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Internet Addiction among Brazilan Students: Prevalence and Association with Emotional Problems*

Adicción al internet entre estudiantes brasileños: prevalencia y asociación con problemas emocionales

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ABSTRACT

The objective of this study was to evaluate the prevalence of Internet addiction (I.A.) among students and its association with emotional problems. A total of 2,214 students (M = 21.9; SD = 1.86) from all Brazilian regions responded to an online questionnaire and were classified according to the IAT instrument score in NRU= No-risk Users, LRU= Low-risk Users, and RHU= Risk and High-risk Users. DASS-21 measured emotional problems, and the data were analyzed using descriptive and inferential statistics. It was observed that 12.5% were classified as URAR and presented higher levels of depression ($p < 0.001$), anxiety ($p < 0.001$), and stress ($p < 0.001$). The main predictors for I.A. were depression (aOR = 3.2), anxiety (aOR = 2.5), and stress (aOR = 2.6). These results confirm an association between DI and emotional problems, as indicated in the literature.

Keywords

internet addiction; depression; stress; anxiety disorders; university students.

RESUMEN

El objetivo de este estudio fue evaluar la prevalencia de dependencia de Internet (DI) entre estudiantes y su asociación con problemas emocionales. Un total de 2214 estudiantes (M = 21,9; DE = 1,86) de todas las regiones brasileñas respondieron a un cuestionario en línea y fueron clasificados según la puntuación del instrumento IAT en USR = usuarios sin riesgo, UBR = usuario de bajo riesgo y URAR = usuario de riesgo y alto riesgo. Los problemas emocionales fueron medidos por el DASS-21 y los datos fueron analizados a partir de estadísticas descriptivas e inferenciales. Se observó que 12,5 % fueron clasificados como URAR y presentaron niveles más altos de depresión ($p < 0,001$), ansiedad ($p < 0,001$) y estrés ($p < 0,001$). Los principales predictores para la DI fueron la depresión (aOR = 3,2), la ansiedad (aOR = 2,5) y el estrés (aOR = 2,6). Estos resultados confirman una asociación entre el DI y los problemas emocionales, como se señala en la literatura.

Palabras clave

dependencia al Internet; depresión; estrés; trastornos de ansiedad; universitarios.

Internet use is linked with significant transformations and expanded access to knowledge to many people. However, the overuse of the Internet by using digital media has been associated with several health problems, such as internet addiction (I.A.), which is a pathological use that shares some symptoms and characteristics with disorders caused by substance misuse like compulsion, withdrawal, tolerance, and functional limitation (Brand et al., 2019; Musetti et al., 2016; Petry et al., 2014).

Particularly I.A. is a growing global public health issue among adolescents and young adults. Some authors have observed an association of I.A. with psychological problems such as depression, anxiety, stress (Baturay & Toker, 2019; Demirer & Bozoglan, 2016; Tsai et al., 2020), substance abuse (Lanthier-Labonté et al., 2020; Morioka et al., 2017; Savolainen et al., 2020) and sleep disorders (Marin et al., 2016; Shadzi et al., 2020; Wang et al., 2020). Additionally, the prevalence of psychological problems is notably higher among young people than older ones (Kuss et al., 2018).

The prevalence of I.A. among students is notably higher in Asian countries. Mak et al. (2014) investigated the prevalence of I.A. among students from six Asian countries, and the rates ranged from almost 20% (China) to more than 50% (Philippines). According to the South Korean Government Statistics, 100% of the young and 50% of the adult population have access to the internet, and I.A. was estimated in 12% and 8% of the young and adult population, respectively (Heo et al., 2014). In a study with students from five European countries (Estonia, Spain, Italy, Romania, and Germany), 6.9% of students were considered problematic internet users (Kaess et al., 2016).

Among Latin America, few authors assessed the prevalence of I.A. In Ecuador, 51.5% of adolescents were considered internet-addicted, especially those in the first year of high school and with better economic conditions (Rueda et al., 2017). In this same country, the prevalence of I.A. among college students was 20.3%, and those with high academic performance showed a lower frequency of I.A. and procrastination scores (Ramos-Galarza et al., 2018). In Colombia, 25% of 640 college students were evaluated as having I.A., and the authors found that these students showed more significant problems of attention disorder (38.5%), depression (27%), and 20% of sleep disorders (Cañón et al., 2016). Among Chilean medical students, I.A.'s prevalence was 11.5%, and 19.3% of these people showed significant scores for depressive symptoms (Berner et al., 2014).

In Brazil, one study detected the prevalence of I.A was 7.3% among medical students (Marin et al., 2016). Also, these students showed a 60% higher risk of excessive daytime sleepiness than other ones. On the other hand, internet use was not associated with depression and anxiety symptoms, but 21.2% of the students reported having family problems due to excessive internet use (Moromizato et al., 2017). When analyzing the I.A. on a general sample of Brazilian college students, Della-Méa et al. (2016) detected that 62% of the students meet the criteria for I.A. However, the authors did not observe any association of I.A. with depression and anxiety symptoms. In another study, the authors reported that those college students with I.A. presented more difficulty demonstrating socially skillful behaviors (Terroso

& Argimon, 2016). Even though all these studies have strengths and limitations, the sample size was a common limitation and the criteria used to detect the I.A. in both studies. In this sense, new studies are necessary to assess I.A.'s association with emotional problems and socio-demographic aspects. Additionally, investigating some predictors of I.A. is necessary to understand better the association between both I.A. and psychological problems in college students.

This study aimed to evaluate I.A.'s prevalence among college students and its possible association with emotional problems. As a secondary objective, we also assessed the predictors of I.A. We hypothesized that; 1) those students with I.A. would present more severe symptoms of psychological problems; 2) more severe symptoms of anxiety, stress, and depression would be the main predictors of I.A.

Methods

Sample

We performed a cross-sectional study with 2,214 college students (M_{age} = 21.9; SD = 1.86) who filled an online survey. The inclusion criteria were: individuals enrolled in a graduation course (any area); having a smartphone with internet access; accessing the internet at least once a day by any digital device; being residents in Brazil, detected by internet protocol address (IP address). Out of 2,887 students who accessed the study's link, 387 were excluded because neither fully complete the questionnaires (n= 286) nor (n= 101) did not have a smartphone with internet access.

Instruments

We developed a socio-demographic questionnaire with eight available items (gender, marital status, age, Brazilian region, income, the number of children, undergraduate courses, type of institution [public or private]). Additionally, we added fifteen specific items regarding smartphones and the internet pattern, as described in the results session. The same protocol was used in other studies (Andrade, Scatena, Bedendo et al., 2020; Andrade, Kim et al., 2020).

Internet Addiction Test (IAT) aimed to detect a possible problematic internet use, which has 20 items organized on a 5-point Likert scale, where (1) corresponds to "rarely" and five (5) to "always." The IAT allows ranking individuals according to their score on internet dependence, as follows: 0 - 19 points (No-risk Users; NRU), 20 - 49 (Low-risk Users; LRU), 50 - 79 (Risk Users), and 80 - 100 (High-risk Users). The IAT was adapted and validated in Brazil by Conti et al. (2012). Based on previous studies (Andrade, Scatena, Bedendo et al., 2020), the students were classified into three possible groups: No-risk Users (NRU; 0-19 points); Low-risk Users (LRU; 20-49 points); and Risk and High-risk Users (RHU; 50-100 points). We considered as I.A. only those participants in the RHU group. Our analyses detected a significant difference among all groups ($F_{(2, 2,211)}$ = 3,902) as well as a reasonable effect size (η^2 = 0.77).

Depression, Anxiety and Stress Scale (DASS-21) was validated in Brazil (Patias et al., 2016; Vignola & Tucci, 2014) and comprises 21 items organized on a *Likert* scale, ranging from 0 "definitely not applicable" to 3 "highly or most of the times applicable". The students were classified into three groups according to their scores to specific symptoms (Andrade Scatena, Bedendo et al., 2020): Depression – [No-risk (scores 0 to 9), Moderate-risk (scores 10 to 20), and High-risk (scores ≥21)]; Anxiety – [No-risk (scores 0 to 7), Moderate-risk (scores 8 to 14) and High-risk (scores ≥ 15)]; Stress – [No-risk (scores 0 to14), Moderate-risk (scores 15 to 25) and High-risk (scores ≥ 26)]. We detected a significant difference among all groups regarding depression (F = 5573, η^2 = 0.83), anxiety (F = 5982, η^2 = 0.83) and stress (F = 4302, η^2 = 0.79).

Procedures

The data were collected using the *Surveymonkey*® platform. Initially, a link was sent to 50 college students to test intelligibility and some possible problems to fill the questionnaires (pilot study test). We also checked the link and forms for technical problems and retrieved the platform's database. These data were not included in this study.

After this phase, our study's link was disseminated differently, as previously described (sample subsection). This link was available for 120 days, and the platform supported responses from smartphones, tablets, and other digital devices. When participants finished completing the form, they were identified by their IP address, which prevented them from filling the questionnaires twice.

Data analyses

We transformed continuous variables into Z-Scores, and outputs above or below three standard deviation units ($3 < Z\text{-}Score > 3$) were excluded from specific analyses to reduce distortions in the results and potential bias, according to some studies (Andrade, Scatena, Martins et al., 2020; Aguinis et al., 2013; Yamauchi et al., 2019).

We analyzed categorical or nominal data with the Chi-Square Test (χ^2) and discrete data through one-way ANOVA, followed by Levene's test to verify the variables' homogeneity (Oliveira-Pinheiro et al., 2020; Schaub et al., 2018; Taurisano et al., 2020). To calculate the effect size for continuous variables, we used the Eta Squared Test (η^2) considering 0 to 0.4 - low effect; 0.41 to 0.79 - medium effect; 0.8 to 1 - high effect (Cruz et al., 2018). We also checked the internal consistency of the DASS-21 and IAT instruments by using the Cronbach's alpha test (IAT: α= 0.93; DASS-21, "Depression": α= 0.87; DASS-21, "Anxiety": α= 0.85; DASS-21, "Stress"= 0.88).

We performed logistic regression models to evaluate the predictors of I.A. Independent variables were: believing that the internet's use is harmful (No = 0, Yes = 1), minutes spent on the smartphone, number of smartphone checks daily, depression, anxiety, and stress severity rating (0= No-risk, 1= Moderate-risk, 2= High-risk). All models were adjusted by age, Brazilian region, and gender. We adopted a significance level of 5% in all the analyses. These models were based on previous studies (Bedendo et al., 2019; Bedendo et al., 2013; Gonçalves et al., 2021).

The software program used in this study was Statistica 12.0 (Statsoft Inc®), and the Figures were designed by Prism 5.0 (GraphPad®).

Ethics

The study was submitted to and approved by the Committee on Ethics in Research of the Institution.

Results

Out of the total number of students (N = 2214), 24.5% were classified as No-risk Users (NRU), 63% as Low-risk Users (LRU), and 12.5% as Risk and High-risk Users (RHU). As shown in Table 1, those students in the NRU group presented a significantly higher mean age (M= 22.2 years, SD= 1.9) than those in the other groups. Most participants were women (78.6%), and the proportion of women was near 83% in the NRU and 70% in the RHU. The NRU group presented a lower income than the other groups (*Scheffé's test*, $p < 0.01$). In all groups, most of the students were from the Southeast region of Brazil, followed by the Northeast. Although only near 8% were married, the proportion of married students was three times higher in the NRU students. Most of the participants were from private institutions (64.6%) and no differences were found in students' frequency from private and public Universities classified as RHU.

Table 1

Social and demographic characteristics of students classified by IAT. Values expressed as the mean and standard deviation (±) or raw number and percentage

Variable	NRU	LRU	RHU	Test	Effect size
Age (M, SD)	22.2 (± 1.9)	21.8 (± 1.8)	21.9 (± 1.9)	$F = 2.6$*	0
Gender				$\chi^2 = 17.7$***	0.08
Female	449 (82.7%)	1098 (78.7%)	193 (69.9%)		
Male	94 (17.3%)	297 (21.3%)	83 (30.1%)		
Income $ [a] (M, SD)	979.47 (± 5479.2)	3160.59 (± 4750.6)	2455.16 (± 4747.4)	F= 1.3**	0.26
Brazilian region				$\chi^2 = 19.3$**	0.07
Southeast	210 (38.6%)	528 (37.9%)	122 (44.2%)		
Northeast	202 (37.3%)	457 (32.8%)	84 (30.5%)		
South	63 (11.6%)	208 (14.9%)	46 (16.6%)		
Midwest	42 (7.7%)	126 (9%)	18 (6.7%)		
North	26 (4.8%)	76 (5.4%)	6 (2%)		
Marital status				$\chi^2 = 32.3$***	0.12
Single	470 (86.6%)	1306 (93.6%)	264 (95.7%)		
Married	73 (13.4%)	89 (6.4%)	12 (4.3%)		
University				$\chi^2 = 29.8$***	0.11
Private	403 (74.2%)	865 (62%)	163 (59.1%)		
Public	140 (25.8%)	530 (38%)	113 (40.9%)		

Note. NRU= No-risk Users (n = 543); LRU = Low-risk Users (n = 1395), RHU = Risk and High-risk Users (n = 276). *$p < 0.05$, ** $p <$ 0.01, *** $p < 0.001$ a1$= 3.22 BRL (Brazilian Real currency- average quotation in June/2016).

78% of those from the RHU group reported having problems with their smartphone use, whereas this proportion was 30% in the LRU (Table 2). Additionally, the number of participants who reported driving while using their mobile was three times higher in the RHU group than in the NRU. We also detected that those students with severe psychiatric symptoms were significantly higher in the RHU. In the LRU, the proportion of participants with severe symptoms of depression, anxiety, and stress was 6.8%, 9.2%, and 8.8%, respectively, whereas, in the RHU group, this proportion was 35.1%, 34.8%, and 33.3%, respectively.

Table 2

Characteristics of users according to the IAT' groups regarding Smartphone use behaviors and DASS-21 scores. Values expressed as the mean and standard deviation (±) or raw number and percentage

Variable	NRU	LRU	RHU	Test	Effect size
Does your smartphone use harm your everyday life?				$\chi^2 = 173.5$***	0.28
Yes	163 (30%)	699 (50.1%)	216 (78.3%)		
No	380 (70%)	696 (49.9%)	60 (21.7%)		
Do you talk on the cell phone while driving? [a]				$\chi^2 = 19.9$***	0.09
Never	251 (74.3%)	520 (64.2%)	97 (59.9%)		
Rarely	79 (23.3%)	253 (31.3%)	51 (31.5%)		
Always	8 (2.4%)	36 (4.5%)	14 (8.6%)		
Depression				χ^2= 155.2***	0.18
No risk	457 (84.2%)	987 (70.8%)	125 (45.3%)		
Moderate risk	49 (9%)	210 (15.1%)	54 (19.6%)		
High risk	37 (6.8%)	198 (14.1%)	97 (35.1%)		
Raw score	5.6 (± 9.9)	9.3 (± 9.9)	16.2 (± 9.7)	F= 108.7***	0.09
Anxiety				$\chi^2 = 120.1$***	0.16
No risk	443 (81.6%)	960 (68.2%)	130 (47.1%)		
Moderate risk	50 (9.2%)	217 (15.9%)	50 (18.1%)		
High risk	50 (9.2%)	218 (15.9%)	96 (34.8%)		
Raw score	4.4 (± 8.7)	7.1 (± 8.7)	13 (± 8.4)	$F = 68.1$***	0.06
Stress				$\chi^2 = 120.4$***	0.16
No risk	439 (80.9%)	925 (66.3%)	126 (45.7%)		
Moderate risk	56 (10.3%)	251 (18%)	58 (21%)		
Highrisk	48 (8.8%)	219 (15.7%)	92 (33.3%)		
Raw score	8.9 (± 10.4)	13.3 (± 10.4)	19.7 (± 10.1)	F= 81.2***	0.07

Note. NRU= No-risk Users (n = 543); LRU = Low-risk Users (n = 1395), RHU = Risk and High-risk Users (n = 276). **$p <$ 0.01, ***$p < 0.001$, [a]A total of 905 students reported they did not drive and were excluded from this analysis [No-risk Users (n = 205); LRU = Low-risk Users (n = 586), RHU = Risk and High-risk Users (n = 205)].

Figure 1 shows the different app and smartphone functionalities among students from the NRU, LRU, and RHU groups. The RHU group showed an average daily time of 446 minutes (7.4 hours), almost twice that of the NRU participants (F= 56.4, $p < 0.001$, η^2 = 0.05). As regards the use of WhatsApp (Figure 1B), the RHU group also presented a longer time than the other groups (F = 38.9, $p <$ 0.001, η^2 = 0.03). Additionally, we detected that users from the RHU group spent more time than the other participants on Facebook (Figure 1C) (F= 50.6, $p < 0.001$, η^2 = 0.04); using websites (Figure 1D) (F = 11.2, $p < 0.001$, η^2 = 0.01); on Instagram (Figure 1E) (F = 19.6 , $p < .001$, η^2 = 0.01); and playing games (Figure 1F) (F = 5.6, $p < 0.001$, η^2 = 0.00). Those students from the RHU group reported receiving (Figure 1G) and sending (Figure 1H) a significantly higher number of messages than those from the other groups. Students from

the NRU group received a significantly higher average of messages than the other participants (*Scheffé's test*, $p < 0.001$). Lastly (Figure 1I), students from the RHU reported checking their smartphones on average 32 times a day ($F = 27.4$, $p < 0.001$, $\eta^2 = 0.04$).

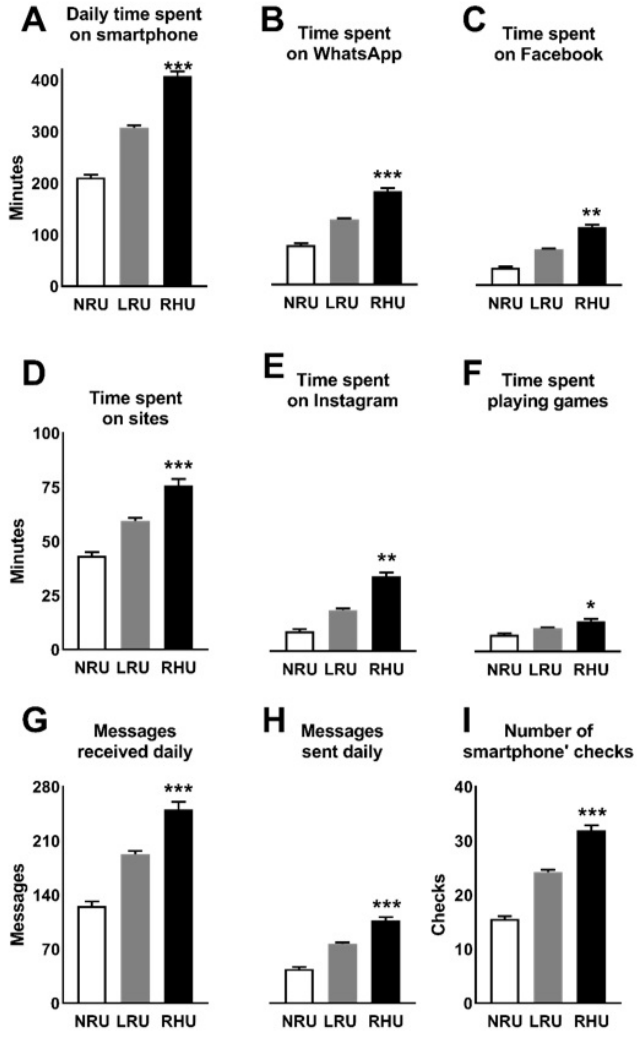

Figure 1

Pattern of internet use among the three groups analyzed.

Note. 1A. Time spent using smartphone daily (*M* and *SE*) among students classified as No-risk Users (NRU; $n = 543$); Low-risk Users (LRU; $n = 1395$) and Risk and High-risk Users (RHU; $n = 276$) 1B. Time spent using WhatsApp (Mean and S.E.) 1C. Time spent using Facebook (*M* and SE). 1D. Time spent navigating websites, blogs, and others (*M* and *SE*). 2E. Time spent using Instagram (*M* and *SE*). 1F. Time spent playing games (*M* and *SE*). 1G. Messages received daily (*M* and *SE*) from any app and website. 1H. Some messages are sent daily from any app and website (*M* and *SE*). 1I. Some smartphone checks daily (*M* and *SE*). * Differs from the NRU group ($p < 0.05$), *** Differs from the NRU groups ($p < 0.01$), ** Differs from the LRU and NRU groups ($p < 0.001$).

Figure 2 shows some characteristics of the students that believe (Group YES) or not (Group NO) that their daily use standard can affect them in their activities, comparing them with scores of the instruments used and some behaviors related to the use of smartphones. When analyzing the IAT scores, ANOVA detected a significant difference in which the group YES scored 10 points more than group NO (F = 664.5; p < 0.001; $\eta\rho^2$ = 0.1). Significant differences were also found to the factors of Anxiety (Figure 2B; F=77.3; p < 0.001; $\eta\rho^2$ = 0.01), Stress (Figure 2C; (F = 118.3; p < 0.001; $\eta\rho^2$ = 0.02)] and Depression (Figure 2D; F = 156.1; p < 0.001; $\eta\rho^2$ = 0.02), being that for this last the difference between groups was only three points.

About the time spent using smartphones (Figure 2E), the YES group reported average daily use of about 5.6 hours (333 minutes) in comparison with the group NO, which used it about 4.3 hours (255 minutes) (F = 166.3; p < 0.001; $\eta\rho^2$ = 0.03). In addition, the YES group reported longer times using WhatsApp (Figure 2F; F = 129.5; p < 0.001; $\eta\rho^2$ = 0.02); Facebook (Figure 2G, F = 134; p < 0.001; $\eta\rho^2$ = 0.02); daily time accessing websites (Figure 2H; F = 20.8; p < 0.001; $\eta\rho^2$ = 0.004) and Instagram (Figure 2I; F = 96.9; p < 0.001; $\eta\rho^2$ = 0.02). About the number of messages received (Figure 2J), students from the YES group reported receiving of 205 messages on average a day, i.e., 48 messages more than the NO group (F = 50.5; p < 0.001; $\eta\rho^2$ = 0.009). The more messages sent (Figure 2L), the shorter the difference between the groups. However, the ANOVA detected significant differences in the group factor (F = 96; p < 0.001; $\eta\rho^2$ = 0.02), so the YES group sent on average 27 more messages than the NO group. About the number of times that students checked their smartphones (Figure 2M), the YES group checked 27 times a day compared with the NO group (19 times) (F = 195.2; p < 0.001; $\eta\rho^2$ = 0.03).

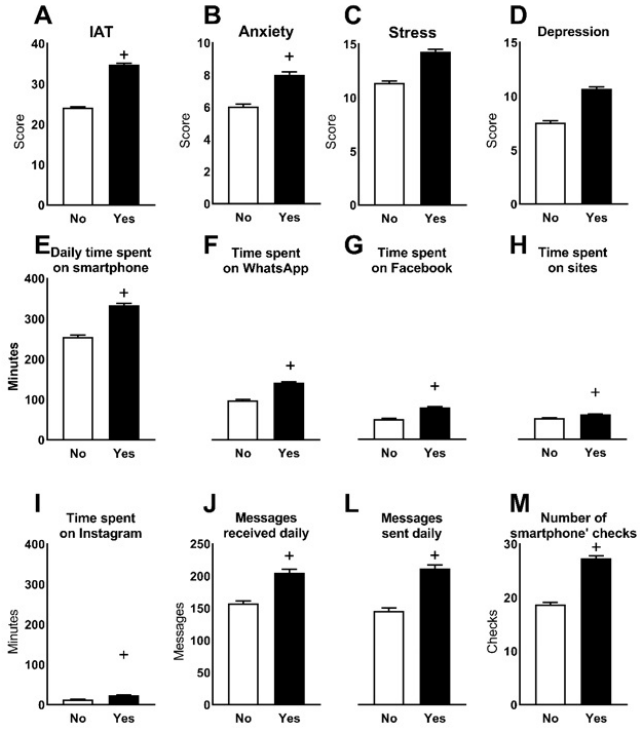

Figure 2
Comparison between students that believe to be harmed in their daily tasks (YES Group; N=1078) with those who do not believe (NO Group; N=1136) regarding to 2A

Note. Gross score (M ± *SE*) of the instruments IAT) 2B. Symptoms of anxiety (M ± *SE*) 2C. Symptoms of stress (M ± *SE*) 2D. Daily time spent using a smartphone (M ± *SE*) 2E. Time spent using WhatsApp (M ± *SE*) 2F. Time spent using Facebook (M ± *SE*) 2G. Time spent navigating on websites, blogs, etc. (M ± *SE*) 2H. Time spent using Instagram (average ± *SE*). 2I. Time spent playing games (M ± *SE*) 2J. Number of messages received daily (M ± *SE*) from any app and/or website. 2L. Number of messages sent daily (M ± *SE*) from any app and/or website 2M. The number of smartphones' checks daily (M ± *SE*). + Difference between groups (Sheffé's Test; p<0.01).

We did not observe differences between students from private and public universities concerning age, time spent using smartphones, WhatsApp, Facebook, Instagram, and websites. On the other hand, students from public universities showed higher IAT (p < 0.001) and anxiety scores (p < 0.05). In both analyses, we observed low effect size (Table 3).

Table 3
Characteristics of students based on the kind of university. Values are expressed as the mean and standard deviation

Variable	Private		Public		Test	*p*	Effect size
	M	*SD*	*M*	*SD*			
Age	22	1.9	22.1	1.8	$F = 1.03$	0.3	0
Time (minutes)							
Smartphone	334.7	251.9	326.8	243.3	$F = 0.47$	0.48	0
WhatsApp	138.7	164.3	152.9	157	$F = 3.8$	0.05	0.01
Facebook	74.3	111.7	79.8	107.6	$F = 1.2$	0.27	0
Instagram	30	65.3	34.9	58.9	$F = 2.9$	0.08	0
Navigation on websites	59.6	90.7	63.3	80.9	$F = 0.80$	0.37	0
Raw Scores							
IAT	30.1	15.8	33.7	15.4	$F = 28$	***	0.01
DASS 21 – Depression	9.5	9.9	10.2	9.7	$F = 2.65$	0.1	0
DASS 21 – Anxiety	7.1	8.7	7.9	8.5	$F = 4.3$	*	0
DASS 21 – Stress	13.2	10.5	14.1	10.3	$F = 3.23$	0.07	0

Note. Private (n = 1431) and Public (n = 783) Universities. *$p < 0.05$, ***$p < 0.001$.

The adjusted logistic regression models (Table 4) showed that those students who believed their smartphone use is harmful had almost three times more chance to have IAT risk scores (LRU or RHU) versus NRU (aOR = 2.77 95 % CI: 2.24-3.41]. Besides, the smartphone's time and the number of smartphone checks daily increased IAT risk scores. Concerning psychological problems, the higher the severity of depression (aOR = 3.2, 95 %, CI: 2.23-4.6), anxiety (aOR = 2.5, 95 %, CI: 1.81-3.45), and stress (aOR = 2.6, 95 %, CI: 1.91-3.68), the higher the chances of IAT risk scores.

Table 4
Ordered regression models (OR) and adjusted ordered regression (aOR) predicting the level of severity to I.A. based on the IAT (N = 2214)

Variable	OR	95% CI	aOR	95% CI
Do you believe your use of the internet is harmful to you?				
No	1		1	
Yes	2.82	[2.29; 3.47]***	2.77	[2.24; 3.41]***
Minutes on the Smartphone	1.12	[1.09; 1.16]*	1.13	[1.10; 1.16]*
Number of smartphone-checks daily	1.02	[1.01; 1.03]*	1.02	[1.01; 1.02]*
Depression				
No risk	1		1	
Moderate risk	2.21	[1.60; 3.06]***	2.21	[1.59; 3.06]***
High risk	3.28	[2.29; 4.69]***	3.20	[2.23; 4.60]***
Anxiety				
No risk	1		1	
Moderate risk	2.17	[1.57; 2.99]***	2.28	[1.64; 3.15]***
High risk	2.55	[1.86; 3.51]***	2.50	[1.81; 3.45]***
Stress				
No risk	1		1	
Moderate risk	2.30	[1.70; 3.13]***	2.29	[1.68; 3.12]***
High risk	2.71	[1.96; 3.74]***	2.66	[1.91; 3.68]***

Note. No-Risk Users ($n = 543$) versus Low-Risk Users (LRU) and Risk and High-risk Users (RHU) ($n = 1\,671$). *** $p < 0.001$

Discussion

We aimed to evaluate Internet addiction prevalence among college students and its association with emotional problems. Our main findings showed that 12.5% of the students were classified as I.A. (RHU Group). The prevalence of severe depression, anxiety, and stress symptoms in this group were five, four, and four times higher than students with no problematic internet use. Additionally, the perception of problematic use and the psychological problems was the main predictors of I.A. On the other hand, we did not observe significant differences between students from private and public universities.

Some authors detected a higher prevalence of I.A.s observed with Chilean students (11.5%), compared with our data by Berner et al. (2014). On the other hand, in a Brazilian study, some authors lower the prevalence of I.A. (7.3%) in a sample with medical students with Brazilian students (Marin et al., 2016). Besides, the prevalence of I.A. in our study is lower than observed in most Latin American studies, such as Ecuador (20.3% and 51.5%, Ramos-Galarza et al., 2018; Rueda et al., 2017,

respectively), Colombia (25%, Cañón et al., 2016) and Brazil (62% and 21.2%, Della-Méa et al., 2016; Terres-Trindade & Mosmann, 2016, respectively). In Europe, 98% of Swiss students (12 to 19 years old) had smartphones, and 17% were considered dependent. Additionally, the prevalence of I.A. was more frequent among younger students (15-16 years old) than among older ones (older than 19 years old) (Haug et al., 2015). Some authors observed that in Lithuania, there was a higher prevalence of internet-dependent youngsters (from 11 to 18 years old) (nearly 11% of the boys and 8% of the girls), where 67% of the males spent at least five hours a day playing on the internet, while 19% of the girls did so (Ustinaviciene et al., 2016). These findings are very heterogeneous because they depend not only on the studies' methodological characteristics but also on each country's cultural aspects.

Regarding socio-demographic characteristics, we did not observe any association of gender with I.A., as reported by some authors (Moromizato et al., 2017; Marin et al., 2016). Although male students used the internet for more extended periods than females In Canada, the authors did not detect significant differences in the prevalence of I.A. regarding gender (Dufour et al., 2016). The full internet addiction scores and frequency of internet problems were similar in male and female Pakistani medical students (Khan et al., 2017). On the other hand, some authors observed a gender difference in which I.A.'s prevalence was higher among male participants (Cañón et al., 2016; Demirer & Bozoglan, 2016; Ak et al., 2013) than female participants (Andrade, Scatena, Bedendo et al., 2020). In one of these studies, males were more interested in playing online games and reading newspapers and magazines, whereas females used the internet, mainly for communication (Ak et al., 2013). In this sense, it is essential to consider considering these data in specific cultures (Shadzi et al., 2020). In Demirer and Bozoglan (2016), the authors pointed out that male students spent more time on the internet than female students because boys have more cultural freedom than girls and more social opportunities.

We observed that those students from the NRU group had the lowest income and those from the LRU the highest. In a study conducted with students from Hong Kong, those with a family income level below average had a chance almost twice as high to have I.A. (Wu et al., 2016). Some authors detected that unemployed internet users were more likely to use the internet for private purposes than working ones (Duplaga, 2017; Rumpf et al., 2014). The authors pointed out that free time may increase the time spent on the internet. Interestingly, in a study conducted with Polish students, those from urban areas presented a lower prevalence of IA (0.45%) compared with those who are living in rural areas (2.9%) (Pawlowska et al., 2015).

The new configuration of social relations has influenced the overuse of digital media (smartphones) and the internet in the last few years, and these technologies are becoming easily accessible. However, the impact of this use on students' quality of life is a little-explored issue (Wang et al., 2020). In our study, the higher the severity of internet use, the longer the daily time using smartphones and computers, and the RHU used their smartphones 7.4 hours daily on average. Wu et al. (2016) reported that 57% of Chinese students with I.A. spent more than six hours a day on it. In South Korea, about 70% of the children aged 11 and 12 have a Smartphone, and 25% meet the criteria for smartphone addiction, using it 5.4 hours a day, on average (Jeong et al., 2016).

When the first studies on I.A. were developed in the 1990s, researcher Mark Griffiths (1999) created the term "digital addiction" to define characteristics these individuals shared, including detachment and mood swings. The association between digital addiction and these symptoms was reinforced in the last decade, notably regarding anxiety and mood disorders (Baturay & Toker, 2019; Tsai et al., 2020). In our study, nearly 35% of the RHU group students presented more severe depression, anxiety, and stress symptoms. Therefore, the depletion of interpersonal relationships could be triggered by the increase of virtual relationships, distorting

the individual's perception of the physical world (Tsai et al., 2020).

Rosenthal et al. (2016) study is an example of this process, as researchers found that youth's depressive symptoms were worsened by experiences and time spent on social networks such as Facebook. According to the authors, a hypothesis could be that as most people post photos/texts only in situations of happiness and well-being, users experience reduced self-esteem and worsen depressive symptoms. In the study of Berner et al. (2014), almost 19% of college students with I.A. showed significant scores to symptoms of depression, but in both Brazilian studies that evaluated the association of I.A. with psychological problems, such association was not found (Moromizato et al., 2017; Della-Méa et al., 2016). The association between I.A. and some mental disorders was deeply discussed by some authors who proposed a theoretical model to explain this relationship (see Brand et al., 2019; Brand et al., 2016).

In our study, those students from public institutions presented IAT and anxiety scores slightly higher than those from private universities. However, we did not detect a robust effect size in both cases. This relationship should be better investigated, considering the restricted number of studies in the literature comparing students from different institutions. In Colombia, Cañón et al. (2016) reported no differences in I.A. prevalence between students from private and public universities, but these last groups showed scores slightly higher than the first ones. In another report, 8.9% of Lebanese public schools and 2.6% of private school students were classified as internet addicted (Hawi, 2012). On the other hand, some authors did not find differences in the prevalence of I.A. between students from the public (17.7%) and private (14.1%) schools (Seyrek et al., 2016).

We observed that depression, anxiety, and stress were all associated with the risk of I.A. Koo and Kwon (2014) conducted a meta-analysis to evaluate the main risky and protective factors to I.A. only in studies using the South Korean sample (N = 59,283). The magnitude of the effect size was significantly higher for intrapersonal variables than interpersonal ones. Regarding the intrapersonal variables, the most substantial risk factor was the "escape from self" variable followed by "attention problem" and "addictive/absorption traits." The authors also observed a significant effect size in the depression/anxiety category. The most substantial risk factor from interpersonal variables was "family functioning" and "parent relationship." Another study conducted with Jordanian college students, university year level, age, and depression were predictors of I.A. (Alzayyat et al., 2015).

This study has limitations that have been considered. Because an online survey collected our data to expand the sample size, there could be a bias regarding the students' profiles who participated in the study. College students' use of the internet in Brazil is even more expected from their smartphones, and internet addiction might have been mistaken for smartphone addiction. We did not evaluate smartphone addiction because there were no validated instruments available in Brazil during the period that our study was performed.

Conclusion

Our findings suggest a prevalence of IA in 12.5 % of the sample, and these students more often presented symptoms of anxiety, stress, and depression. We did not observe significant differences between students from public and private universities. Moreover, several variables were identified as predictors of the risk of internet addiction. Taken together, these data are relevant as they improve the understanding of the characteristics of this population and hence could help the development of mental health prevention actions focused on youngsters.

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Notes

* Research article.