Acta Psychologica 229 2022) 103698

Contents lists vailable t ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy

Alexithymia internet g ing disorder i the light of epression: A cross-sectional clinical study

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A R T I C L E I N F O

Keywords:
Internet g ing isorder
Internet use isorder
Alexithymia
Depression

A B S T R A C T

Background: Social e otional eficits re ssumed to be involved i the evelopment aintenance of internet g ing disorder (IGD). Alexithymia refers to personality construct, which is characterized by eficits in e otional wareness processing. The constructs of alexithymia epression share similarities, epression is common comorbidity of IGD patients. The im of this study w s to lyze the relationship between lexithymia IGD when controlling for epression symptom severity. Moreover, we compared lexithymia traits of IGD patients with those of on-pathologic al video g ers.

Methods: In cross-sectional study = 38 le IGD patients (EG) were recruited t specialized healthc re services i Germany. In ition, = 39 le on-pathological video g ers (CG) were recruited via social edia bulletin board announcement. Both groups completed questionnaires easuring lexithymia (TAS-20), epression symptom severity (BDI) IGD severity (s-IAT).

Results: Alexithymia epression symptom severity both predicted IGD severity. Yet, when i cluding both factors i multiple regression analysis, only lexithymia predicted IGD severity. The prevalence of lexithymia in the EG was 34.2 % (n = 13). None of the non-pathological video gamers scored bove the cut-off indicating alexithymia. IGD patients showed higher traits of lexithymia i general on each subscale, irrespective of whether or ot they were currently consuming video games. As previously observed, epression symptom severity was significantly greater in IGD patients compared to healthy video gamers. Yet, group differences in alexithymia traits remained stable, with a ~29 % decrease of effectiveness in the relationship, when controlling for epression symptom severity sociodemographic f ctors.

onclusion: The results reveal that lexithymia is ssociated with predicts IGD severity independently of epression symptom severity. Moreover, lexithymia is highly prevalent in IGD patients.

1. Introduction

In 2019, the World Health Organization (WHO) ounced to include the diagnostic criteria for (internet) gaming disorder (IGD) s specific form of internet use disorder (IUD) i the 11th revisio of the International Classification of Diseases (ICD-11), i the sectio *disorders due t addictive behaviors* (WHO, 2019). The global IGD prevalence was reported with 3.05 %, with higher prevalence rates in les o-lescents (Stevens et l., 2021). According to the 'Interaction of Person-Affect-Cognition-Execution' (I-PACE) odel (Brand et l., 2019) specific forms of IUD, such s IGD, evelop re intained s consequence of predisposing factors in i teraction with oderating edi ting ffects cognitions. In the past 20 years, vast amount of surveys has been published examining the correlates and risk f ctors of IGD (for an overview see: Mihara & Higuchi, 2017). Problematic gaming behavior was found to be ssociated with male gender, young age, poor c emic performance, being single, divorced, or separated (King et l., 2013; Wang et l., 2014; Wittek et l., 2015). Moreover, excessive gaming is ssociated with lower e otional intelligence eficits in emotion etection processing (Rehbein et al., 2010; Strittmatter et l., 2015; Torres-Rodríguez et l., 2018). It has been hypothesized that people with deficits in emotional wareness and regulation, as well as ensuing

Abbreviations: IUD, Internet Use Disorder; IGD, Internet Gaming Disorder.

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https://doi.org/10.1016/j.actpsy.2022.103698
Received 22 October 2021; Received i revised form 12 July 2022; Accepted 2 August 2022
Available online 5 August 2022

social problems tend to engage i addictive behaviors, to regulate feelings externally (Aldao et l., 2010; Estevez et l., 2017; Ricketts & Macaskill, 2004).

1.1. Internet gaming disorder and alexithymia

Alexithymia can be defined as a personality construct characterized by both, eficits identifying feelings (DIF) escribing feelings (DDF), s well s extern-oriented thinking style (EOT) (Taylor & Bagby, 2004). Alexithymia is ssociated with male gender, aladaptive copi g strategies, interpersonal problems as well as low e ucation levels egative ffect (Besharat, 2010; Hendryx et l., 1991; Kokkonen et l., 2001; Lundh & Simonsson-Sarnecki, 2001; Swart et l., 2009), showing similarity to IGD. Yet, in contrast to IGD, lexithymia was fou to be ssociated with increasing age (Lane et l., 1998; Mattila et al., 2006). Prior studies i icated strong correlations between the gold st rd self-assessment questionnaire for identifying lexithymia (Toro to-Alexithymia Scale, TAS-20) (Bagby et l., 1994) the widely used Beck's Depression Inventory Scale (BDI) (Beck et al., 1961; Montebarocci & Surcinelli, 2018). This ay be partially explained by overlapping symptoms of epression lexithymia, such s emotional blunting social withdrawal (Hamaideh, 2018; Lane et l., 1996). Although lexithymia epression share clinical similarities, Parker et l. emonstrated that the BDI TAS-20 ssess ifferent constructs by using factor analyses with correlation matrix of both easure ents (Parker et al., 1991). The analysis yielded four-factor solution, with o overlap of the scales i student sample, s well s i psychi tric outpatients.

It has been presumed that deficits in internal emotional regulation processing, caused by high traits of lexithymia, y result i substance-related or external (often behavioral) regulation of emotions (Kauhanen et al., 1992). A series of studies found correlations between lexithymia IUD in student samples excessive computer g e users, s well s positive predictive effect of lexithymia o IUD severity (Craparo, 2011; Dalbudak et l., 2013; Geisel et l., 2015; Maganuco et l., 2019). A itionally, comparative lyses indicated higher traits of lexithymia s well s severe epression in excessive internet users (Geisel et al., 2015; Kandri et al., 2014). Recently, study of 429 video gamers was published suggesting both positive association between lexithymia IGD severity higher traits of lexithymia in problematic compared to non-problematic gamers (Bonnaire & Baptista, 2019). till, there is eed for clinical studies, examining the role of alexithymia in patients suffering from IGD.

In recently published eta-analysis the high comorbidity the overlap of IGD epression is highlighted (Ostinelli et l., 2021). Moreover, epression is k own s relevant risk factor in IGD pathogeneses (Teng et l., 2021). Given the strong associations between the three constructs, it would be reasonable to examine the relatio ship between lexithymia IGD subtracted from the impact of epression symptom severity.

1.2. Study aim

We lyzed the ssociation between lexithymia IGD when controlling for depression symptom severity. The first aim of this study was to compare lexithymia traits of IGD patients with non-pathological video gamers. Based on prior non-clinical findings, we hypothesized that lexithymia traits would be higher i IGD patients (**I**). Furthermore, we ssumed that considering epression symptom severity s covariate might partially weaken the group differences in alexithymia traits (**II**).

. Materials and methods

2.1. articipants and procedure

Between February 2018 June 2019 total of = 38 male IGD inpatients outpatients (Experimental Group, EG) were recruited within cross-sectional collaborative study of the *LWL-University Hospital Bochum, Department sychosomatic Medicine and Psychotherapy* in cooperation with the *Centre for Behavioural Addiction Research (CeBAR, University Duisburg/Essen, Germany)*. Patients were recruited at the *LWL-University-Hospital Bochum, Department ychosomatic Medicine and ychotherapy* , the *LWL-Hospital Gütersloh, linic Bernhard-Salzmann, AHG Hospital Münchwies* the *Auxilium Reloaded* project for supervised living in Dortmund, Germany. They were either seeking for or i IGD-oriented treatment in specialized settings t one of the he lthcare services. The participants were iagnosed with IGD ccording to the DSM-5 criteria conducted by experienced psychologists psychiatrics. In ddition, each of them were legal ge. Exclusion criteria were intellectual isability, insufficient language skills, past or ctual hypo- ia ia, psychosis, suicidal tendencies, substance-use isorders. Over the period of 15 onths only = 1 female IGD patient could be recruited, which is why we ecided to focus on the comparison of male participants, and excluded the female patient from the subsequent nalyses. Within the recruitment process, we noted that s result of iverging therapy programs half of the patients (n = 19) id not consume video games at the day of ta collection (on vera ge for 5 onths).

The Control Group (CG) was recruited via social edia dvertise- ents ressed to young online-game users, i.e. via Facebook Whatsapp. I ition, ouncements were represented on bulletin boards of the Ruhr-University Bochum. The study was ounced s online-survey examining "risk factors of problematic internet (gaming) isorder ". A total of 58 interested people received link to completed onymous online-survey. The participants were ot compensated for the study participation, yet they received feedback about their gaming behavior fter completing the questionnaire. People who scored above the cut-off (>37 points) of the short version of Kimberly Young's I ternet Addiction Test (s-IAT) i icating IGD received information bout the isorder specialized health care services (Pawlikowski et l., 2013). Due to that, one p rticipant w s subsequently excluded from analysis. Female p rticipants (n = 1) participants who eclared that they id not play any online computer g es (n = 15) were excluded from the analysis. A total of = 41 le onpathological video gamers built the CG.

2.2. Measurements

Each group completed psychometric questionnaires measuring IGD, lexithymia and epression, s well as socio-demographic factors.

2.2.1. Internet gaming disorder

In order to measure IGD severity, the short version (s-IAT) of *Internet Addiction Test* (IAT), pted to the German language specified on IGD was used (Pawlikowski et l., 2013). The self-reported questionnaire consists of 12 items which are rated on 5-point-Likert scale from 1 ("rarely") to 5 (" lways ") with total score range from 12 to 60 points, with higher scores reflecting higher IGD severity. The items comprise two facets of pathological internet use: (1) *loss of control/time management* (2) *craving/social problems*. Sum scores bove the cut-off of 37 points i icate pathological gaming use. Fit-indices (CFI = 0.95 SRMR = 0.064) revealed good odel fit for the two-factor odel. Cronbach's Alpha for internal consistency of $\alpha = 0.942$ indicates good reliability in the sample.

2.2.2. Alexithymia

Alexithymia was ssessed using the German version of the *Toronto Alexithymia Scale* (TAS-20) (Bach et al., 1996). The TAS-20 is one of the ost frequently used ssessments for lexithymia. It i cludes three factors: (1) *difficulties identifying eelings* (DIF), (2) *difficulties describing eelings* (DDF), (3) *externally oriented thinking* (EOT). A eta-analysis of international studies summarized that the values for factorial validity

of the TAS-20 meet the criteria standard (Taylor et al., 2003). The self-reported questionnaire consists of 20 items which are rated on 5-point-Likert scale from 1 (“strongly disagree”) to 5 (“strongly agree”), with a total score range from 20 to 100. A total score of 61 or above indicates *alexithymia*, whereas score between 52 60 points represents oderate egree or *potential alexithymia*. Cronbach's Alpha for i ternal consistency of $\alpha = 0.879$ indicates good reliability of the TAS-20 in the sample.

2.2.3. Depression

To easure epression symptom severity, the German version of *Beck's Depressions Inventory* (BDI) was used (Hautzinger et l., 1994). It consists of 21 groups of items representing 21 symptoms of depression, which can be rated from 0 to 3 in terms of intensity based on the last 7 ys, with total score from 0 to 63, with higher scores indic ting higher symptom severity. A total score between 10 18 points i - icates *mild t moderate degree depression*, score between 19 29 represents *moderate t severe degree depression* total score bove 30 points i icates *evere depression*. Cronbach's Alpha for i ternal consistency of $\alpha = 0.915$ indicates good reliability in the sample. I sum, studies investigating the replicability stability of factor solutions of the BDI revealed that the BDI represents one u erlying general sy - drome of depression (Richter et l., 1998).

2.3. Data analysis

All lyses were conducted with *IBM SPSS tatistics r windows* (Version 25.0, Armonk, NY: IBM Corp.) *Microsoft Excel* (Version 16.0, Microsoft Cooperation). To etect outliers in the ta the Inter-quartile range (IQR) rule was pplied (Vinutha et l., 2018). We efined values lower or higher than 3 × IQR s extreme outliers subse-quently excluded = 2 CG participants from subsequent lyses due to extremely high BDI scores. Descriptive analyses were conducted using percentages frequencies for categorical variables, as well s eans standard eviations for continuous variables. *Chi-square* istribu-tions that compared categorical variables between groups were i ple-ented s well s i ependent *t*-tests comparing etrically scaled variables. Associations between ge, lexithymia, epression sy ptom severity IGD severity were lyzed using *Pearson correlations multiple regression analysis* (post hoc power: $1 - \beta = 0.893$). In order to lyze ifferences of lexithymia between the groups, *univariate analysis variance* (ANOVA) was conducted. Additionally, to control for epression symptom severity sociodemographic f ctors, *univariate analysis c variance* (ANCOVA) was carried out (post hoc power: $1 - \beta = 0.997$).

2.4. Ethics

In ccordance with the Helsinki Declaration of 1975 s revised in 1983, the Ethics Committee of the Ruhr-University Bochum pproved the study (registration number: 16-5815). All subjects of the EG were informed bout the study prior to participation provided written informed consent. Participants of the CG were informed about the study online prior to participation and provided informed consent.

3. Results

The final EG consisted of = 38 IGD patients the final CG consisted of = 39 non-pathological video g ers.

3.1. Sociodemographic characteristics and game genres

Group ifferences on sociodemographic characteristics g e genres re presented in Table 1.

The attendees of the EG were significantly younger compared to the attendees of the CG. Moreover, less of them were living in relationship graduated from high school compared to the participants of the CG.

All participants were sked to choose their favorite computer g e. With regard to the type of games four groups were formed: *action* (e.g. first-person-shooter = FPS), *trategy* (e.g. Multiplayer Online B ttle Arena = MOBAs), *role-playing* (e.g. Massively Multiplayer Online Role Playing Games = MMORPGs) *thers* . Within the EG preferred game genres were nearly b lanced with slightly tendency towards *trategy* games (n = 14, 36.8 %), while ost of the on-pathological video gamers (= 20, 51.3 %) chose g es classified s *thers* , i.e. obile games. Overall, the IGD patients the non-pathological video g ers preferred different types of games, $\chi^2(3) = 20.92$, $p < .001$, $\varphi = 0.52$.

3.2. IGD severity and depression

Group differences on IGD severity epression are presented in Table 2.

A total score > 10 can be interpreted s clinically relevant severity of epression. More than half of the patients (54.1 %, = 20), but 20.5 % of the non-pathological video gamers (n = 8) scored bove the cut-off, indicating group ifferences in suffering from epression, $\chi^2(1) = 7.80$, $p = .005$, $\varphi = 0.35$.

The IGD patients scored higher on both IGD severity depression symptom severity compared to non-pathological video gamers, $t_{IGD}(73) = 4.70$, $p < .001$, $d = 1.09$; $t_{DEP}(74) = 4.14$ $p < .001$, $d = 0.94$. A i-tionally, both factors of IGD severity) *craving/social problems* b) *loss control/time management* were significantly higher i the EG compared

Table 1
Group differences on sociodemographic characteristics and game genres.

	Total (N = 77)		CG (= 39)		EG (n = 38)			
		%		%		%	*p*-Value	
Marital status							<.001	$\phi = 0.53$
Married/in couple	28	36.4	24	61.5	4	10.5		
ingle	49	63.6	15	38.5	34	89.5		
Education							.016	$\phi = 0.30$
High school graduate	57	74.0	34	87.2	23	60.5		
Less than high school	20	26.0	5	12.8	15	39.5		
Game genre							<.001	$\phi = 0.52$
Action	20	26.0	8	20.5	12	31.6		
trategy	22	28.6	8	20.5	14	36.8		
Role-playing	13	16.9	3	7.7	10	26.3		
Others	22	28.6	20	51.3	2	5.3		
	M	*SD*	*M*	*SD*	*M*	*SD*	*p*-Value	
Age	27.53	6.28	29.33	6.12	25.68	5.97	.010	$d = 0.60$

Bonferroni justed *p*-values.

Table
Group differences on IGD severity epression (s-IAT & BDI).

	Total (N = 77)		CG (n = 39)		EG (n = 38)			
		%		%		%	*p*-Value	
Depression[b]							.005	$\phi = 0.35$
Yes	28	36.8	8	20.5	20	54.1		
No	48	63.2	31	79.5	17	45.9		
	M	*SD*	*M*	*SD*	*M*	*SD*	*p*-Value	
s-IAT-score	27.14	11.27	21.87	5.79	32.55	12.92	<.001	$d = 1.07$
Craving/social problems	12.39	5.46	9.51	2.66	15.34	6.02	<.001	$d = 1.25$
Loss of control/time gement	14.75	6.32	12.36	3.86	17.21	7.38	.004	$d = 0.82$
BDI-score	10.09	8.08	6.67	5.44	13.70	8.88	<.001	$d = 0.94$

Note that because of issing values total of N = 76 individuals ($n_{CG} = 39$, $_{EG} = 37$) were included into the calculation of BDI-Scores. Abbreviations: s-IAT = short Internet A iction Test (pted to gaming), BDI = Beck's Depression Inventory.
Bonferroni justed *p*-values.
[b] BDI cut-off: 10 points.

to the CG, $t_{CRA}(75) = 5.47, p < .001, d = 1.25$; t_{LO} (75) = 3.60, $p = .004$, $d = 0.82$.

3.3. Alexithymia, IGD severity and depression

Results from correlation analyses of IGD severity with lexithy ia, epression symptom severity ge re presented i Table 3.

IGD severity was positively correlated to lexithymia traits epression symptom severity. In ition, lexithymia traits predicted IGD severity ($\beta = 0.38, p = .001$), s id epression symptom severity ($\beta = 0.31, p = .006$). ubsequently, linear ultiple regression lysis was conducted with IGD severity s ependent lexithymia tr its epression symptom severity as independent variables. The odel explained 17 % of the variance in IGD severity ($R^2 = 0.168$, $F(2,73) = 7.39$, $p = .001$). When ing both f ctors, lexithymia traits significantly predicted IGD severity ($\beta = 0.30$, $p = .014$), while epression symptom severity did not ($\beta = 0.17$, $p = .155$).

According to the TAS-20, 34.2 % of the IGD patients (= 13) scored above the cut-off (>60 points) that indicates alexithymia. None of the non-pathological video gamers scored bove the cut-off. ubsequently, significant relationship between 'group' lexithymia was found, $\chi^2(1) = 13.71$, $p < .001$, $\varphi = 0.46$.

Overall, IGD patients ($M = 52.97$, $SD = 12.46$) scored higher on lexithymia traits compared to on-pathological video g ers ($M = 37.46$, $SD = 8.73$), $t(75) = 6.31$, $p < .001$, $d = 1.44$. Table 4 gives overview of results from independent t-Tests lyzing group ifferences (CG vs. EG) on all subscales of the TAS-20, indicating that the CG the EG iffered significantly on each component of lexithym ia.

In the course of divergent therapeutic interventions, = 19 recruited IGD patients reported that they were currently ot consuming vi eo games at the day of ta collection. The relative stability of lexithymia traits i substance-use-disorders is ssumed to be moderate to high (e Haan et al., 2014). We subsequently hypothesized that being currently bstinent from playing video games would ot result i ecrease lexithymia traits. Still, i order to void confounding effects, the following lyses h been conducted comparing three groups: 1. currently consuming IGD patients (CEG, = 17), 2. currently on-consuming IGD patients (NCEG, = 19) 3. on-pathological video gamers (CG, = 39).

Table 3
Pearson correlations mong psychological test scores (N = 75).

	Age	TAS-20	BDI	s-IAT
Age	1	−0.216	0.039	−0.090
TAS-20	−0.216	1	0.456**	0.372**
BDI	0.039	0.456**	1	0.310**
s-IAT	−0.090	0.372**	0.310**	1

Note that because of issing values total of $N = 74$ ($n_{CG} = 39$, $_{EG} = 35$) were included i to the calculation of BDI-Scores. Abbreviations: s-IAT = short Internet A iction Test (pted to gaming), BDI = Beck's Depression Inventory, TAS-20 = Toronto Alexithymia Scale.
** Correlation is significant at the 0.01 level (2-tailed).

Table 4
Group differences on the TAS-20 subscales.

	Total (N = 77)		CG (n = 39)		EG (n = 38)			
	M	*SD*	*M*	*SD*	*M*	*SD*	*p*-Value	
DIF	13.65	5.95	10.05	3.16	17.34	5.90	<.001	$d = 1.55$
DDF	12.83	4.88	10.28	3.68	15.45	4.58	<.001	$d = 1.25$
EOT	18.64	4.88	17.13	4.10	20.18	5.18	.020	$d = 0.65$

Abbreviations: DIF = subscale "difficulties identifying feelings", DDF = subscale " ifficulties escribing feelings", EOT = subscale "externally-oriented thinking style".
Bonferroni justed p-values.

Results from u ivariate nalysis of variance (ANOVA) revealed statistically significant differences between the groups i the overall lexithymia trait, $F(2, 72) = 22.07$, $p < .001$, $\eta p^2 = 0.38$. Bonferroni-justed post-hoc tests revealed significant difference of alexithymia traits ($p < .001$) between the CG NCEG (18.64, 95 %-CI [11.40, 25.88]). Additionally, the CG significantly ($p = .001$) iffered i lexithymia traits from the CEG (12.13, 95 %-CI [4.61, 19.64]). Yet, o statistically significant ifference ($p = .205$) of lexithymia traits was found between the CEG and the NCEG (6.52, 95 %-CI [−2.12, 15.15]).

The subsequent lyses were carried out while controlling for epression symptom severity. Yet, the results from univariate lysis were re-evaluated fter adding the BDI score s covariate (ANCOVA). Due to the group differences on sociodemographic variables, we i-tionally i cluded ge, education relationship status into the odel. Differences between the groups i lexithymia traits remained stable, although losing effectiveness (~29 %), $F(2, 62) = 11.61$, $p < .001$, $\eta p^2 = 0.27$.

4. Discussion

In the present study we lyzed the role of lexithymia in the context of IGD when controlling for comorbid epression symptom severity i sample of N = 77 male participants, who either suffered from IGD or consumed video games i non-pathological way. Overall, IGD severity was correlated to both lexithymia epression symptom severity. Subsequent regression lyses revealed positive predictive effect of both, lexithymia and epression symptom severity on IGD severity. Yet, when dding both factors into the model, only lexithymia predicted IGD severity.

We subsequently compared results from n = 38 IGD patients with a group of = 39 non-pathological video gamers. We inferred that lexithymia traits would be higher i IGD patients compared to on-pathological video gamers (**I**).

The results from the univariate nalysis of variance confirmed our inference since lexithymia scores in general on each subscale were higher i IGD patients compared to on-pathological video gamers (Mahapatra & Sharma, 2018). A itionally, one third (n = 13, 34.2 %) of the IGD patients, but o non-pathological video gamer scored bove the cut-off of the TAS-20 indicating lexithymia. Since half of the patients id not consume video games at the day of ta collectio we split the EG i to group of currently consuming (CEG) currently on-consuming (NCEG) IGD patients. Even when splitting the groups, significant group differences on the total score ll subscales were found between the CG both the NCEG the CEG. Post-hoc tests revealed o ifferences between the CEG the NCEG, indicating that alexithymia in the group of IGD patients is robust personality trait, even if the patients re bstinent from the " rug " itself (de H et al., 2014).

Furthermore, we ssumed that considering epression symptom severity s covariate ight partially weaken the differences in lexithymia traits between IGD patients non-pathological video gamers (**II**). Due to the group ifferences on sociodemographic variables, we itionally i cluded ge, e ucation relationship status i to the odel.

The group ifferences on lexithymia traits remained stable, lthough ecrease in the effectiveness (~29 %) could be observed.

In summary, we replicated prior studies i icating strong associations between lexithymia, epression symptom severity IGD severity (Bonnaire & Baptista, 2019; Dalbudak et l., 2013; Maganuco et l., 2019; Mahapatra & Sharma, 2018; Montebarocci & Surcinelli, 2018). I our study lexithymia was positive predictor of IGD severity, even when controlling for epression symptom severity. The prev lence of alexithymia in IGD patients was 34.2 %. That is comparable to prior studies i icating high prevalence of lexithymia in patients suffering from ental isorders (21.36 %) (Leweke et l., 2012), i.e. ictions, like lcohol use isorder (30–49 %) (Cruise & Becerra, 2018), rug iction (43.5 %) (Farges et al., 2004), g bling disorder (31.4 %) (Lumley & Roby, 1995).

Coming back to the I-PACE odel our results suggest that lexithymia might be potential predisposing variable contributing to the development of IGD (Brand et l., 2019). till, the ctual evelopment intenance of IGD epend on interactions of such predisposing personal core elements with various oderating mediating cognitions, ffects behaviors. everal f ctors re ssociated with both could be relevant in the relationship between lexithymia IGD severity, such s emotional intelligence (Parker et l., 2001; Parker et l., 2013), aladaptive coping strategies (Besharat, 2010; Lin et l., 2021; Schneider et al., 2018), loneliness (Qualter et l., 2009; Yu et l., 2022) social nxiety (Dalbudak et l., 2013; Yu et al., 2022).

As expected, IGD patients suffered from higher egrees of IGD severity compared to healthy video gamers on both factors of the s-IAT (craving/social problems loss of time/time management), yet the effect was ore pronounced for craving/social problems. This result emphasizes the role of social eficits i the context of IGD (Gentile et l., 2011; Wartberg et l., 2017; Whang et al., 2003).

4.1. Sample characteristics, limitations and utlook

Our sample only consisted of le participants. We excluded the only female IGD patient, since the sample sizes were too small to calculate gender-specific effects. Still, it is limitation of the study that no women participated, especially because gender-specific ifferences in lexithymia re suspected as well (Kokkonen et l., 2001). I ition, fewer IGD patients graduated from high school fewer were living in relationship compared to the non-pathological video gamers, which is in line with previous studies (Gentile, 2009; Wittek et l., 2015). We considered these differences by including the sociodemographic factors into the ultivariate lysis, yet they re jor limitations of the study.

Further limitations re the different recruitment strategies of both groups, which might have i fluenced our results. Since the IGD p tients were recruited t clinical f cilities, their results ight h ve been confounded by social esirability. Moreover, the results of the CG ight be confounded by selection bias, since those i ividuals low i otivation ight not p rticipate t online-surveys, but ight differ in relevant constructs from those higher i otivation (Thielo et al., 2021).

Contradictive to previous studies, which predominantly ssociated MMORPGs with problematic gaming behavior (Dieris-Hirche et l., 2020; Rehbein et al., 2011), the majority of the IGD patients i this study preferred strategy games, i.e. MOBA games. The relationship between lexithymia IGD severity is reported to be especially high in MOBA players (Bonnaire & Baptista, 2019), which might have i fluenced our results. I addition, other studies report associations between preferred game type emotion regulation strategies (Kökönyei et l., 2019). The on-pathological video g ers preferred other g es, such s mobile games. It might be the case, that people who predominantly play mobile games re more socially connected, since excessive mobile game usage was found to be ssociated with high perceived visibility, i.e. sharing high scores on social edia platforms (Sun et l., 2015). ubsequent social i tegration y lleviate the likelihood of developing IGD (Lemmens et al., 2011; Rehbein & Baier, 2013). Taken together, it might be reasonable to consider game type s relevant variable in the relationship between lexithymia IGD severity in future studies with larger sample sizes.

In Germany i 2020, 2.7 illion olescents ged under nine years reported to use video games at least occasionally (The German Games Industry Association, 2020) early gaming onset is ssociated with higher risk to evelop IGD (Nakayama et l., 2020). Given that, it ight be possible that lexithymic symptoms, such s eficits in escribing feelings, evelop s consequence of social withdrawal in early youth. It would be reasonable to conduct long-term studies to further examine the causality of the ssociation between alexithymia IGD.

Notwithstanding the methodological limitations, the relevance of the study lies i the investigation of IGD patients who h been i gnosed according to DSM-5 criteria by experienced psychologists psychitrics, since previous studies lyzed predominantly non-clinical samples ividing the participants i to healthy p thological users by eans of questionnaires. Future studies should improve the clinical quality to enhance the validity of the results, e.g. by using standardized clinical interviews for the diagnostic of comorbidities closer supervision ocumentation of bstinence periods. Depression symptom severity id t least p rtially explain the ssociation between lexithymia IGD severity in our study. We therefore propose to consider epression symptom severity in future studies examining lexithymia in IGD patients is warranted. It might further be reasonable to lyze IGD patients with without comorbid epression separately i future studies, since there are some divergences know with regard to cognitive functioning which ight confound our results (Marchica et l., 2020). It ight moreover be reasonable to recruit l rger samples sizes tch control participants i terms of sociodemographic variables. We lso recommend ssessing relevant clinical comorbidities i future studies by using, for example structure clinical interviews. Given the high prevalence of lexithymia in other ental disorders, it would also be reasonable to build clinical control groups. Finally, future studies should make use of ore performance-oriented hence objective ssessments of emotional wareness processing (Kessler et al., 2010; Lane et l., 1990; Subic-Wrana et al., 2001). It would lso be interesting to replicate the investigation in fMRI study, to further elineate illustrate emotional processing in IGD p tients.

Despite the limitations of the study, our results ight be useful i clinical practice, since they highlight the eed for emotional-focused therapeutic approaches in IGD treatment.

5. Conclusions

Our results reveal that lexithymia is ssociated with predicts IGD severity independently of depression symptom severity. Moreover, lexithymia is highly prevalent in IGD patients. IGD patients show higher traits of lexithymia compared to non-pathological video g ers this effect can only be partially explained by comorbid epression symptom severity. Future studies re w rranted that compare larger sample sizes consider potentially oderating mediating factors in the relationship between lexithymia and IGD severity.

CRediT a thorship contribution statement

MP: Conceptualization, cquisition of ta, formal lysis, interpretation of ata, writing- original draft. BR: Conceptualization, writing - review & editing. LB: cquisition of ata, writing – review & editing. SH: Writing- review & editing. HK: I terpretation of ta, analysis. JDH: Conceptualization, i terpretation of ata, writing – review & editing. All authors have read pproved the manuscript. All authors have re greed to the published version of the uscript.

Declaration of ompeting nterest

None.

Acknowledgments

We acknowledge support by the Open Access Publication Funds of the Ruhr-Universität Bochum. We especially acknowledge the cooperation with the *Center r Behavioral Addiction Research* (CeBAR, University Duisburg/Essen, Germany) under the irection of Prof. Dr. Matthias Brand. We thank ll responsible lab embers t the *LWL-University-Hospital Bochum, Department ychosomatic Medicine and ychotherapy* , the *LWL-Hospital Gütersloh, linic Bernhard-Salzmann, the AHG Hospital Münchwies* the *Auxilium Reloaded Dortmund* for their help on recruitment ta collection, i.e. Christian Groß, Holger Feindl P trick Portmann. We cknowledge Alina Venjakob Alicia Menze for research ssistance, as well as Hans Maximilia Henrich for language proofreading.

Funding

The study has been funded by FoRUM-a funding program of the edical epartment of the Ruhr-Universität Bochum. The funding body had o role i the esign of the study collection, nalysis, interpretation of ta and in writing the manuscript.

Institutional review b ard tatement

The study was conducted according to the guidelines of the Decl - ration of Helsinki, pproved by the Institutional Review Bo rd (or Ethics Committee) of the Ruhr-University Bochum (registration umber: 16-5815).

Informed c nsent tatement

All subjects of the EG were informed bout the study prior to participation provided written informed consent. Participants of the CG were informed bout the study online prior to participation provided informed consent.

Data availability tatement

The tasets used /or lyzed uring the current study re available from the corresponding author on reasonable request.

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