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Traumatic experiences, alexithymia, and Internet addiction symptoms among late adolescents: A moderated mediation analysis

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HIGHLIGHTS

- Internet addiction (IA) symptoms were investigated in 358 late adolescents.
- The relationship between trauma, alexithymia, and IA symptoms was explored.
- Alexithymia partially mediated the association between trauma and IA symptoms.
- Gender had differential effects on the relationship between trauma, alexithymia, and IA symptoms.
- Tailored treatment plans for late adolescents suffering from IA are suggested.

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ABSTRACT

The association between traumatic experiences, alexithymia, and substance abuse is well established. Less is known about the role of traumatic experiences and alexithymia in the onset and maintenance of Internet-related disorders. In the present study, self-report measures on traumatic experiences, alexithymia, and problematic Internet use were administered to 358 high school students (57% females) aged 18–19 years old, to test whether alexithymic traits mediated the relationship between traumatic experiences and Internet addiction symptoms, and whether gender moderated the proposed mediation in the sample. While partial mediation occurred in the entire sample, gender directly affected the relationship between the investigated constructs: Internet addiction symptoms were independently related to traumatic experiences among males, and to alexithymic traits among females. Therefore, the results of this study suggest that trauma memories among males, and problems with affect regulation among females, may increase the risk of problematic Internet use during late adolescence. Such findings might have relevant implications to inform any treatment plan for late adolescent students who are overinvolved with online activities, pointing out that tailored approaches to their problems and difficulties are particularly needed in clinical practice.

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1. Introduction

It is well-known that people suffering from substance addiction have been often exposed to severe traumatic experiences and frequently display emotion regulation problems (Banducci, Hoffman, Lejuez, & Koenen, 2014; Evren, Evren, Dalbudak, Ozcelik, & Oncu, 2009; Oyefeso, Brown, Chiang, & Clancy, 2008). Even though it is now established that research on trauma and affect dysregulation may effectively inform the treatment of addictive behaviors (Darke, 2013;

Evren et al., 2013; Weiss, Tull, Anestis, & Gratz, 2013), only a few studies have focused on the relationship between traumatic experiences, affect dysregulation, and Internet addiction symptoms (Dalbudak, Evren, Aldemir, & Evren, 2014; Dalbudak et al., 2013; Schimmenti, Passanisi, Gervasi, Manzella, & Famà, 2014; Yates, Gregor, & Haviland, 2012). Internet addiction can be defined as an excessive preoccupation with the Internet and its applications, causing impairments and distress in the personal, social, and professional lives of individuals (Young, 1998). Notably, the excessive involvement in online activities, often referred to as Internet addiction or problematic Internet use, can result in negative effects on psychological, psychosocial, and physical health of the individuals (Aboujade, 2010; Kuss, Griffiths, Karila, & Billieux, 2014). Accordingly, there is an impetus to conduct studies aiming to better

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understand the relationship between trauma and affect dysregulation in the onset of Internet addiction symptoms, in order to improve both its prevention and treatment (Yates et al., 2012), especially during late adolescence.

In fact, developmental research has consistently supported the view that late adolescence is a critical life stage, in which the psychological distress is often ubiquitous due to the transition from adolescence to adulthood (Pace, Cacioppo, & Schimmenti, 2012). Also, there is substantial evidence that addictive behaviors emerging in late adolescence often continue into adulthood (Englund et al., 2013). Therefore, it could be critical to investigate whether Internet addiction symptoms are associated with traumatic experiences and affect dysregulation in late adolescence. Also, it could be important to conceptualize the relationships between these constructs within a comprehensive framework, in which the interactions between developmental risk factors, individuals' ways of processing thoughts and feelings, and current symptoms are considered (Billieux, Schimmenti, Khazaal, Maurage & Heeren, 2015; Schimmenti et al., 2014). In this context, research on affect development and affect regulation has highlighted the detrimental effect of emotional dysregulation resulting from traumatic experiences in the onset and maintenance of psychiatric disorders (Fonagy, Gergely, Jurist, & Target, 2002). So, research in this field might be effectively used to improve the preventative actions designed to reduce the risk of problematic Internet use, and might help clinicians to develop tailored treatment plans for youth who already suffer from impairing Internet addiction symptoms.

1.1. Traumatic experiences and problematic Internet use

Traumatic experiences are significantly associated with psychopathology in every life stage (Frewen & Lanius, 2006), and this also applies for problematic Internet use (Dalbudak et al., 2014; Rafla, Carson, & De Jong, 2014; Schimmenti & Caretti, 2010; Schimmenti, Guglielmucci, Barbasio, & Granieri, 2012). For what concerns late adolescents, Schimmenti et al. (2014) found that child sexual abuse increased the odds of suffering from significant Internet addiction symptoms in a sample of 310 students aged 18–19 years old by over 7 times. Similarly, Yates et al. (2012) found that college students who were maltreated during childhood were at disproportionate risk for excessive Internet use. However, despite the emerging evidences in this field, studies on the relationship between exposure to traumatic experiences and Internet addiction symptoms are still lacking. Further research is needed, as a huge literature suggests that many types of trauma, not only child abuse, can increase the risk of addictive behaviors (da Silva, Diehl, Cherpitel, & Figlie, 2015; Keyser-Marcus et al., 2015; Mason et al., 2014; Ullman, Relyea, Peter-Hagene, & Vasquez, 2013).

1.2. Alexithymia and problematic Internet use

Alexithymia is a psychological construct closely connected to affect dysregulation and difficulties using feelings as a guide for one's own behavior (Taylor, Bagby, & Parker, 1997). It refers to a difficulty identifying feelings and distinguishing them from bodily sensations, a difficulty describing feelings to others, a pragmatic, externally oriented, cognitive style, and restricted imagination marked by paucity of fantasies, dreams, and daydreaming (Taylor & Bagby, 2013). Even though alexithymia is a personality trait normally distributed in the community (Parker, Keefer, Taylor, & Bagby, 2008), there are convincing evidences that stressful events may temporarily increase the alexithymic responses (Wise, Mann, Mitchell, Hryvniak, & Hill, 1990), as per the construct of secondary alexithymia (Nemiah, Freyberger, & Sifneos, 1976). Such alexithymic responses may persist if not adequately assessed and treated (Fukunishi, Kikuchi, Wogan, & Takubo, 1997; Honkalampi, Hintikka, Laukkanen, Lehtonen, & Viinamäki, 2001). The relationship between traumatic experiences and alexithymia is well documented (Eichhorn, Brähler, Franz,

Friedrich, & Glaesmer, 2014; Kooiman et al., 2004). Likewise, research shows that alexithymia is consistently associated with Internet addiction symptoms (Dalbudak et al., 2013; Kandri, Bonotis, Floros, & Zafropoulou, 2014; Scimeca et al., 2014). For instance, Scimeca et al. (2014) found in a sample of 600 high school students aged 13 to 22 years that a high level of alexithymia was associated with more severe symptoms of Internet addiction, including compromised quality of life, compromised academic career, compromised time control, and compensatory Internet usage. In the only study examining the role of alexithymia in the relationship between traumatic experiences and Internet addiction symptoms, Yates et al. (2012) found that alexithymia partially mediated the relationship between traumatic experiences and Internet addiction scores. However, the study by Yates et al. restricted its focus on child maltreatment, and did not consider other types of traumatic experiences (e.g., being exposed to a natural disaster, loss of a family member, serious bodily injury).

1.3. Gender differences

Since Internet addiction was proposed as a potential psychiatric diagnosis (Young, 1998), gender differences in the use and misuse of the Internet have been frequently reported in the literature (Greenberg, Lewis, & Dodd, 1999). The majority of the available studies suggests that Internet addiction symptoms are more common among males (Bakken, Wenzel, Götestam, Johansson, & Oren, 2009; Kormas, Critselis, Janikian, Kafetzis, & Tsitsika, 2011). For example, a study by Durkee et al. (2012) on a sample of 11,956 adolescents from 11 European countries showed that the prevalence of Internet-related disorders was higher among males than females (5.2% versus 3.8%). Moreover, gender differences were frequently observed in research on psychological trauma, with females being more exposed to direct victimization and assaultive violence than males (Asscher, Van der Put, & Stams, 2015; Breslau, 2002; Dube et al., 2005), and were consistently observed in research on alexithymia, with males being more likely than females to present significant alexithymic traits (Levant, Hall, Williams, & Hasan, 2009), perhaps because of socio-cultural factors, such as gender socialization (Levant et al., 2003).

1.4. The present study

The present study aimed to explore the relationship between traumatic experiences, alexithymia, and Internet addiction symptoms in a sample of late adolescents attending the last year of high school. A moderated mediation model was tested, in which alexithymia scores mediated the relationship between trauma scores and Internet addiction scores, and gender moderated the relationships between trauma scores and alexithymia scores, and between trauma scores and Internet addiction scores. The conceptual model configuring the investigated variables in a moderated-mediation relationship is depicted in Fig. 1.

2. Materials and methods

2.1. Participants

The study involved 358 late adolescents (154 males, 43%; 204 females, 57%) aged 18 to 19 years old ($M = 18.36$, $SD = .48$) attending their last year of high school. Students were recruited within six public high schools specialized in different subjects, i.e. teacher training, science, accountancy, languages, tourism and hotel management, and industrial engineering. The schools were located in Enna, a relatively small urban area (about 170,000 citizens) in Italy. There was no significant association between gender and age of participants ($t_{(356)} = .46$, $p = .65$, n.s.).

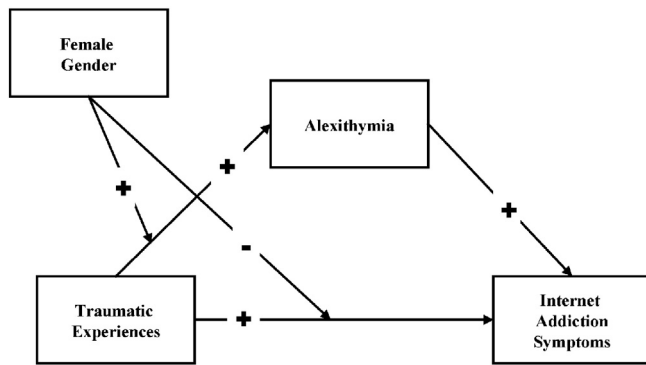


Fig. 1. Conceptual model of the moderated mediation relationship. Note: The model predicts that traumatic experiences will be positively related to alexithymia, which will subsequently increase Internet addiction symptoms. However, gender should moderate the relationship between traumatic experiences and Internet addiction, such that being female decreases the impact of trauma on Internet addiction. In contrast, being female should increase the impact of trauma on alexithymia, adding to this relationship.

2.2. Procedures

After ethical clearance by the University IRB for psychological research, we contacted the head teachers of public high schools in Enna and we described the objectives of the study to them. The Teachers' Council of six schools approved the research and allowed the administration of questionnaires to the students. Participants were recruited by randomly selecting two last-year classes (13th grade in Italy) from each school. Out of 366 students eligible for the study, 362 (98.9%) accepted to participate and signed an informed consent release. Three hundred fifty-eight of them (97.8% of the initial sample) entirely and correctly completed the measures used in the present study. Students consecutively completed the questionnaires in their classrooms.

2.3. Measures

2.3.1. Internet Addiction Test (IAT; Young, 1998)

The IAT is a 20-item self-report measure for the screening of Internet addiction. It assesses problematic Internet usage, in terms of the degree of preoccupation, inability to control use, extent of hiding or lying about online use, and continued online use despite negative consequences of behavior. The IAT includes questions such as, "How often do you try to cut down the amount of time you spend online and fail?" The answers to the IAT are marked on a 5-point scale. IAT scores range from 20 to 100, with higher scores indicating higher levels of Internet addiction symptoms. The IAT has been validated in many countries, including Italy (Ferraro, Caci, D'Amico, & Di Blasi, 2007). It has shown good internal consistency and adequate concurrent validity in many studies (Ha et al., 2006; Widyanto & McMurran, 2004). The Cronbach's alpha coefficient of the IAT in the current study was .91.

2.3.2. Traumatic Experiences Checklist (TEC; Nijenhuis, Van der Hart, & Kruger, 2002)

The TEC is a self-report measure addressing 29 types of potentially traumatic events (e.g., "Loss of a family member when you were a child"). It is used in both clinical practice and research, including research on addictive behaviors (Kok, de Haan, van der Meer, Najavits, & de Jong, 2015; Schimmenti et al., 2014). The TEC has demonstrated adequate reliability and validity in Italian and international studies (Craparo, Schimmenti, & Caretti, 2013; Nijenhuis et al., 2002; Schimmenti et al., 2014; van Duijl, Nijenhuis, Komproe, Gernaat, & de Jong, 2010). Different scores can be calculated on the TEC. In this study, we computed the descriptive statistics for the principal outcomes of the measure, and we used the cumulative score as an index of total

trauma exposure to investigate the proposed moderated mediation model.

2.3.3. 20-item Toronto Alexithymia Scale (TAS-20; Bagby, Parker, & Taylor, 1994; Bagby, Taylor, & Parker, 1994)

The TAS-20 is a 20-item self-report measure for the assessment of alexithymia. Participants are asked how much they agree with each statement (e.g., "I have feelings that I can't quite identify") on a 5-point scale. The TAS-20 total score can range from 20 to 100, with higher scores indicating higher levels of alexithymic traits. The TAS-20 has good reliability and validity, a 3-factor structure which is consistent across countries (DIF, Difficulty Identifying Feelings; DDF, Difficulty Describing Feelings; EOT, Externally Oriented Thinking), and its total score is used to evaluate the presence and severity of alexithymic traits in Italy (Bressi et al., 1996) and worldwide (Parker et al., 2008; Taylor & Bagby, 2013). In this study, we computed the descriptive statistics for TAS-20 total and factor scores, and we used the total score to investigate the proposed moderated mediation model. Cronbach's alpha of TAS-20 in this study was .78.

2.4. Statistical analyses

Descriptive statistics were computed for all the variables. Gender differences were examined through *t*-test. Pearson's *r* correlations were used to investigate the associations between the variables. The proposed moderated mediation model was examined using the Process Macro for SPSS (Hayes, 2013), applying Model 8 with 5000 bias-corrected bootstrap samples. Moreover, three sets of hierarchical regression analyses were undertaken to examine the relationships between the investigated constructs in the entire sample, and separately by gender. For each set of regressions, IAT scores were entered as the dependent variable, TEC total scores were entered as predictors in the first step, and TAS-20 scores in the second step. Then, two-way interactions were examined (Aiken & West, 1991; Preacher, Curran, & Bauer, 2006) to deepen the results of the analyses. A *p* value of .05 was set as the critical level for statistical significance (for the analysis of indirect effects, if the 95% confidence interval includes 0 then the indirect effect is not significant at the .05 level, if 0 is not in the interval then the indirect effect is statistically significant at the .05 level; see Hayes, 2013).

3. Results

Descriptive statistics are reported in Table 1 for the full sample and differentiated by gender, along with level of significance for gender differences. Male students scored higher than females on the IAT and on the EOT factor of the TAS-20. Female students reported a higher negative impact of traumatic experiences at the TEC.

Subsequently, the intercorrelations between the investigated variables were examined (see Table 2). IAT scores were significantly associated with both TAS-20 and TEC total scores. Furthermore, IAT scores were associated with difficulty identifying feelings, with experiences of emotional neglect and abuse, and with the number of traumatic events that do not concern neglect or abuse. The association between TAS-20 and TEC total scores was also significant.

Then, the proposed moderated mediation model was tested. TEC total scores were positive predictors of TAS-20 scores ($t = 2.36, p = .02; B = .70, SE = .30, CI[.12, 1.29]$), and TAS-20 scores were positive predictors of IAT scores ($t = 3.00, p < .01; B = .19, SE = .06, CI[.06, .31]$). Also, TEC total scores were positively associated with IAT scores ($t = 2.68, p < .01; B = .90, SE = .33, CI[.24, 1.56]$), suggesting that only partial mediation occurred in the sample. Gender added to the model, with being female (coded as 2, males coded as 1) negatively predicting IAT scores ($t = -3.08, p < .01; B = -3.82, SE = 1.24, CI[-6.26, -1.38]$). The model was significant ($t = 11.16, p < .01; B = 32.26, SE = 2.89, CI[26.58, 37.95]; R^2 = .09; F_{(4353)} = 10.21, p < .01$). However, the interaction between TEC total scores and gender was

Table 1
Descriptive statistics.

	Full sample (N = 358)				Males (n = 154)		Females (n = 204)		<i>t</i> ₍₃₅₆₎
	M	(SD)	Observed range	Possible range	M	(SD)	M	(SD)	
Internet Addiction Test	41.06	(11.95)	20–84	20–100	43.23	(12.22)	39.43	(11.51)	3.01**
TAS-20 total score	47.39	(10.64)	23–80	20–100	48.21	(9.82)	46.77	(11.20)	1.26
DIF: Difficulty Identifying Feelings	16.22	(5.77)	7–32	7–35	15.77	(5.33)	16.56	(6.07)	1.28
DDF: Difficulty Describing Feelings	13.18	(4.71)	5–25	5–25	12.82	(4.04)	13.45	(5.16)	1.25
EOT: Externally Oriented Thinking	17.98	(4.81)	8–33	8–40	19.61	(4.67)	16.75	(4.55)	5.84**
TEC total score	2.76	(2.22)	0–12	0–29	2.60	(1.97)	2.87	(2.39)	1.13
Emotional neglect/abuse	1.00	(1.11)	0–5	0–6	.88	(1.01)	1.09	(1.17)	1.80
Physical abuse	.11	(.34)	0–2	0–3	.10	(.33)	.12	(.36)	.50
Sexual abuse	.05	(.30)	0–3	0–3	.03	(.27)	.07	(.32)	1.13
Other types of trauma	1.60	(1.43)	0–8	0–17	1.60	(1.40)	1.61	(1.45)	.07
Averaged perceived impact	2.63	(1.38)	0–5	0–5	2.44	(1.37)	2.77	(1.38)	2.22*
Age first trauma (year)	8.94	(5.64)	0–19	0–19	8.76	(5.61)	9.08	(5.67)	.53
Trauma maximum length (years)	1.57	(2.97)	0–15	0–19	1.29	(2.67)	1.78	(3.17)	1.54
Averaged perceived support	.79	(.81)	0–2	0–2	.72	(.79)	.84	(.83)	1.36

Note: TAS-20: 20-item Toronto Alexithymia Scale; TEC: Traumatic Experiences Checklist.

* $p < .05$.

** $p < .01$.

not significant ($t = -1.82$, $p = .07$; $B = -1.15$, $SE = .63$, $CI[-2.40, .09]$). Likewise, gender was not associated with TAS-20 scores in the model ($t = -1.46$, $p = .15$; $B = -1.62$, $SE = 1.11$, $CI[-3.81, .56]$). The analysis of conditional direct and indirect effects of TEC total scores on IAT scores via TAS-20 scores confirmed that gender significantly affected the relationship between the variables, but in an unexpected way. Being male had a significant and positive direct effect on the relationship between TEC and IAT ($t = 3.65$, $p < .01$; $B = 1.56$, $SE = .43$, $CI[.72, 2.40]$), but had no significant indirect effect on the relationship between TEC and IAT via TAS-20 ($B = .13$, $SE = .11$, $CI[-.02, .41]$). In contrast, being female had no significant direct effect on the relationship between TEC and IAT ($t = .84$, $p = .40$; $B = .40$, $SE = .48$, $CI[-.54, 1.35]$), but had a significant and positive indirect effect on the relationship between TEC and IAT via TAS-20 ($B = .14$, $SE = .08$, $CI[.01, .35]$). Since the indirect effect of the highest order interaction between the mediator (TAS-20) and the moderator (gender) was not significant ($B = .01$, $SE = .11$, $CI[-.24, .24]$), it was possible that the development of Internet addiction symptoms followed two independent pathways in male and female participants. Therefore, hierarchical regression analyses were undertaken. The results of these analyses are presented in Table 3. While in the entire sample both TEC total scores and TAS-20 scores added to the model, providing further evidences of partial mediation between traumatic experiences and Internet addiction symptoms via alexithymia (as the effect of TEC scores on IAT scores lowered of $B = .13$ after the inclusion of TAS-20 in the model), separate analyses for male and female participants showed that only TEC total scores

predicted IAT scores among males, and only TAS-20 scores predicted IAT scores among females. Controls for the potential clustering effects of schools showed that school clustering did not affect these findings, since results from fixed-effect models were very similar to those from multilevel models, in which the clustering effects of schools ($p = .69$, ns) were accounted for.

So, we examined the potential two-way interactions differentiated by gender. Multiple regression analyses showed that TEC scores directly added to the positive association between male gender and IAT scores ($t = 3.84$, $p < .01$; $B = 1.69$, $SE = .44$, $CI[.82, 2.55]$), while TAS-20 scores directly added to the negative association between female gender and IAT scores ($t = 3.00$, $p < .01$; $B = .23$, $SE = .08$, $CI[.08, .39]$). The simple slopes representing the relationship between gender and IAT scores at $-1SD$, mean, and $+1SD$ values of TEC total scores and TAS-20 scores are shown in Fig. 2a and b.

4. Discussion

In the present study, we tested a moderated mediation model in which alexithymia mediated the association between traumatic experiences and Internet addiction symptoms, and gender moderated this relationship in a sample of late adolescents. Internet addiction scores in this sample were similar to those found in previous studies with adolescent students in Southern Italy (Bruno et al., 2014; Schimmenti et al., 2014; Scimeca et al., 2014). Gender differences were found, with male adolescents showing higher scores on Internet addiction symptoms, in

Table 2
Pearson's r correlations between the variables.

	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Internet Addiction Test	.20**	.16**	.24**	.07	.06	.12*	.06	.10	.13*	.10	.06	.06	-.05
2. TAS-20 total score	-	.14*	.75**	.75**	.55**	.17**	.02	-.05	.10*	.08	.04	.09	-.09
3. TEC total score	-	-	.27**	.07	-.08	.75**	.31**	.28**	.84**	.44**	.14**	.35**	.10
4. Difficulty Identifying Feelings	-	-	-	.41**	.08	.25**	.08	.02	.20**	.15**	-.01	.16**	-.02
5. Difficulty Describing Feelings	-	-	-	-	.18**	.14**	-.04	-.04	.03	.10	.00	.12*	.04
6. Externally Oriented Thinking	-	-	-	-	-	-.06	-.01	-.11*	-.04	-.11*	-.05	-.07	-.15**
7. Emotional neglect/abuse	-	-	-	-	-	-	.11*	.14*	.34**	.29**	.14**	.27**	.05
8. Physical abuse	-	-	-	-	-	-	-	.13*	.12*	.12*	.00	.12*	.00
9. Sexual abuse	-	-	-	-	-	-	-	-	.09.	.09	-.04	.06	-.05
10. Other types of trauma	-	-	-	-	-	-	-	-	-	.41**	.12*	.29**	.11*
11. Averaged perceived impact	-	-	-	-	-	-	-	-	-	-	.46**	.27**	.29**
12. Age first trauma (year)	-	-	-	-	-	-	-	-	-	-	-	-.07	.23**
13. Trauma maximum length (years)	-	-	-	-	-	-	-	-	-	-	-	-	.18**
14. Averaged perceived support	-	-	-	-	-	-	-	-	-	-	-	-	-

* $p < .05$.

** $p < .01$.

Table 3
Hierarchical regression analyses.

	Full sample (N = 358)						Males (n = 154)						Females (n = 204)					
	Step 1			Step 2			Step 1			Step 2			Step 1			Step 2		
	B	t	p	B	t	p	B	t	p	B	t	p	B	t	p	B	t	p
TEC total score	.88	3.11	.002	.74	2.63	.009	1.69	3.49	.001	1.60	3.28	.001	.54	1.61	.109	.38	1.14	.255
TAS-20 total score				.20	3.42	.001				.13	1.34	.183				.22	3.09	.002
R ²	.03			.06			.07			.09			.02			.06		
R ² change				.03						.02						.04		
F =	9.67 (p = .002)			10.84 (p < .001)			12.15 (p < .001)			7.00 (p = .001)			2.59 (p = .109)			6.13 (p = .003)		

the same vein with previous research (Durkee et al., 2012; Kormas et al., 2011). Internet addiction symptoms were modestly, but significantly, associated with total trauma exposure and with alexithymic traits. This result was also consistent with previous studies (Dalbudak et al.,

2013; Kandri et al., 2014; Schimmenti et al., 2014; Scimeca et al., 2014; Yates et al., 2012). Alexithymia scores partially mediated the predictive association between traumatic experiences and Internet addiction symptoms, mirroring previous findings by Yates et al. (2012), who found in a sample of adolescents and young adults that the strength of the relation between child maltreatment and Internet addiction symptoms dropped significantly when the indirect path through alexithymia was taken into account. Strikingly, controls for covariates in the study by Yates et al. showed that being male was a positive predictor of Internet addiction symptoms, supporting the hypothesis that a moderated mediation model, in which gender acted as a mediator, could better explain the mediating role of alexithymia in the relationship between traumatic experiences and problematic Internet use. However, the moderated mediation model was not confirmed in our sample, and results of regression analyses showed that two gender-specific pathways could be observed. Trauma scores were predictive of Internet addiction symptoms among males, whereas alexithymia scores were predictive of Internet addiction symptoms among females. The effects of trauma and alexithymia on Internet addiction symptoms were both positive, which means that a higher number of traumatic experiences among males, and higher levels of alexithymic traits among females, increased the Internet addiction symptoms in our sample.

Therefore, our findings support the view that tailored clinical interventions are required to address the motives behind the excessive use of the Internet among youth (Billieux, Schimmenti, et al., 2015; Billieux, Thorens, Khazaal, Zullino, Achab, & Van der Linden, 2015; Kardefelt-Winther, 2014). A possible interpretation of the current findings could be that male and female late adolescents differently use – and misuse – the Internet as they are struggling with the same developmental task (the transition into adulthood) but in different manners (Meeus, 2011). In this sense, while males might overuse the Internet to feel more confident and, more generally, to achieve a higher self-direction and sense of mastery after being exposed to significant trauma that damaged their self-image and self-efficacy, females who have problems with identifying and describing their feelings might feel that the Internet can help them build relationships or better relate with other people. In fact, research in this field showed that late adolescent males are more frequently addicted to Internet gaming, while late adolescent females tend to be overinvolved with blogging and social networks (Heo, Oh, Subramanian, Kim, & Kawachi, 2014). Moreover, according to Ehlers and Clark's (2000) influential model on the development of post-traumatic stress symptoms, people who were exposed to distressful experiences may use dysfunctional coping strategies – such as an excessive use of the Internet – to avoid memory of such experiences and thoughts about their potential consequences; however, the use of dysfunctional coping strategies might hamper the cognitive processing of traumatic events and might reinforce instead the perception of a current threat, ultimately perpetuating the presence of trauma-related symptoms. In the same vein, it is possible that some male adolescents are more prone to overusing the Internet to push away distressing memories of traumatic experiences (Schimmenti & Caretti, 2010; Schimmenti et al., 2012). Consequently, it is likely that addressing trauma memories in treatment could help these adolescents to reduce their

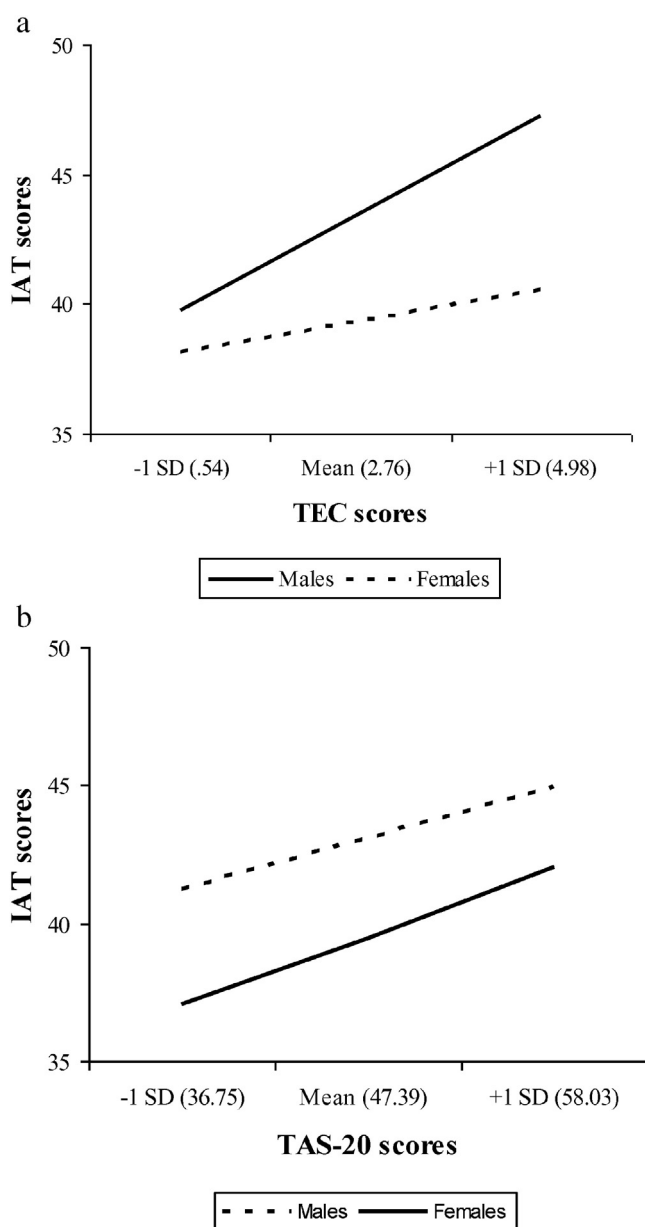


Fig. 2. a. Simple slopes of trauma scores and Internet addiction symptoms. b. Simple slopes of alexithymia scores and Internet addiction symptoms. Note: Straight lines indicate significant effects of the predictor on IAT scores at $p < .01$.

problematic Internet use. In contrast, some female adolescents with higher alexithymic traits could excessively use the Internet as a way to regulate their affective states and to feel more comfortable through on-line social interactions (Scimeca et al., 2014). Therefore, treatment plans aimed to help these girls develop better abilities to identify and share feelings could be particularly appropriate in some cases.

4.1. Limitations and directions for future research

As with all research, the present study comes with a number of limitations. First, although efforts on random selection of participants from different schools were made, and a relatively large sample was recruited, our sample included only students attending the last year of high school, so our results are not generalizable to all late adolescents (e.g., those who do not attend school because they are already working, those from clinical samples, those from other cultures). Therefore, cross-cultural studies with representative clinical and non-clinical samples are needed to extend these findings. Second, the information was entirely collected by self-reported measures, so the accuracy of individual reports cannot be guaranteed, although the measures used in the present study are applied worldwide and have demonstrated adequate psychometric properties. Moreover, the measure for total trauma exposure weights all traumatic experiences equally, while research suggests that different types of trauma might differently affect the development of addictive behaviors (Schimmenti & Bifulco, 2015). Probably, a multimethod assessment of traumatic experiences, alexithymia, and Internet addiction symptoms would have led to more valid and reliable findings. In addition, future assessment of Internet addiction symptoms could also include a detailed assessment of Internet usage, because it is very likely that the types of online activities favored by males and females are not the same. The assessment of specific Internet usage might further contribute to understand the relationship between trauma, affect dysregulation, and Internet addiction symptoms. Third, although a reverse causation model might have been ruled out in our study – as both life-time traumatic experiences and personality traits such as alexithymia are hypothesized to precede the development of Internet addiction symptoms – the cross-sectional nature of the study made it impossible to definitively establish causal links, and cannot allow us to exclude that our findings were affected by other variables not explored here (e.g., depression, impulsivity, insecure attachment). So, longitudinal studies are greatly needed to advance this line of work. However, this initial study provided new and somewhat unexpected evidences about the differential role that gender may play in the complex relationship between trauma, alexithymia, and Internet addiction symptoms, which could inform any treatment plan aimed to help late adolescents who displays problematic Internet use.

5. Conclusions

This study has likely shed new lights on how gender may modulate the relationships between traumatic experiences, alexithymia, and Internet addiction symptoms among late adolescents. We failed to confirm in our sample a moderated mediation model, in which gender moderated the mediating role of alexithymia in the relationship between traumatic experiences and Internet addiction symptoms. Instead, we found that trauma predicted Internet addiction symptoms among males, and that alexithymia predicted Internet addiction symptoms among females. This might have relevant implications to inform prevention of problematic Internet use among youth, and treatment of late adolescents who are already overinvolved with the Internet. However, in order to directly influence the tailoring of prevention actions and treatment interventions, future research should uncover why some alexithymic or traumatized adolescents misuse the Internet, while others do not.

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Contributors

AS designed the study. AP, LLM, CI, AMG, and NRM were responsible for data collection, conducted literature searches, and provided summaries of previous studies. AS and AP conducted the statistical analysis. VC, AG, and JB contributed with relevant theoretical and clinical inputs. AS and JB wrote the first draft of the article, and were responsible for subsequent collation of inputs and redrafting. All authors critically revised the manuscript and approved its final version.

Conflict of interest

The authors declare that they have no conflicts of interest.

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