopata et al., 2013). Adaptive behavior has been shown to be an even stronger predictor of overall well-being than IQ (Farley et al., 2009; Kanne et al., 2011). Higher levels of adaptive skills were found to be associated with optimal outcomes in adults with ASD (Farley et al., 2009). However, there is limited research on the factors contributing to adaptive skills in adults. In a typically developing population, adaptive skills are positively associated with cognitive ability (Sparrow et al., 1984). Nonetheless, adaptive behavior ratings reported among children with ASD (Lee and Park, 2007; Liss et al., 2001) and adolescents and adults with ASD (Matthews et al., 2015; Pugliese et al., 2015) were lower than typically developing individuals with similar IQ levels. Moreover, the discrepancy between expected (considering IQ levels) and the actual adaptive behavior levels among individuals with ASD, was found to increase with age (Perry et al., 2009; Pugliese et al., 2015; Salomone et al., 2018) mostly due a stagnation of adaptive skills in adolescence/young adulthood (Meyers et al., 2018) and reaching a plateau around 17 years of age (Kanne et al., 2011; Szatmari et al., 2009). The few studies that examined adaptive skills and the factors that contribute to this outcome in adults with ASD (Bal et al., 2015; Matthews et al., 2015; Kraper et al., 2017; Pugliese et al., 2015) reported reduced adaptive skills in this population. Among the ASD population with no cognitive impairments, communication adaptive skills were associated with IQ scores but socialization skills were not (Klin et al., 2007). Nonverbal mental age was the strongest predictor for daily living skills (Bal et al., 2015), and age was found to be negatively correlated with communication and socialization (Klin et al., 2007) and daily living adaptive subdomain scores (Pugliese et al., 2015). Several studies have reported a negative association between comorbid psychopathology and adaptive skills or social and daily functioning (Gillberg et al., 2016; Lever and Geurts, 2016; Matson et al., 2009; Moss et al., 2015). Kraper et al. (2017) were the first to examine the association of adaptive skills with psychiatric comorbidities in a population of young adults (17.6–30.8 years) with no intellectual disability (IQ > 70), and reported significantly higher IQ scores than level of adaptive skills as measured by the Adaptive Behavior Assessment System—(ABAS II). Negative significant correlations were reported between psychopathology (anxiety, depression and ADHD indices) and adaptive behavior. Additionally, the IQ/adaptive functioning discrepancy correlated significantly with depression and anxiety levels. Possible explanations regarding the association between psychiatric comorbidities and adaptive behavior have been raised; some authors have suggested that intact self-awareness among cognitively-able individuals with ASD may lead to more social comparison, emphasizing the gap between cognitive abilities and adaptive behavior, and thereby leading to an increase in depression or anxiety(Headley and Young, 2006). Another possibility is that psychiatric comorbidities such as depression and anxiety (associated with avoidance and lack of motivation) may impair daily functioning and lead to less adaptive behavior (Headley and Young, 2006; Kraper et al., 2017). However, the mechanisms by which psychiatric comorbidities affect the association between cognitive ability and adaptive behavior is still not clear and further research is needed.

In recent years, research interest regarding the adaptation of young adults with ASD pursuing post-secondary education has grown (Gelbar et al., 2014, 2015). Adaptive skills may be strong predictors of adult outcomes, and identifying factors associated with adaptive skill deficits has implications for promoting independence in young adults starting a new stage of academic study. Only a few studies have assessed the association between various factors and adaptive ability (Kraper et al., 2017; Pugliese et al., 2015) and there is a paucity of research examining adaptive skills in a population of university students. The current study evaluated adaptive skills and co-morbid psychiatric symptoms in university students with ASD, a unique cohort that represents an ASD population in the higher range of cognitive abilities. Although the level of psychiatric comorbidities among individuals with ASD has been studied before (Howlin and Magiati, 2017), this is the first study to examine functional and psychiatric comorbidities in cognitively-abled university students with ASD in comparison to non-ASD students.

The study had three aims: (1) To compare adaptive functioning and severity of psychiatric symptoms between students with and without ASD. (2) To examine the correlation between adaptive skill scores and the severity of psychiatric symptoms in groups of students with/without ASD. (3) To look for predictors, including age, ASD diagnosis, and severity of psychiatric symptoms, of adaptive skills in the student population. Specifically, the study examined whether severity of psychiatric symptoms adds to the explained variance of adaptive behavior beyond having an ASD diagnosis.

2. Methods

2.1. Participants

The final study population included 95 participants (11 females), 55 of whom (4 females) were diagnosed with ASD (ASD group) and 40 of whom (7 females) had no ASD diagnosis (non-ASD group). Participants with an ASD diagnosis had to receive score of 32 or higher on the Autism Spectrum Quotient (AQ, Baron-Cohen et al., 2001) while a score of 31 or less was required of participants in the non-ASD group (a score of 32 on the AQ is the commonly used cutoff criteria for ASD; Baron-Cohen et al., 2001). Six participants were excluded from the study due to AQ scores that were outside the range of their group's inclusion criteria (2 participants with ASD scored 31 or less, while 4 participants without ASD scored 32 or more). Thus, the initial study sample had 101 participants. All participants were undergraduate students. Diagnoses of the participants in the ASD group included ASD, Asperger's Syndrome, or Pervasive Developmental Disorder, and documentation of diagnosis from a licensed neurologist or psychiatrist was verified. Most of the students in the ASD group (62.5%) were diagnosed before the age of 7. Participants in the ASD group attended the university's "integration program", which guides students with ASD through their academic studies. Each student met the formal academic entry requirements of the university department to which he/she applied. 15% of the students in the ASD group lived with their families, while the rest moved out (dormitories/other accommodations). No significant difference in gender was found between the ASD and non-ASD groups [$\chi^2(1.95) = 2.37$, $p > 0.1$]. Participants in the ASD group were significantly younger (mean age = 23.56 ± 2.81 years, age range 18–34) than the non-ASD group (mean age = 25.08 ± 2.67 years, age range 20–36), [$F(1,92) = 6.96$, $p = 0.01$, $\eta^2 = 0.07$]. Students with ASD were characterized by higher Socioeconomic Status (SES) as indicated by

higher educational attainment; high educational attainment (at least one of the parents had a Bachelor's degree) was reported by 80% of participants in the ASD group, and only 47% of participants in the control group ($p < 0.01$).

2.2. Measures

2.2.1. Adaptive Behavior Assessment System—ABAS-II (Harrison and Oakland, 2003)

The ABAS provides a General Adaptive Composite (GAC) score, presented as standard scores ($M = 100$, SD = 15). The GAC (used in this study) incorporates the assessment of 10 subdomains (communication, functional academics, self-direction, social, leisure, self-care, home/school living, community use, health and safety, work). The adult self-report version was used. High internal consistency (0.90) and high test-retest reliability (0.90) were reported for the GAC score of the ABAS. Convergence validity with the VABS was also reported (Harrison and Oakland, 2003). The ABAS has been used in several studies that examined adaptive behavior among individuals with ASD, indicating correlation between the ABAS GAC and ASD symptomatology (Kenworthy et al., 2010; Lopata et al., 2013). In the current sample, Cronbach's alpha internal consistency for the GAC items was $\alpha = 0.90$.

2.2.2. Liebowitz Social Anxiety Scale (LSAS) (Liebowitz, 1987)

The LSAS assesses social interaction and social performance-related anxiety. Twenty-four items are summed up in six subscales (Fear of Social Interaction, Fear of Performance, Avoidance of Social Interaction, Avoidance of Performance, Total Fear, and Total Avoidance) as well as an overall total score (ranging from 0 to 144)—higher ratings indicating a higher level of social anxiety. The overall total score was used in the current study. High reliability ($r = 0.82$, test-retest reliability) and validity ($r = 0.83$ with other social anxiety inventories) were reported for the self-report version used in the current study (Baker et al., 2002). LSAS scores were found to be significantly correlated with other measures of social anxiety among adults with ASD (Spain et al., 2016). The LSAS was previously used to examine the level of social anxiety among adults with ASD (Bejerot et al., 2014; Spain et al., 2016). Cronbach's alpha internal consistency for the 48 items in the current sample was $\alpha = 0.94$.

2.2.3. State Trait Anxiety Inventory (STAI)

The STAI includes two subscales, assessing state and trait anxiety, which produce 2 scores derived by summing up the relevant items for each subscale. Previous studies reported high internal consistency coefficients (0.86–0.95) (Spielberger and Gorsuch, 1983). Moderate validity, as expressed by high correlation with other measures of anxiety (0.73–0.85), was also reported (Cattell and Sheier, 1963; Taylor, 1953). Since a high correlation between trait and state anxiety on the STAI was observed ($r = 0.829$), only the trait score was used in the current study. A STAI version for children was used to study anxiety in children and adolescents with ASD (Corbett et al., 2017). Cronbach's alpha internal consistency for the 20 trait items in the current sample was $\alpha = 0.89$.

2.2.4. Yale-Brown Obsessive Compulsive Scale II (Y-BOCS II) (Goodman et al., 1989)

The Y-BOCS measures symptom severity in obsessive–compulsive disorder (OCD). The scale yields a total score (range: 0–40), used in the current study, and 2 subscale scores for obsessions and compulsions. Previous research has demonstrated moderate to high reliability (internal consistency 0.73–0.80) as well as strong convergent validity and good divergent validity (Deacon and Abramowitz, 2005; Wu et al., 2016). The YBOCS has previously been used to examine obsessive compulsive symptoms among adults with ASD (Russell et al., 2005). In the current sample, Cronbach's alpha internal consistency for the 10 YBOCS items was $\alpha = 0.90$.

2.2.5. Beck Depression Inventory-II (BDI-II) (Beck et al., 1996)

A 21-item self-report measure assessing outcomes of depression. A total BDI score (as used in the current study) is derived by summing up all 21 items. High reliability and validity, as expressed by high correlations with other depression-related self-rating scales ($r = 0.66$), were reported in individuals without ASD (Beck et al., 1996) and with ASD (Gotham et al., 2014). Cronbach's alpha internal consistency for the 21 Beck items in the current sample was $\alpha = 0.83$.

2.2.6. Autism Spectrum Quotient (AQ) (Baron-Cohen et al., 2001)

The AQ is a 50-item self-report measure for characterizing an individual's degree of autistic traits designed for adults with average or above average IQ. The total AQ score (used in this study) is derived by summing up responses (1 point each) that match the scoring of samples of persons with AS/HFA, either by indicating a “disagree” response, (half of the responses) or an “agree” response (half of the responses) (Baron-Cohen et al., 2006). A score of 32 and higher has been previously associated with clinically significant levels of autistic traits and used as a screening tool for autistic spectrum conditions among the general population. Construct (Baron-Cohen et al., 2001) as well as Concurrent validity (Ko et al., 2018; Wheelright et al., 2006) have been reported. The AQ was previously used to examine samples of typically developing individuals and those with ASD (Baron-Cohen et al., 2001). In the current sample, Cronbach's alpha internal consistency for the 50 items of the AQ was $\alpha = 0.97$.

2.2.7. Socioeconomic Status—SES

Socioeconomic status was evaluated by educational attainment. Following Durkin et al. (2017), we divided participants into two groups according to whether at least one of the parents had a Bachelor's degree or higher (high education) or not (low education). This indicator is widely considered to be an SES indicator and was highly correlated with other measures of SES such as median household income (Durkin et al., 2017).

2.3. Procedure

Approval by the University Ethics Committee was obtained prior to the study's onset. All participants gave informed consent to participate in the study and signed a consent form. The ASD group completed the study questionnaires in two sessions, the first of which included the YBOCS II, which was administered by a licensed clinical psychologist. In the second session, the participants completed the remaining questionnaires. Participants with ASD took approximately 105 min to complete all the tasks in both sessions, and usually enlisted the help of a research assistant. The non-ASD group completed the study's questionnaires in one session (the research assistant was also available for this group). The questionnaires were administered in the following order—YBOCS II, ABAS II, BDI II, LSAS, STAI and AQ. Data was available from all 95 participants for the ABAS, AQ, LSAS and Y-BOCS II. Results of the STAI were available for 86 participants (46 ASD, 40 control) and the BDI for 88 participants (49 ASD, 39 control).

2.4. Data analysis

Analyses were conducted using SPSS version 25 (Arkmonk, N.Y.; IBM Corp., 2013). Missing data were completed for the ABAS, STAI and the BDI II. Data imputations were performed only when 20% or less of the data in a specific measurement were missing, using the “expectation maximization” technique only when data were missing completely at random (Little's MCAR test).

Chi-square analysis was used to compare gender and SES among the study groups. Normal distribution of the dependent variables across the entire sample as well as for each of the study groups (ASD, non-ASD)

was tested by skewness and kurtosis, according to Kim (2013). Additionally, a non-parametric (Mann-Whitney) analysis was conducted to assess group differences (ASD, non-ASD) for all four psychiatric symptom variables (LSAS, STAI, YBOCS-II, BDI-II). Pearson correlation analyses were conducted for continuous psychiatric and behavioral measurements in each group. Group differences in age were examined using one-way ANOVAs. Since the groups differed in their ages, age served as a covariate in all the analyses. A univariate analysis of variance (ANCOVA) was conducted to examine group differences in the GAC-ABAS. A multivariate analysis (MANCOVA) was conducted to examine group differences in psychiatric measures. Univariate analyses for each variable followed the MANCOVA.

In addition, a hierarchical linear regression analysis was performed in order to identify the relative contribution of the study's variables to the variance in adaptive behavior. The GAC (adaptive behavior) score served as an outcome variable. Independent variables included group (ASD/non-ASD), sex, levels of social anxiety (LSAS scores), trait anxiety (STAI-T scores), and obsession-compulsion (Y-BOCS II scores). In addition, the contribution of interactions of group and the three psychiatric measures were tested.

3. Results

Skewness and kurtosis values for the entire sample indicated a normal distribution of all the study measures (Z $p > 0.05$, Kim, 2013), except for the depressive symptoms (BDI-II). Adaptive behavior (ABAS-GAC) and social anxiety (LSAS) scores were also normally distributed for both the ASD and non-ASD groups, while a non-normal distribution was evident for trait anxiety (STAI) and obsessive compulsive symptoms (YBOCS-II) among non-ASD participants, and depressive symptoms (BDI-II) in the ASD group.

For the first study aim, to examine the differences between the ASD and control groups, we conducted an ANCOVA on the ABAS General Adaptive Composite (GAC). The analysis yielded a significant group effect [$F(1, 92) = 17.00$, $p < 0.001$, $\eta^2 = 0.16$]. Significant differences were observed between the ASD (mean = 84.38, SD = 14.56) and the non-ASD group (mean = 97.95, SD = 15.39). GAC scores were in the 14th ("very low") and the 42nd ("average") percentile, respectively, according to ABAS norms (Harcourt Assessment, 2003).

Next, we examined the level of psychiatric symptoms (LSAS, STAI, Y-BOCS II and BDI II) in the study groups. A one-way MANCOVA yielded a significant group effect [$F(4,79) = 13.28$, $p < 0.01$, $\eta^2 = 0.40$]. Series of ANOVAs revealed significant group effects in all four measures (Table 1).

The mean LSAS score reported by the ASD group was higher than 30, considered a cutoff point for social phobia (Rytwinski et al., 2009). The reported level of obsessive compulsive symptoms among the ASD group was at the cut-off value for OCD (13, Castro-Rodrigues et al., 2018), while the control group was in the subclinical range (Goodman et al., 1989). The average depression scores for both groups indicated non-depression levels (BDI score < 13))Beck et al., 1996; Whisman and Richardson, 2015). In all the analyses, no significant age effect was noted. Additionally, a non-parametric (Mann-Whitney) analysis indicated significant group differences in all the study's measures (Table 1).

Table 2
Correlations between the study measures.

	Group	ABAS	STAI	LSAS	Y-BOCS	BDI
ABAS	**ASD**	1.00	-0.24	-0.32**	-0.26*	0.01
	non-ASD	1.00	-0.18	-38**	-0.13	-0.30*
STAI	**ASD**		1.00	0.15	0.17	0.51***
	Control		1.00	0.34*	0.20	0.87***
LSAS	**ASD**			1.00	0.36**	0.15
	non-ASD			1.00	0.28*	0.30*
Y-BOCS	**ASD**				1.00	0.21
	non-ASD				1.00	0.27
BDI	**ASD**					1.00
	non-ASD					1.00

Note: ASD = autism spectrum disorder; LSAS = Liebowitz Social Anxiety Scale; STAI = State Trait Anxiety Inventory; Y-BOC-II = Yale-Brown Obsessive Compulsive Scale-II; BDI-II = Beck Depression Inventory II.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

For the second aim of the study, we examined the association between adaptive skills (GAC-ABAS) and the psychiatric symptom measures (LSAS, BDI II, STAI, and Y-BOCS II) in the ASD and non-ASD groups (Table 2).

Adaptive behaviour correlated negatively and significantly with social anxiety and with levels of obsessive compulsive symptoms in the ASD group, and with social anxiety and level of depression in the non-ASD group. A marginally significant correlation ($p < 0.06$) was evident between adaptive behaviour and trait anxiety in the ASD group.

To identify variables that predict adaptive behavior (aim 3) we performed a three-step hierarchical regression with the adaptive skills score (GAC-ABAS) as the dependent variable. Independent variables included group as a major factor examined in this study, and sex, a demographic variable strongly associated with ASD (Hartley and Sikora, 2009), in the first step. Psychiatric measures (STAI, Y-BOCS, LSAS) were entered in the second step in order to examine their possible contribution beyond having an ASD diagnosis. These three variables significantly correlated with adaptive behavior in the ASD group (correlation of trait anxiety was marginally significant). Interaction of group and psychiatric measures in the third step were in stepwise form. In total, the model explained 41.7% of the variance in adaptive skills. The results are presented in Table 3.

Group and sex in the first step significantly explained 31.2% of the variance. Having a diagnosis of ASD and being a male were associated with lower adaptive functioning. In the second step, psychiatric measures of social anxiety, trait anxiety and obsessive compulsive scores added significantly to the explained variance (10.5%). However, only

Table 1
Study measure means and standard deviations among study groups with and without ASD.

	ASD *M*(SD)	Range	Non-AS *M*(SD)D	Range	Cutt-off	*F*	η^2	*U*
LSAS	45.43(24.60)	3–108	27.29(17.65)	2–75	30	15.58***	0.16	621.00***
STAI	44.49(8.99)	26–62	35.69(10.61)	21–62		16.55***	0.17	467.50***
YBOCS-II	13.12(5.72)	2–26	4.45(5.65)	0–24	13	45.18***	0.35	288.50***
BDI-II	11.11(11.54)	0–28	5.43(4.78)	0–17	13	7.38**	0.08	655.00**

Note: ASD = autism spectrum disorder; LSAS = Liebowitz Social Anxiety Scale; STAI = State Trait Anxiety Inventory; Y-BOC -II = Yale-Brown Obsessive Compulsive Scale-II; BDI -II = Beck Depression Inventory II. Cut-off points were taken from Menin et al. (2002) for LSAS; Castro-Rodrigues et al. (2018) for the Y-BOCS-II; Whisman and Richardson, 2015 for the BDI-II.
[a]U = Mann-Whitney U test.
** $p < 0.01$.
*** $p < 0.001$.

Table 3
Hierarchical regression model for Adaptive Behavior Assessment System—(ABAS-II) scores.

Step	Variable	*B*	SE	β	R^2	$R^2\Delta$
1	Group	−6.99	1.57	−0.42***	31.2***	31.2***
	Sex	15.92	4.59	0.32***		
2	Group	−3.78	1.83	−0.23*	41.7***	10.5***
	Sex	14.00	4.39	0.28**		
	Trait anxiety - (STAI)	−1.82	1.62	−0.11		
	Obsessive compulsive symptoms (Y-BOCS)	−1.25	1.96	−0.07		
	Social anxiety - LSAS	−4.58	1.63	−0.28**		

Note: LSAS = Liebowitz Social Anxiety Scale; STAI = State Trait Anxiety Inventory; Y-BOC-II = Yale-Brown Obsessive Compulsive Scale-II.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

social anxiety scores (LSAS) correlated negatively and significantly with adaptive skills, as higher scores were associated with lower adaptive functioning. None of the interactions (Group with psychiatric measures) added significantly to the explained variance, meaning that the associations between severity of psychiatric symptoms and adaptive skills were similar for both groups.

4. Discussion

In this study, university students with ASD reported significantly lower adaptive skills in comparison to students without ASD. Additionally, the ASD group showed significantly higher levels of social anxiety, trait anxiety, obsessive compulsive and depression symptoms than the non-ASD students.

Lower levels of adaptive skills in individuals with ASD have been previously described (Howlin and Magiati, 2017; Matthews et al., 2015; Mazzone et al., 2012). However, this is the first research that has examined the functioning of young adults with high cognitive abilities who were accepted to university. Though considered "optimal outcome," this population demonstrated impaired functioning. These findings might explain previous reports of the high frequency of unemployment and social and economic dependence among cognitively-able adults (age range 18–62) with ASD (Gotham et al., 2015; Roy et al., 2015).

Previous research has indicated a high prevalence of anxiety disorders among cognitively-able adults (age range 16–42) with ASD (Maddox and White, 2015; Spain et al., 2016; Howlin and Magiati, 2017). Elevated self-reports of trait anxiety among ASD participants, as were found in this study, were also observed in previous studies of children and youth with ASD (age range 8–14) (Corbett et al., 2017; Lanni et al., 2012). As in previous research (Russell et al., 2005), the current finding also demonstrates high OCD symptomatology among high-functioning adults. Previous findings reported a high prevalence of depression (20–70%) in adults (age range 19–79) (Howlin and Magiati, 2017; Lever and Geurts, 2016; Lugnegard et al., 2011); however, the average BDI II score reported by both groups in the study was in the subclinical range (though significant group differences were found). A possible explanation for the current findings relates to the participants' characteristics: participants with ASD were young undergraduate students with a relatively high cognitive ability and previous academic success. Thus, it is possible that this ASD subgroup, characterized by a sense of competence, is less susceptible to depression. Two other studies have also reported relatively low depression levels among adults with ASD (Gotham et al., 2015; Spain et al., 2016).

The main goal of the current study was to identify variables correlated with adaptive behavior and which might explain the variability of adaptive behavior in students with ASD. Lower adaptive functioning was associated with the severity of social anxiety and obsessive compulsive symptoms in ASD participants. However, no statistically significant group differences in the correlations between these variables was found, leading to the conclusion that psychiatric symptoms are similarly associated with adaptive skills in both ASD and non-ASD populations. As expected, a diagnosis of ASD had a significant predictive value of 31% in accounting for the variance in adaptive skill levels. Sex also had a significant contribution to the explained variance in adaptive skills. However, in light of the mixed findings regarding sex differences in adaptive behavior (Andersson et al., 2013; Frazier et al., 2014; Mandic-Maravic et al., 2015) and the small number of female participants in the current study, our finding encourages further investigation of this issue.

The only psychiatric symptom that contributed to the explained variance of adaptive skills beyond the ASD diagnosis was social anxiety, which was negatively correlated with adaptive behavior. High rates of social anxiety are frequent in children and youth as well as among adults with ASD (Cholemkery et al., 2014; Spain et al., 2016, respectively). Several postulations have been suggested to explain the high prevalence of social anxiety in ASD and its relation to behavior. One possible explanation has to do with cognitive factors, wherein elevated social anxiety is a result of increased levels of negative automatic thoughts in children as well as adults with ASD, as suggested by previous research (Farrugia and Hudson, 2006; Kerns and Kendall, 2012). Additional explanations related to other factors such as limited cognitive flexibility, rigidity, and fear of negative feedback or rejection from others as potential facilitators of social anxiety (Cholemkery et al., 2014; Kerns et al., 2015; Yasuda, 2014) as well as conceptualizing high social motivation as a potential contributor to social anxiety and impaired social functioning among individuals with ASD (Mazefsky et al., 2012; White et al., 2014). One common denominator of these theories is that aspects of ASD lead to greater social anxiety, resulting in impaired adaptive behavior. Lastly, previous research findings suggest that psychiatric comorbidities such as depression and anxiety (associated with avoidance and lack of motivation) may impair daily functioning and lead to less adaptive behavior (Hedley and Young, 2006; Kraper et al., 2017).

The present research has several strengths: the examination of adaptive skills and specific psychiatric symptoms, and the inclusion of a non-ASD group. However, the study's findings are limited by the fact they are based on self-report questionnaires and the fact that we did not collect any corroborative informant data. Moreover, a convenience sample was used and students in the ASD group were also participating in an integration program in the university. A statistically significant age difference between the study groups was observed. However, in all the analyses, no significant age effect was noted and it is reasonable to assume that the effect of this relatively small age difference on our outcome variable is minor. Additionally, our participants did not undergo a full psychiatric assessment and, accordingly, we did not obtain formal diagnoses for the psychiatric comorbidities that were the subject of this research. Moreover, whether individuals with ASD were receiving treatment (medical and/or psychological) was not included as a factor in the analyses; therefore, it is not known whether, or to what extent, our findings would be affected by this factor. It is possible that reported levels of psychiatric symptoms in the ASD group were already mitigated by the receipt of medical/psychological treatment, raising the possibility that more profound differences actually exist between ASD and non-ASD participants. Data regarding the participant SES was limited and based on parental educational attainment (Durkin et al., 2017). Previous research has linked between lower SES and a higher risk for social anxiety (Cheng et al., 2015). However, the finding indicates that students with ASD reported on higher SES, thus, the relatively high levels of social and trait anxiety cannot be explained by SES differences. Data on attention deficit and hyperactivity disorder (ADHD) symptoms were not available in the current study. These issues should be addressed in future research.

The study has several potentially significant implications. High-functioning young adults in formal academic and vocational settings should undergo psychiatric assessment to identify possible elevated anxiety, (social anxiety and OCD) and their effect on adaptive behavior. Finally, medication and/or psychological treatment should be considered in cases in which psychiatric symptoms are significant. The current findings should be considered by programs designed for students with ASD, since they indicate that anxiety may have a considerable effect on adaptation to campus life. Therefore, it is suggested that other domains of behavior should be addressed as well: assistance with integration into social life on campus, as well as management of daily life tasks, both seem essential for success in integration programs for young adult students with ASD.

Further research on young adults with ASD is needed. Low functioning individuals with ASD should also be assessed in regard to psychiatric symptoms and their association with functioning. In addition, proof of the effectiveness of university programs for cognitively-able young adults with ASD might provide a positive new path for this specific population.

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