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Autistic traits and self-harm in adolescents: a study on interpersonal psychological theory of suicide

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Abstract

Background The purpose of the study was to investigate whether autistic traits predicted the presence and recurrence of self-harm and to determine any relationship mediated by the Interpersonal Psychological Theory of Suicide (IPTS), which composed of the social influence of negative life experiences on suicide, is referred to as "acquired capability", while proximal social risk factors are referred to as "thwarted belonging and perceived burdensomeness."

Results We evaluated any interaction with the Autistic Quotient (AQ) score and self-harm whether it was explained by the thwarted belonging/perceived burdensomeness in the Interpersonal Needs Questionnaire (INQ), victimization in the Olweus Bully/Victim Questionnaire (OBVQ), and maltreatment in the Childhood Trauma Questionnaire (CTQ). Communication and social skill as autistic traits predicted the presence of self-harm, yet the association vanished after including thwarted belonging and perceived burdensomeness, which are independent predictors of the presence of self-harm. Social skill and the sum score of autistic traits predicted the recurrence of self-harm, and the prediction was mediated largely by thwarted belonging and much less by perceived burdensomeness.

Conclusions The unique interaction of autistic traits and IPTS increases the risk of self-harm. Within autistic traits, social skills, in particular, are likely associated to attempts at self-harm through acquired capability. The results of this research were identified as attention to loneliness and social support may be helpful in reducing self-harm in adolescents with autistic traits.

Keywords Autistic traits, Perceived burdensomeness, Self-harm, Thwarted belonging

Background

The frequency of self-harm in adolescents has been an increasing concern in recent years. Relatedly, there has been extensive literature on Autism Spectrum Disorder (ASD) and self-harm [1]. However, the degree of variation in the dimensions of autism in typically developing children is diverse. A retrospective analysis of relevant data shows that many individuals with subthreshold presentations of autism have remained undiagnosed or have been misdiagnosed until adulthood [2]. Such presentations have been identified as risk factors for adverse psychological outcomes, including suicidal behaviors [1, 3]. Therefore, several study strategies have shifted toward the trait-based approach to autism-related characteristics in clinical groups [4, 5]. Autistic traits are atypical personality traits that are regularly identified in relatives of people with autism and are thought to be milder forms of clinically confirmed autism symptoms

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[6]. Specific psychometric instruments, such as the Autism-Spectrum Quotient (AQ) [7] and the Social Responsiveness Scale (SRS) [8], have enabled for more exact measurement of subthreshold autistic features. To date, only a few studies have explored autistic traits and self-harm in children and adolescents without investigating the mediators and moderators. Only a few meta-analyses have been conducted to date on suicidality in autistic individuals [9, 10]. The one showed threefold increase in suicidality (not divided ideation and behavior) [10]. The other founded pooled prevalence estimates were 25.2% for suicidal ideation and 8.3% for suicide attempts [9]. In this study, autistic traits were explored in the framework of the Interpersonal Psychological Theory of Suicide (IPTS), which has a strong focus on social context. The IPTS states that for suicide, the social impact of adverse life experiences is termed "acquired capability" and proximal social risk factors as "thwarted belonging and perceived burdensomeness" [11]. Therefore, suicide must, to some extent, be planned rather than being accidental and must include a non-zero amount of willingness to die. The IPTS suggests that the two proximal risk variables of perceived burdensomeness and thwarted belonging occur together when there is suicidal ideation. The negative belief that one is a burden to others or that dying would somehow benefit others is known as perceived burdensomeness [12]. Lack of social support from family and friends, as well as a sense of loneliness and the inability to build and sustain satisfying relationships, are all features of thwarted belongingness [12]. For autistic and typically developing individuals with autistic traits, loss of social support (an expression of perceived burdensomeness) and self-reported loneliness (an expression of thwarted belonging) have been associated with suicidal thoughts [13, 14]. In general, the IPTS may help to understand how some adolescents with elevated autistic traits are more likely to be at risk of self-harm. Aligned with such findings, the correlation between depression and the components of the IPTS was found to be lowest among people with higher autistic traits [13]. One understanding of this finding is that the constructions of the IPTS, as described in the general population, do not adhere as strongly to those with high autistic traits. Similarly, previous studies with adult samples have indicated that victimization, depressive symptoms, thwarted belonging, and perceived burdensomeness mediate the relationship between autistic traits and self-harm, but these studies used various sampling methods that limit their generalizability [3, 13, 15, 16]. In this study, the problem was approached with a broader perspective with three exploratory mediation models resulting from the IPTS framework and considering a recent review that examined the IPTS in ASD [17]. The Interpersonal Needs Questionnaire (INQ) was used for the proximal social risk factors (thwarted belonging and perceived burdensomeness) and expanded with the distal social risk factor (acquired capability assigned as maltreatment and victimization). The primary aim of this study was to investigate whether autistic traits predicted self-harm, and the secondary aim was to support previous work [5, 13, 16] by quantitatively evaluating any observed associations explained by acquired capability while adjusting for common confounders such as depression and anxiety symptoms [3, 11]. Based on previous work [4, 18, 19], this research hypothesized that definite autistic traits (impairments in communication and social skills, attention switching) would be associated with the presence and recurrence of self-harm and that the association between autistic traits and self-harm could be significantly explained by the IPTS variables.

Methods

The self-harm group consisted of 60 adolescents, aged 14–18 years, recruited within 72 h after a deliberate self-harm or suicide attempt from the child and adolescent psychiatry clinic between January 2020 and December 2020. A healthy control group of 60 adolescents in the same age range was recruited from the same clinic (siblings of patients who came for other reasons). Subjects were excluded if they had been diagnosed with severe intellectual disability, psychosis, cerebral palsy, or epilepsy. No significant differences were determined in the demographic data regarding the presence or recurrence of self-harm (depicted in Additional file 1: Tables S2 and S3). Within the self-harm group, 35 adolescents attempted deliberate self-harm, and 25 adolescents attempted suicide. The diagnoses and comorbidities were not involved as they were not included in the design of the study.

The study protocol was conducted in accordance with the Helsinki Declaration and the International Council for Harmonization Note for Guidance on Good Clinical Practice. The study was reviewed and approved by the Local Ethics Committee, dated October 11, 2019. The informed assent forms were also signed 'applicable' by the Local Ethical Committee. After the clinical evaluation and treatment of reason for clinical demand, the consent to participate in the study was requested from the adolescent or the assent from their legal guardians. The Adolescent version of the Autism Spectrum Quotient (AQ-Adolescent), the Interpersonal Needs Questionnaire (INQ), the Childhood Trauma Questionnaire (CTQ), the Olweus Bully/Victim Questionnaire (OBVQ), the Children's Depression Inventory (CDI), and the

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State-Trait Anxiety Inventory (STAI) were completed by the adolescents with the help of the clinician.

The data on the presence and recurrence of self-harm were obtained from the clinical evaluation of adolescents and interviews with their parents during the acute clinical examination after self-harm. No structured tool was used for investigating self-harm during the clinical examinations. Autistic traits were measured with the AQ-Adolescents scale, which has the five subdimensions of social skills, communication, imagination, attention to detail, and attention switching. The AQ was created to test for autistic traits or broad autism phenotypes in adult individuals [7]. The study for the adolescent version was later carried out by Baron-Cohen and colleagues [20]. The Cronbach α value was determined as 0.829 in the Turkish adaptation study [21].

The INQ was used to assess the proximal social risk factors of the IPTS. The scale was developed in the context of the IPTS [12]. The Likert-type scale consists of 15 items: the subscales of perceived burdensomeness (first six items) and thwarted belonging (last nine items). The Cronbach α value is 0.90 for perceived burdensomeness and 0.72 for thwarted belonging [22].

The OBVQ was used to detect adolescents who have been exposed to victimization. The self-report survey consists of 39 items to identify bullying and victimization in children and adolescents [23]. The Cronbach α value of the Turkish form was determined to be 0.81 [24]. CTQ was used to detect maltreatment. It is a self-reporting scale that was prepared for a retrospective screening of traumatic experiences before the age of 18 [25]. It includes 40 items with a total score ranging from 40 to 200. A study of psychometric properties in Turkish adolescents measured three childhood trauma groups: emotional, physical, and sexual maltreatment. The Cronbach α value was calculated as 0.91 [26].

Basic Information Form (BIF) was created by the authors to investigate socioeconomic variables (age, sex, parents' education and employment) and the family history of self-harm (either non-suicidal or suicidal self-harm). The socioeconomic status classification was based on the Hollingshead index [27]. The Child Depressive Inventory (CDI) was developed to measure the severity of depression in adolescents [28]. Scores range from 0 to 54, with higher scores indicating greater severity of depression. The cut-off value for the Turkish adaptation version is 19 [29].The State-Trait Anxiety Inventory (STAI) was used to measure anxiety levels. It is a self-report instrument developed to measure symptoms of anxiety [30]. It includes the State Anxiety Subscale and the Trait Anxiety Subscale, each consisting of 20 items. The total score obtained from both subscales varies between 20 and 80. In the current study, only the State Anxiety Subscale scores were used. The Cronbach α values for the State Anxiety Subscale were found to be 0.83–0.92 [31].

Statistical analyzes were performed using the IBM SPSS version 25 software. The Chi-square test, the independent samples t test, and the Mann–Whitney U test were performed in univariate analyses to compare scale scores and the demographic data between groups, which were divided as self-harm/control or recurrent/single episode of self-harm. Cohen's d (small $d = 0.2$; medium $d = 0.5$, large $d = 0.8$) for the independent samples t test [32] and (small $d = 0.1$, medium $d = 0.3$, large $d = 0.5$) for the Mann–Whitney U test [33], and the Phi value (small $\Phi = 0.1$; medium $\Phi = 0.3$; large $\Phi = 0.5$) for the Chi-square test [34] were used to measure the effect sizes of univariate analyses. Hierarchical logistic regression analysis was used to examine variances with explanatory variables on the primary outcome of self-harm. In the first model, demographic data (age, sex, socioeconomic status, family history of self-harm), internalizing symptoms (depressive and anxiety symptoms), AQ scores and two subscales' (communication and social skills) scores which were significant in univariate analyzes were treated as predictors. The secondary outcome of self-harm recurrence (divided dichotomously) was predicted with standard (Enter method) binary logistic regression analysis with similar explanatory variables while excluding the communication subscale of AQ due to irrelevance in univariate analysis. Odds ratios (*OR*) in logistic regression analyses were considered as measures of the effect size.

To assess the importance of the IPTS variables in explaining the association between autistic traits and self-harm, thwarted belonging and perceived burdensomeness were included in the hierarchical logistic regression analysis as a second step towards the main effects. Distal social risk factors for the IPTS were not included in the regression analysis because they were not statistically significant in the univariate analysis (maltreatment in CTQ) or because predominant significance (victimization in OBVQ) may have impeded the goodness-of-fit of the second model. Taking into account the multicollinearity between autistic traits and IPTS variables (VIF > 3), the mediation between autistic traits and self-harm recurrence (treated dichotomously) was estimated using the Process Macro model 4 (thwarted belonging and perceived burdensomeness were treated as mediators). A value of $p < 0.05$ was accepted as statistically significant.

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Results

Hierarchical logistic regression analysis was performed on the presence of self-harm as the primary outcome. To statistically control variables, demographic data, autistic traits, and internalizing symptoms were entered in the first step, then proximal social risk factors for the IPTS were entered in the second step. Separate models evaluated the additional variance in the presence of self-harm. Models 1 and 2 revealed a significant overall model fit. Subsequently, the decrease in the $-2LL$ value for both models (135.380–53.966, respectively) and the increase in the Nagelkerke R^2 value (accounted for the 72.5% and 89.2% of the variance in the dependent variable) indicated that the inclusion of proximal social risk factors for the IPTS significantly improved the goodness-of-fit model compared to the previous model (step χ^2 for Model 2; 81.413, $p < 0.001$). For Model 2, a higher thwarted belonging score was the most significant predictor, and it increased the risk of self-harm 1.27 times. The other significant predictor was perceived burdensomeness, which increased the risk of self-harm 1.25 times. Social skills and communication scores of AQ were found to be independent predictors of self-harm (1.28 and 1.30 times, respectively). The significances were lost after the inclusion of the IPTS variables (see Table 1), which suggests

that AQ scores predicted self-harm indirectly through proximal social risk factors.

Binary logistic regression analysis was performed on the recurrence of self-harm within the self-harm group. The IPTS variables were excluded due to multicollinearity with AQ scores (VIF > 3) (Table 2). The results of the analysis demonstrated that higher AQ total and social skills scores predicted self-harm recurrence by 1.37 and 2.24 times, respectively, independent of the demographic data and internalizing symptoms. Binary logistic mediation using the Process macro was used [35] to determine the mediating effect of thwarted belonging (Mediator 1) and perceived burdensomeness (Mediator 2) between autistic traits (AQ total score as Independent Variable) and self-harm recurrence (Dependent Variable) (schematized in Fig. 1). The logistic mediation model indicated that the relationship between autistic traits and self-harm recurrence was mediated primarily by thwarted belonging compared to perceived burdensomeness. The figure illustrates that there was no direct effect of autistic traits on the recurrence of self-harm ($b = 14.31$, $SE = 68.69$, $p = 0.83$, CI = [-120.32, 140.95]). The same mediation model conducted after changing the Independent Variable to social skills revealed similar results (Fig. 2) except that there was no significant mediation through

Table 1 Hierarchical logistic regression analyses with the occurrence of self-harm as a dependent variable

Independent variables	Model 1			Model 2		
	B	Wald	OR	*B*	Wald	OR
Demographic data						
Age	− 0.249	2.501	0.780	− 0.363	1.073	0.696
Sex	0.600	1.156	1.823	0.960	0.513	2.612
SES	− 0.009	0.012	0.991	− 0.049	0.050	0.953
Family history of self-harm	1.351	3.245	3.860	1.493	0.776	4.450
Internalizing symptoms						
Depressive symptoms	− 0.010	0.564	0.990	− 0.003	0.008	0.997
Anxiety symptoms	− 0.014	0.995	0.987	0.037	1.082	1.038
Autistic traits						
Total	0.071	1.866	1.073	− 0.005	0.002	0.995
Social skills	0.254	8.922	1.289**	0.221	1.260	1.247
Communication	0.265	4.491	1.304*	− 0.084	0.102	0.919
IPTS variable						
Thwarted belonging				0.242	7.025	1.273**
Perceived burdensomeness				0.227	11.394	1.254**
Statistics of the model						
− 2LL	135.380			53.966		
Model χ^2	30.976 (*df* = 9)***			112.389 (*df* = 11)***		
Step χ^2	30.976 (*df* = 9)***			81.413 (*df* = 2)***		
Nagelkerke R^2	0.303			0.811		
Classification accuracy	72.5			89.2		

SES socioeconomic status, *IPTS* Interpersonal Psychological Theory of Suicide

* $p < 0.05$; **$p < 0.01$; ***$p < 0.001$

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Table 2 Binary logistic regression analyses with self-harm, recurrence of self-harm as a dependent variable

Independent variables	Model		
	B	**Wald**	**OR**
Demographic data			
Age	− 0.308	0.845	0.735
Sex	0.412	0.168	1.510
SES	− 0.349	3.802	0.705
Family history of self-harm	− 0.610	0.140	0.543
Internalizing symptoms			
Depressive symptoms	− 0.041	2.032	0.960
Anxiety symptoms	0.006	0.043	1.006
Autistic traits			
Total	0.315	7.179	1.371**
Social skill	0.810	7.683	2.248**
Statistics of the model			
− 2LL			
Model χ²	42.076		
Nagelkerke R^2	31.227 ($df=8$)***		
Classification accuracy			
	0.575		
	85.0		

SES socioeconomic status, *IPTS* Interpersonal Psychological Theory of Suicide

**p < 0.01; ***p < 0.001

perceived burdensomeness. Social skills did not have a direct effect on self-harm recurrence, as well ($b=1.31$, $SE=1.02$, $p=0.19$, CI = [− 0.68, 3.31]). The indirect effects of the mediators are summarized in Table 3.

Discussion

The current study investigated whether the distinctive characteristics of autistic traits increased self-harm. The results of the study showed that high levels of communication difficulties and, to a lesser extent, social skill problems predict self-harm in adolescents. This finding reinforces the notion that autistic traits should be approached separately, at least in typically developing adolescents [36]. More as a practical matter, abnormalities in social communication may be further labeled as traits linked to higher psychopathology beyond the diagnosis of autism.

To our knowledge, this study has been the first to analyze the impact of the three dimensions of the IPTS in the context of autistic traits. The results confirmed that autistic traits do not explain the significant additional variance in self-harm within various established proximal and distal social risk factors of the IPTS. Autistic traits may predispose to self-harm indirectly via the IPTS principles, which is in parallel with the prevailing view that thwarted belonging and perceived burdensomeness mediate the relationship between autistic traits and suicidal tendencies and provide essential evidence of the IPTS [13, 37].
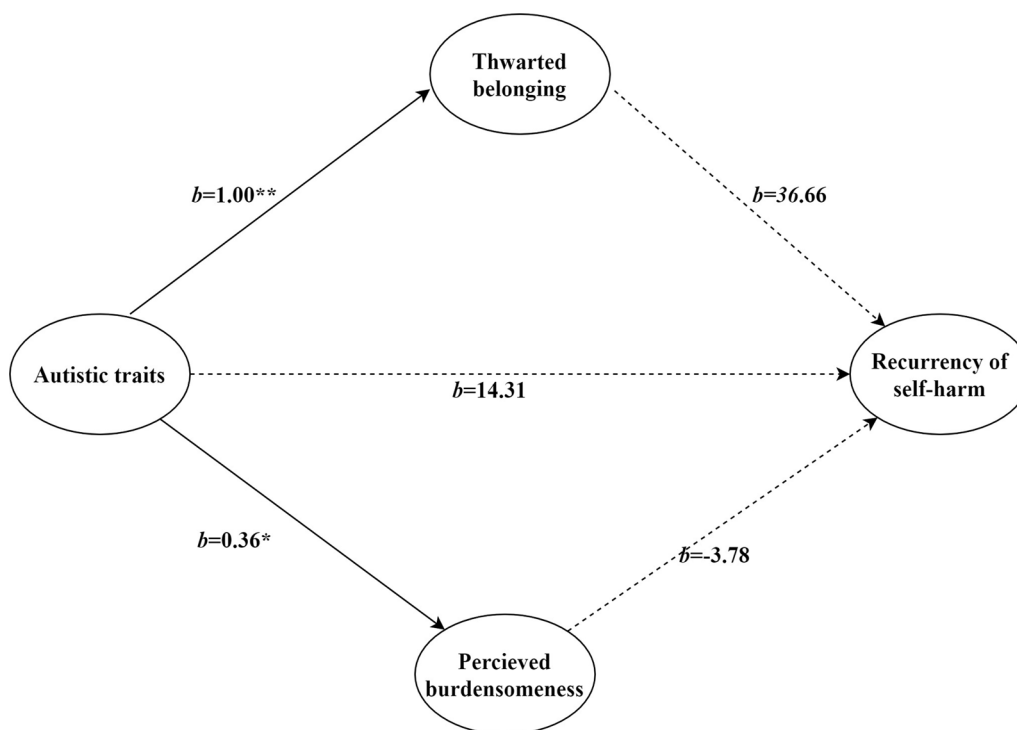

Fig. 1 The connection between autistic traits and the recurrence of self-harm mediated by IPTS variables
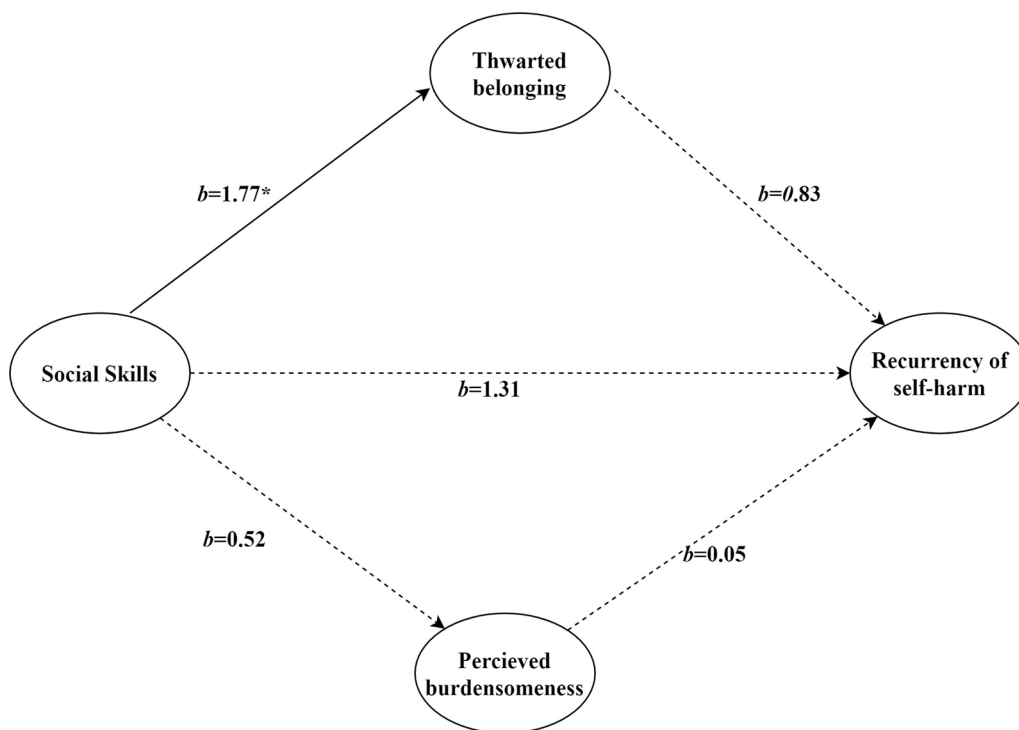
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Fig. 2 The connection between social skill and the recurrence of self-harm mediated by IPTS variables

Table 3 The indirect effect of mediators in two mediation models on the recurrence of self-harm as the dichotomous dependent variable

Variables	*b*	95% CI
Mediators (autistic traits as IV)		
Thwarted belonging	36.68	2.68 to 48.09
Perceived burdensomeness	− 1.38	− 3.34 to 1.73
Total indirect effect	35.30	2.61 to 46.61
Mediators (social skill as IV)		
Thwarted belonging	1.49	0.64 to 256.29
Perceived burdensomeness	0.03	− 2.12 to 20.33
Total indirect effect	1.52	0.67 to 270.96

IV independent variable; *b* mediation coefficient; *95% CI* lower and upper limits of the *b* value at 95% confidence interval

Interestingly, autistic traits predicted recurrence, but not independently of proximal social risk factors for the IPTS. Similarly, a survey study of suicide data based on a self-report scale conducted in a non-clinical adult sample suggested that higher autistic traits predicted the frequency of suicide attempts [38]. It is not possible to compare the results of the current study as there was no similar adjustment for confounders. Communication and imagination subscales were reported to predict suicide recurrence in Cassidy and colleagues' research [38], while the present study indicated that social skills and total autistic traits predicted self-harm recurrence.

Current research also extends existing knowledge on the IPTS with striking results which indicate that the interaction between social skills and self-harm is mediated by thwarted belonging, with an emphasis on social skills beyond those of previous studies on autistic traits [39]. Lack of meaningful social support was shown to be associated with a higher risk of suicidal behavior, partially due to depression in autistic adults [14]. Thwarted belonging was previously interpreted to drive autistic traits to social isolation and diminished reciprocal interactions [13]. Individuals with higher autistic traits have lower social connection and support, resulting in suicidal and parasuicidal behaviors. One theory could be that adolescents who self-harm suffer from limited adaptability to social situations from an early age, leaving them more vulnerable to loneliness [40]. Evidence sheds light on potential interventions focusing on sociability, which could be highly beneficial to prevent self-harm, rather than costly management aimed at social networks.

In rejection of the hypothesis of the current study, no association was detected between attention switching and self-harm. This was surprising given that the attention switching subscale was reported to be higher in individuals with Asperger syndrome who have attempted

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suicide [41]. However, there are some differences in our research from the aforementioned study. First, autism was included as a dichotomous diagnostic category in the Paquette-Smith and colleagues' research [41], while in the current study, autistic traits were assessed on a continuum of symptoms, not a dichotomous diagnostic definition. Second, the current study included a broader definition of suicidal behavior as self-harm with/without suicidal intent and was conducted in a broader sample than adults with Asperger syndrome.

The other theme worth considering from the findings of the current study is the impact of victimization, not maltreatment, as an acquired capability. Some previous research has suggested that victimized participants with ASD demonstrate a marked increase in the rate of suicidality (>threefold) compared to non-ASD groups [42]. However, in the present study, victimization was not included in the multivariate analysis to avoid impeding the goodness-of-fit in the regression model. A possible explanation of the large effect size in the univariate analysis is sampling bias since the sample from the self-harm group was generally recruited from the residential care center due to the location of the clinic. A larger sample with a more heterogeneous clinical group is needed to achieve reliability.

Previous research showed a link between autistic traits and post-traumatic stress disorder (PTSD), revealing that autistic traits might often lead to a broad scope of stress-related conditions [43]. Stress-related symptoms in individuals with autistic traits could also cause an increase in the prevalence of suicidal thoughts [44]. Together, these pieces of evidence may indicate that subjects with higher autistic traits have weaker coping mechanisms and less capacity to manage traumatic events. Therefore, maltreatment was expected to mediate the interplay between autistic traits and self-harm. The findings of the current study were somewhat surprising since they did not support this postulation. The inconsistency may be explained by the exclusion of minor life experiences in the present study, while they have been considered in previous studies and have been associated with various results in individuals with autistic traits [45].

The results need to be viewed in the face of a range of limitations. First, autistic traits may lead to over- or under-reporting on self-report scales due to a limited ability to perceive the attitudes and abstract thoughts of others. Second, an important caveat to bear in mind when drawing conclusions from mediation analysis is that the study was cross-sectional, so it was not well-grounded enough to address precise causality. Third, the over-representation of females and adolescents with residential care prevented the generalizability of the findings. Also, the low sample size and the selection of the control group from siblings of the clinical population may limit the generalizability of the results. Lastly, the AQ scale did not include restricted interest and repetitive behavior, which may be involved in the self-harm process, as has been identified previously [46]. More prospective studies are required to overcome these limitations.

This study has also several notable strong aspects. First, we discuss various combined theoretically important variables which have not been considered in previous research on adolescents. Second, the evaluation of participants within 72 h after a self-harm incident strengthens the reliability of the findings. Third, the magnitude of the differences between the two groups and the potency of the mediating variables were moderate to large. Although the topic has been of intense interest, to our knowledge, this is the first study to investigate IPTS variables with autistic traits in the adolescent population with a substantial rate of parasuicidal and suicidal behaviors.

Conclusions

The analysis of the current study brings together several conclusions. This research examined the complex interplay between autistic traits and IPTS principles from a novel analytical point of view. The results suggested that adolescents with higher autistic traits are more likely to develop thoughts such as the feeling that they do not belong to the world and are burdensome to those around them, and this stress can increase the risk of committing self-harm.

This study emphasized the importance of detecting subthreshold manifestations of autistic traits. Clinicians should be aware of autistic traits through screening social and communication skills and implement a safety plan to lessen the probability of future self-harm attempts. New tailored interventions that encourage social inclusion and coping strategies in adolescents with higher autistic traits are likely to have the potential to prevent self-harm. By encouraging autonomy and competence, activities that adolescents can do alone and that give them a sense of mastery may assist to lessen the perceived burdensomeness [47].

Abbreviations

AQ	The autism spectrum quotient
ASD	Autism spectrum disorder
BIF	Basic Information Form
CDI	The Child Depressive Inventory
CI	Confidence interval
INQ	The Interpersonal Needs Questionnaire
IPTS	Interpersonal Psychological Theory of Suicide
OBVQ	The Olweus Bully/Victim Questionnaire
OR	Odds ratio

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PTSD   Post-traumatic stress disorder
RR   Relative risk
SE   Standard error
STAI   The State-Trait Anxiety Inventory
VIF   Variance inflation factor

Supplementary Information

> **Additional file 1: Table S1**. SES of both parents according to the Hollingshead index. **Table S2**. Comparisons of demographic data and victimization between adolescents with and without self-harm. **Table S3**. Comparisons of demographic data and victimization within self-harming adolescents. **Table S4**. Descriptive analysis of autistic traits, internalizing symptoms, and proximal risk factors of IPTS between self-harm and control groups. **Table S5**. Comparison of CTQ scores between adolescents with and without self-harm. **Table S6**. Comparison of CTQ scores within the group of self-harming adolescents.

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Author contributions

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Availability of data and materials
The data that support the findings of this study are openly available in Mendeley Data at http://doi.org/10.17632/k4sxpg3344.1, reference number V1.

Declarations

Ethics approval and consent to participate
The study protocol was conducted in accordance with the Helsinki Declaration and the International Council for Harmonisation Note for Guidance on Good Clinical Practice. The study was reviewed and approved by the Ondokuz Mayıs University Faculty of Medicine Ethic Committee on 11 October 2019 (No: OMÜKAEK 2019/747) (B.30.2.ODM. 0.20.08/851-988). Informed assent forms were signed applicable by Local Ethical Committee, as well.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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