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Gaming addiction and perceived stress among Saudi adolescents

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ABSTRACT

Introduction: Adolescents (age: 10–19 years) make up 15% of the Saudi population and have easy access to electronic gadgets and the Internet, yet data on gaming addiction among adolescents are negligible. We aimed to determine the prevalence of gaming addiction and its association with stress among Saudi school students.
Methods: In this cross-sectional survey, 2675 school students (grades 7–12) from 40 randomly selected schools in four main cities of Al-Qassim province in Saudi Arabia participated. The questionnaire inquired about demography, lifestyle, gaming addiction (7-item Game Addiction Scale), and stress (10-item Perceived Stress Scale). Multinomial logistic regression assessed the association between gaming addiction (yes, no) and stress (high, moderate, low).
Results: Participants' mean age was 16.1 (SD = 1.6) years; 50% were female; 64% reported > 3 h of daily screen time; 5% were addicted to gaming; 11.4% had high-level stress. Addiction to gaming was strongly associated with stress in the adjusted analysis (moderate OR = 6.7, 95% CI = 2.9–15.5; high OR = 11.9, 95% CI = 4.7–30.1). Additionally, those who were older, female, had poor grades, unhealthy dietary habits, an inactive lifestyle, and smoked were more likely to experience high stress.
Conclusions: Gaming addiction is strongly associated with stress among Saudi adolescents.

1. Introduction

Gaming (i.e., online and offline) is a source of addiction for young adults (Gentile, 2009; Leonard, 2003; Loton et al., 2016; Pew Research Center, 2019). It is recognized as a behavioral and mental health condition, both by the American Psychiatric Association (APA) and by the World Health Organization (WHO) (American Psychiatric Association, 2013; World Health Organization, 2019; Spekman et al., 2013). The APA has yet to classify it as a formal disorder due to lack of sufficient evidence, whereas the WHO labels it as 'gaming disorder' (World Health Organization, 2019). Regardless of the terminology used, gaming addiction is common across the world. The current prevalence estimate suggests that gaming addiction ranges between 1% and 15% in Europe and 3% to 8.5% in the USA, while it reaches around 14% in the United Kingdom and the Republic of Korea, and 17% in Iran (Gentile, 2009; Rehbein et al., 2015; Lopez-Fernandez et al., 2014; Zamani et al., 2010; Ferguson et al., 2011; Kim et al., 2016; Thomas and Martin, 2010).

Stress is a common correlate of gaming addiction in adolescents, which adversely affects their family and social relationships, self-control and self-regulation, as well as academic performance (Ferguson et al., 2011; Wang et al., 2014; Wan and Chiou, 2006; Rehbein et al., 2010; Gonzalez-Bueso et al., 2018; Kuss and Griffiths, 2012; Canale et al., 2019; Plante et al., 2018). The relationship between gaming addiction and stress may be bidirectional. Instinctually, many presume that gaming addiction leads to stress, and supporting evidence has shown that excessive gaming is associated with neurobiological changes in the brain, particularly those areas that are responsible for

Abbreviations: APA, American Psychiatric Association; DASS, Depression, Anxiety and Stress Scale; DSM-V, Diagnostic and Statistical Manual of Mental Disorders, 5th ed.; GAS, Game Addiction Scale; IGD, Internet gaming disorder; PSS, Perceived Stress Scale; WHO, World Health Organization

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decision-making and emotional regulation (Weinstein, 2017). It is also possible that adolescents with certain traits naturally gravitate towards gaming, and this tendency may be compounded by stress.

For Saudi adolescents, there is some data on stress but little on gaming addiction, and even less on the relationship between the two. Between 36% and 53% of all Saudi secondary school students experience some form of stress, and around 10% experience severe stress symptoms (Al-Gelban et al., 2009; Al-Gelban, 2007). A staggering 80% of Saudi secondary school students play video games, and those who do are more likely to be smokers, exhibit reckless behaviors, engage in violence and have a road traffic accident (Awadalla, Hadram, Alshahrani, & Hadram, 2017). One study reported that 16% of the adolescent participants were addicted to video games, and they were four times more likely to be psychologically distressed than those who are not addicted to video games (Saquib, Saquib, & Wahid, 2017). However, in addition to being a small-sized study (n = 276), it specifically targeted expatriate non-Saudi adolescents, and therefore, was not informative about gaming addiction among Saudi adolescents (Saquib et al., 2017).

It is important to assess gaming addiction and stress among Saudi adolescents for multiple reasons. Saudi Arabia is a leading Internet user (90% of the population uses the Internet) among Arab countries (Alhantoushi and Alabdullateef, 2014; Bafakih et al., 2016). It is estimated that up to a third of Saudis are addicted to the Internet (range = 20–30%) (Alhantoushi and Alabdullateef, 2014; Bafakih et al., 2016; Khan and Gadhoum, 2018). Since online gaming addiction forms a significant portion of Internet-based addictions (Başol & Kaya, 2018), it is therefore likely that a significant portion of Saudi adolescents (age: 10–19) would also be addicted to gaming. These adolescents constitute 15% of the total population (The General Authority for Statistics Saudi Arabia, 2019). They use various electronic gadgets and have easy access to Internet connections. They also enjoy long school vacations, and the hot weather in the summer months largely restricts their outdoor activities.

This study assessed gaming addiction and stress in a sample of intermediate and high school students from the Al-Qassim region of Saudi Arabia. Gaming addiction was measured with the Game Addiction Scale (GAS), while stress was measured with the Perceived Stress Scale (PSS). The study objectives were: (1) to determine the prevalence of gaming addiction, (2) to determine the prevalence of stress, and (3) to assess the association between gaming addiction and stress. It was hypothesized a priori that those who were addicted to gaming would more likely be stressed compared to those who were not addicted.

1.1. Conceptual framework

This study proposes a bidirectional cyclical conceptual model between gaming addiction and stress among adolescents (Fig. 1). It is based on published literature and the framework presented by Rujataronjai and Varma (2016). Gaming addiction leads to inadequate sleep, poor performance in school, and negative psychosocial consequences (e.g., anxiety, social phobia, lower self-esteem, poorer self-control and impaired social network), which in turn make the adolescents prone to higher levels of stress (Mei et al., 2016; Rasmussen et al., 2015; Wu et al., 2016; Young, 2009; Sota, 2011). Conversely, higher levels of stress motivate individuals to seek short-term rewards to alleviate their stress levels (Brand, Young, & Laier, 2016). As such, pleasurable gaming might be considered a psychological escape and is used as a means to relieve stress (Young and De Abreu, 2010; Snodgrass et al., 2014). Excessive gaming may be considered an avoidance coping mechanism that adolescents employ in order to avoid stressful situations via diversion (cognitive distancing) (Finset, Steine, & Haugli, 2002).

2. Materials and Methods

2.1. Sample

This cross-sectional study was conducted between February and March of 2018 among students enrolled in governmental intermediate schools (7th to 9th grade) and high schools (10th to 12th grade) in four main cities of the Al-Qassim region of Saudi Arabia (i.e., Buraydah, Unaizah, Al-Rass, Bukairyah). Saudi school education is under the jurisdiction of the Ministry of Education (MOE); the majority of schools are governmental (~83%) and segregated by gender (Ministry of Education Statistics Saudi Arabia, 2019). The study protocol was reviewed and approved by the research/ethical committee at the directorate of Ministry of Education in Al-Qassim, Kingdom of Saudi Arabia.

2.2. Sample size

In Al-Qassim, the total population between the ages of 10 and 19 is 189,500. The study needed a minimum of 2371 participants in order to estimate the prevalence of gaming addiction with a 2% margin of error and with a 95% confidence level.

2.3. Sampling frame

A total of 40 male and female intermediate and secondary schools were selected randomly from the list of all such schools (n = 190) in the aforementioned cities. The schools in each city were selected according to school level (i.e., intermediate vs. secondary) and type (i.e., male vs. female) in order to ensure adequate representation of the adolescent population.

2.4. Inclusion criteria

The inclusion criteria were (1) currently enrolled in any of the selected schools, and (2) enrolled in grade seven to twelve.

2.5. Study procedures

Research assistants made two visits to each school. On the first visit, they explained the study to the school administrators, sought their cooperation, and set a schedule for data collection. On the second visit, they went to the classrooms, explained the study purpose, invited the students to participate, and obtained their informed consent. Afterwards, they administered the paper-based survey, which took the participants between 20 and 30 min to complete. Out of 3110 eligible participants, 436 did not give consent to participate (86% response rate). A total of 2675 participants filled out the survey; 23 records were mostly empty, and another 115 records had missing data on key variables; therefore, the remaining 2537 were the focus of this paper.

2.6. Exposures

Gaming addiction was assessed with a 7-item Game Addiction Scale (GAS). It is based on the DSM criteria for pathological gambling (i.e., salience, tolerance, mood modification, withdrawal, relapse, conflict, and problems) (Lemmens, Valkenburg, & Peter, 2009). Each item was assessed with a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = very often). A participant who responded “sometimes” or higher on at least four items was considered addicted to gaming (Lemmens et al., 2009). The GAS has been tested and has had high reliability (Cronbach alpha: 0.82–0.87) in various settings (Lemmens et al., 2009; Khazaal et al., 2016).

2.7. Outcome

Stress was assessed with the Perceived Stress Scale (PSS), a

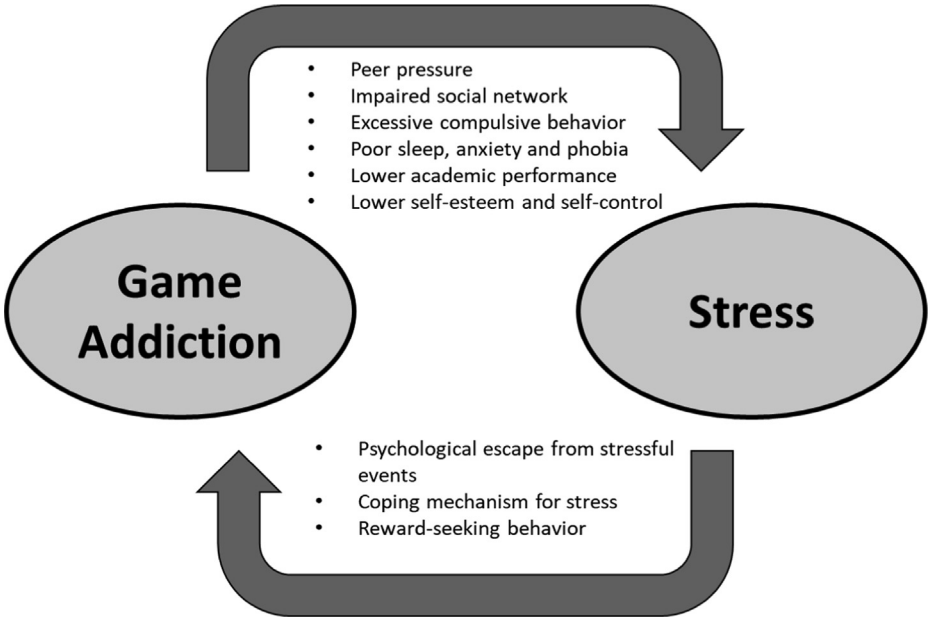

Fig. 1. The bidirectional cyclical conceptual model describing the association between GA and stress in our study.

validated scale that assesses the degree to which life events are appraised as stressful (Cohen, Kamarck, & Mermelstein, 1983). It has 10 items rated on a 5-point Likert scale, ranging from 0 (never) to 4 (very often). The items consisted of both positive and negative factors; the score of the negative items were reversed and re-coded during analysis. Total scores ranged from 0 to 40, with higher scores indicating higher levels of stress. Participants were categorized as having low ($\leq$13), moderate (14–26), or high stress ($\geq$27) (Bhat, Sameer, Bolumbu, & Eustress, 2012). The Arabic version was validated and reported to have an internal consistency of 0.68 (Hamdan-Mansour & Dawani, 2008) and an alpha coefficient of 86.4 (Hattar-Pollara & Dawani, 2006).

2.8. Co-variables

A set of variables were selected from literature review for the analysis: age, gender, parents' marital status (married, divorced/widowed), grade (excellent, very good, good, pass, fail), current smoking status (non-smoker, smoker), self-reported diet (healthy, unhealthy), self-reported physical activity (active, inactive), screen time per day (> 3 h, 2–3 h, 1–2 h, < 1 h).

2.9. Statistical analysis

The data was analyzed in SPSS (version 25) and all tests were two-sided with an alpha of 0.05. Continuous variables were presented as mean (SD), and categorical variables were presented as frequency (%). The set of co-variables were compared and contrasted across the levels of gaming addiction and perceived stress; the nature of the outcomes and co-variables determined the tests that were used (i.e., chi-square, t-tests, or analysis of variance).

The multinomial multilevel logistic regression was chosen to identify the correlates of perceived stress with gaming addiction as the main exposure variable and others as co-variates. The multilevel regression helped avoid underestimation of parameters from a single-level model (Griffiths et al., 2002; Alexandraki et al., 2018) due to the stratified nature of data in this study, i.e., adolescents were nested into school level (intermediate or secondary), school levels were nested into school type (male or female), and school type was nested into city. Therefore, city, school type, and school level were level-2 variables under which individual-level data (level-1) were nested. A stepwise process was adopted for model building for perceived stress. It started out with random effects for the 'city' only (model 1), followed by addition of school type (model 2), school level (model 3), gaming addiction (model 4), age and academic performance (model 5), and lifestyle indicators such as screen time, smoking, physical activity, and diet (model 6). In each step, the log-likelihood ratio difference between the full and reduced model were taken into account to assess the significance of an addition of a variable. The unadjusted and adjusted estimates of gaming addiction are presented in the main manuscript. The adjusted estimates of all variables in the full model are presented in the Appendix. Odds ratios and their corresponding 95% confidence intervals were presented as measures of associations.

3. Results

The mean (SD) age of participants was 16.1 (1.6) years. Fifty-five percent were female. Half of the participants reported getting an 'excellent' grade, followed by 48% with a 'good' or 'very good' grade, leaving only 2% with either a 'fail' or a 'pass' grade. Around 10% of the participants were from a single-parent home. Only 4% were smokers, but nearly half (45%) reported having an unhealthy diet. Almost two thirds (64%) spent > 3 h in front of a screen per day, 15% between 2 and 3 h, and 13% between 1 and 2 h (Table A1).

Nearly 75% of the participants were experiencing stress, including 11.4% who had high stress. Around 5% of the participants were addicted to gaming.

The participants with gaming addiction were, on average, younger than those who were not addicted to gaming. Game-addicted individuals were more likely to be male than female; they were also more likely to come from a broken family than from an intact family. The game-addicted participants were far less likely to receive an excellent academic grade than those who were not addicted (38.5% vs. 51.2%). The proportion of participants who smoked as well as the proportion with greater screen time (> 3 h/day) was significantly higher among the game-addicted than among the non-addicted. The proportion of participants with unhealthy dietary habits or an inactive lifestyle was higher among the game-addicted than among the non-addicted; the difference, however, was not statistically significant (Table 1).

Participants' average age was higher across the increasing categories of stress. Girls were more likely to be stressed than boys; girls constituted three-fourths of all participants in the high-stress group. The proportion of participants with a broken family (i.e., divorced or

Table 1
Comparison of demographic characteristics (determined a priori) by gaming addiction status in a sample of Saudi Adolescents (n = 2537).*

	Gaming Addiction Status		
	Yes (n = 130)	No (n = 2407)	*P*
Age mean (SD)	15.76 (1.71)	16.09 (1.58)	0.022
Sex			0.007
Female	56 (43.1)	1327 (55.1)	
Male	74 (56.9)	1080 (44.9)	
Parents' marital status			0.012
Divorced or one parent passed away	22 (16.9)	242 (10.1)	
Married	108 (83.1)	2165 (89.9)	
Grade			0.018
Pass and Fail	3 (2.3)	52 (2.2)	
Good and Very good	77 (59.2)	1123 (46.7)	
Excellent	50 (38.5)	1232 (51.2)	
Current smoking status			< 0.0001
Smoker	12 (9.2)	79 (3.3)	
Non smoker	118 (90.8)	2328 (96.7)	
Self-reported diet			0.244
Unhealthy	65 (50.0)	1078 (44.8)	
Healthy	65 (50.0)	1329 (55.2)	
Self-reported physical activity			0.149
Inactive	32 (24.6)	468 (19.4)	
Active	98 (75.4)	1939 (80.6)	
Screen time (per day)			0.032
> 3 h	89 (68.5)	1522 (63.2)	
2–3 h	9 (6.9)	375 (15.6)	
1–2 h	17 (13.1)	322 (13.4)	
< 1 h	15 (11.5%)	188 (7.8)	

* The cells in the table contain mean (SD) or n (%) as applicable.

Table 2
Comparison of demographic characteristics (determined a priori) across stress status in a sample of Saudi Adolescents (n = 2537).*

	Stress			
	High (n = 289)	Moderate (n = 1608)	Low (n = 640)	*P*
Age	16.24 (1.59)	16.12 (1.59)	15.86 (1.56)	< 0.0001
Sex				< 0.0001
Female	221 (76.5)	876 (54.5)	286 (44.7)	
Male	68 (23.5)	732 (45.5)	354 (55.3)	
Parents' marital status				0.013
Divorced or one parent passed away	41 (14.2)	172 (10.7)	51 (8.0)	
Married	248 (85.8)	1436 (89.3)	589 (92.0)	
Grade				< 0.0001
Pass and Fail	6 (2.1)	45 (2.8)	4 (0.6)	
Good and Very good	155 (53.6)	810 (50.4)	235 (36.7)	
Excellent	128 (44.3)	753 (46.8)	401 (62.7)	
Current smoking status				0.011
Smoker	14 (4.8)	66 (4.1)	11 (1.7)	
Non smoker	275 (95.2)	1542 (95.9)	629 (98.3)	
Self-reported diet				< 0.0001
Unhealthy	171 (59.2)	736 (45.8)	236 (36.9)	
Healthy	118 (40.8)	872 (54.2)	404 (63.1)	
Self-reported physical activity				< 0.0001
Inactive	92 (31.8)	311 (19.3)	97 (15.2)	
Active	197 (68.2)	1297 (80.7)	543 (84.8)	
Screen time (per day)				< 0.0001
> 3 h	217 (75.1)	1019 (63.4)	375 (58.6)	
2–3 h	31 (10.7)	238 (14.8)	115 (18.0)	
1–2 h	26 (9.0)	221 (13.7)	92 (14.4)	
< 1 h	15 (5.2)	130 (8.1)	58 (9.1)	

* The cells in the table show mean (SD) or n (%) as applicable.

one deceased parent) was higher among the high-stress (14.2%) than the low-stress group (8%). However, the proportion with an excellent academic grade was lower among the high-stress (44.3%) than the low-stress group (62.7%). The proportion of participants with unhealthy dietary habits, an inactive lifestyle, and greater screen time (> 3 h/day) was significantly higher in the high-stress group than their corresponding proportions in the low-stress group (Table 2).

Table 3 shows the model-building process and selection of the final model. Model 1 was nested under Model 2, Model 2 was nested under Model 3, Model 3 was nested under Model 4, Model 4 was nested under Model 5, and Model 5 was nested under Model 6, which was the final model. The log-likelihood statistics (i.e., −2LL) between the full and reduced model indicate that the addition of variables in each step significantly improved the model. It is important to note that perceived stress varied significantly by all three level-2 variables (i.e., city, school type, and school level). Together, they accounted for nearly 5% variation in perceived stress, leaving the remaining 95% to the individual-level factors as well as unknown factors.

The final model of perceived stress shows that gaming addiction was strongly and significantly associated with both moderate and high stress among the adolescents (moderate OR = 6.7, 95% CI = 2.9–15.5; high OR = 11.9, 95% CI = 4.7–30.1) (Table 4). The magnitude of association between gaming addiction and perceived stress changed very little with the addition of covariates. The adjusted model further showed that those who were older, female, had poor grades, unhealthy dietary habits, an inactive lifestyle, and who smoked were more likely to have high stress (Table A2).

4. Discussion

This study explored the association between gaming addiction and perceived stress with a large sample of school students (grade 7 through 12) from Saudi Arabia. The findings could be summarized as (1) the prevalence of gaming addiction was around 5%, (2) the prevalence of high stress was 11%, and (3) a strong significant association was observed between gaming addiction and stress, i.e., those who were addicted to gaming were more likely to be stressed (moderately as well as highly) compared to those who were not addicted to gaming.

Studies from elsewhere in the world showed that the prevalence of gaming addiction is 1.2% in Germany, 7.7% in Spain, 8% in the USA, 9.4% in the Netherlands and 14.6% in the United Kingdom (Rehbein et al., 2015; Lopez-Fernandez et al., 2014; Lemmens et al., 2009). The prevalence found in this current study was a little below that midrange. A recent study among high school students in Lebanon reported a higher prevalence (9.2%) of Internet gaming disorder (IGD) (Hawi, Samaha, & Griffiths, 2018), while an Iranian study found the prevalence of IGD to be 17.1% in a similar population (Zamani, Kheradmand, & Cheshmi, 2010). The wide variance of reported prevalence of gaming addiction among the studies could be explained by several factors: (1) use of disparate scales for assessment of gaming addiction, (2) use of the same scale but the choice of different cut-off values to define gaming addiction, (3) use of different, independently defined terms, for instance, IGD, pathological video gaming, problematic gaming behavior, Internet addiction, etc., (4) differences in sample characteristics, such as age, gender, academic performance etc., and (5) use of different methodology in terms of sampling procedures, setting, and time frame of data collection. For example, studies among adolescents that were conducted in summer months when students were on vacation may have reported a higher percentage of gaming addiction because of excessive use; similarly, studies conducted during exam weeks may have found a lower percentage of gaming addiction.

The stress prevalence reported in this study (75%) was higher than other similar studies (Al-Gelban et al., 2009; Al-Gelban, 2007; Rikkers et al., 2016; Lopes et al., 2016; Hanprathet et al., 2015). Two studies conducted on secondary school boys and girls in Abha, Saudi Arabia reported a prevalence of 36% and 53% (Al-Gelban et al., 2009; Al-Gelban, 2007). The difference in prevalence might be due to the use of disparate assessment tools [e.g., Depression, Anxiety and Stress Scale (DASS) vs. PSS] and/or sample characteristics such as age (e.g.,

Table 3
Multinomial multi-level logistic regression model building for perceived stress (n = 2537).

Level	Variables	Model 1 −2LL (full –reduced) (*p* value)	Model 2 −2LL (full –reduced) (*p* value)	Model 3 −2LL (full –reduced) (*p* value)	Model 4 −2LL (full –reduced) (*p* value)	Model 5 −2LL (full –reduced) (*p* value)	Model 6 −2LL (full –reduced) (*p* value)
Level 2	City	43.7 (< 0.0001)	11.7 (0.067)	13.03 (0.042)	12.03 (0.061)	11.5 (0.072)	10.04 (0.123)
	City + school type (M/F)		52.7 (< 0.0001)	46.2 (< 0.0001)	50.2 (< 0.0001)	50.08 (< 0.0001)	59.9 (< 0.0001)
	City + school type (M/F) + school level			23.7 (0.008)	25.5 (0.004)	22.2 (0.014)	22.7 (0.012)
Level 1	City + school type (M/F) + school level + GAS				54.3 (< 0.0001)	50.4 (< 0.0001)	43.4 (< 0.0001)
	City + school type (M/F) + school level + GAS + age + academic grade					3.2 (0.195) 61.4 (< 0.0001)	3.2 (0.194) 43.4 (< 0.0001)
	City + school type (M/F) + school level + GAS + age + academic grade + screen time + smoking + physical activity + diet						10.3 (0.112) 13.4 (0.001) 17.1 (< 0.0001) 16.7 (< 0.0001)

LL: log-likelihood ratio.

Table 4
The association between gaming addiction and perceived stress among a sample of Saudi adolescents (n = 2537).

Gaming Addiction Status	N	Stress: univariate				Stress: multivariate			
		Moderate (n = 1608)		High (n = 289)		Moderate (n = 1608)		High (n = 289)	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Yes	130	6.70***	2.92–15.38	11.33***	4.63–27.69	6.72***	2.90–15.57	11.96***	4.75– 30.10
No	2407	1.0	ref	1.0	ref	1.0	ref	1.0	ref

Reference group: low stress. Models were adjusted for: level 2 (city + school type + school level), level 1 (GAS + age + academic grade + screen time + smoking status + physical activity + diet).

intermediate vs. secondary schools) and gender distribution (e.g., both vs. single gender). A recently published study among expatriate adolescents from the same Al-Qassim region reported a high prevalence of psychological distress (54%) (Saquib et al., 2017). Additionally, our findings of higher stress among older participants and among girls are supported by several other studies (Rikkers et al., 2016; Lopes et al., 2016; Hanprathet et al., 2015).

The significant association identified between gaming addiction and stress is supported by Saquib et al. (2017), who reported a significant association of video game addiction with psychological distress (OR = 4.1) among expatriate adolescents in Saudi Arabia. Likewise, Canale et al. reported that perceived stress was associated with higher scores of IGD (Canale, Marino, & Griffiths, 2019).

The significant association between smoking and gaming addiction found in this study was consistent with previous studies (Lee et al., 2018; Walther et al., 2012; Ream et al., 2011). Boys who are smokers are almost twice as likely to have problematic video gaming than boys who are non-smokers (Thomas & Martin, 2010). This relationship is plausible since gaming addicts and substance users share similar neurobiological features, including cortical changes in the reward inhibitory mechanisms and loss of control (Ko et al., 2013; Meng et al., 2015). There is abundant evidence that shows substance use, including cannabis, smoking, and alcohol use are higher among individuals with problematic video gaming (Vanooij, Kuss, & Griffiths, 2014).

The study had several strengths and limitations. It had a robust sample, included both genders, had a high response rate for participation, and used a better assessment tool for gaming addiction than previous studies. The assessment tool, the Game Addiction Scale (GAS), was developed specifically to assess gaming addiction among adolescents, and is validated (Lemmens et al., 2009); compared to other scales, the GAS has better coverage of the Internet gaming disorder (IGD) criteria presented in the DSM-V (Petry, Rehbein, & Gentile, 2014) and possesses good psychometric properties (Khazaal, Chatton, & Rothen, 2016).

At the same time, the results should be interpreted with the following in mind: (1) the associations explored herein were cross-sectional in nature and no causal inferences can be drawn, (2) the sample did not include students from private schools, (3) some particular characteristics related to gaming were not assessed, such as types of games (e.g., fighting, combat, car racing, virtual simulations, real-time strategy, sports etc.), money spent on games (payment for subscription and equipment costs, etc.), play settings (alone, with friends, with family, etc.), or play schedule (day vs. night, weekdays vs. weekend, etc.), (4) gaming addiction and stress were self-reported, and therefore, were

subjective in nature, and (5) some information was subject to recall, such as screen time and academic performance.

5. Conclusion

We conclude, based on our study findings, that gaming addiction is a challenging problem among Saudi adolescents who also suffer from high levels of stress. Furthermore, gaming addiction is associated with higher levels of perceived stress. Our findings shed light on the magnitude of gaming addiction in Saudi Arabia and its significant correlation with the mental health of adolescents, who are the future and stakeholders of all societies. We recommend authorities consider gaming addiction a serious problem for the young population and make this growing phenomenon an adolescent health priority. Future research should aim to acquire a more comprehensive picture of common mental problems related to gaming addiction among adolescents and different age groups. Future studies should examine the risk factors and the family's role in order to help develop appropriate tools to combat the negative consequences of gaming addiction. Some of the proposed solutions to control the problem include school awareness campaigns, parental education and guidance, and better legal restrictions on games that encourage harmful acts.

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Contributors

NS and JS designed the study. SE, TMR, AMA, AB, SWA, JE, and SA wrote the proposal, conducted the fieldwork, entered and cleaned the data, and reviewed the literature. MSZ, SBB, and AMR analyzed the data and interpreted the results. NS, AMR, and MSZ drafted the manuscript. All authors contributed to, read, and approved the final manuscript.

CRediT authorship contribution statement

Ahmad Mamoun Rajab: Formal analysis, Writing - original draft. **Mohamed Saddik Zaghloul:** Formal analysis, Writing - original draft. **Saed Enabi:** Investigation, Data curation. **Tawfik Mamoun Rajab:** Investigation, Data curation. **Abdullah Murhaf Al-Khani:** Investigation, Data curation. **Abdulrahman Basalah:** Investigation, Data curation. **Sara Wafik Alchalati:** Investigation, Data curation. **Joud Enabi:** Investigation, Data curation. **Saadi Aljundi:** Investigation, Data curation. **Syed Baqui Billah:** Formal analysis. **Juliann Saquib:** Conceptualization, Writing - review & editing, Supervision. **AbdulRahman AlMazrou:** Writing - review & editing. **Nazmus Saquib:** Conceptualization, Writing - original draft, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.abrep.2020.100261.

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