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Escuela Profesional de Medicina Humana

Problematic internet use associated with dry eye disease in medical students from Peru

Trabajo de Investigación para obtener el Grado Académico de Bachiller en Medicina Humana

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Lima, setiembre de 2021

DECLARACIÓN JURADA DE AUTORÍA DEL TRABAJO DE INVESTIGACIÓN

Salomón Huancahuire Vega, de la Facultad de Salud, Escuela Profesional de Medicina Humana, de la Universidad Peruana Unión.

DECLARO:

Que la presente investigación titulada: **"PROBLEMATIC INTERNET USE ASSOCIATED WITH DRY EYE DISEASE IN MEDICAL STUDENTS FROM PERU"** constituye la memoria que presentan los estudiantes Ismael Benjamin Condori Meza y Luz Alessandra Dávila Cabanillas para obtener el Grado Académico de Bachiller en Medicina Humana, cuyo trabajo de investigación ha sido realizado en la Universidad Peruana Unión bajo mi dirección.

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ORIGINAL RESEARCH

Condori-Meza et al

Problematic internet use associated with dry eye disease in medical students from Peru

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Abstract

Purpose: Dry eye disease (DED) is a pathology of the ocular surface that is characterized by low tear production, which is widely associated with alterations in mental health. Problematic Internet use is defined as the feeling of concern about using this tool irresistibly, for longer periods than usual, accompanied by anguish that results from not doing so without reaching mania or hypomania behaviors. However, there are no published studies that report its

relationship with problematic internet use (PIU). Therefore, this study aims to determine the association between PIU and DED in Peruvian medical students.

Patients and methods: Analytical cross-sectional study that included human medicine students from Peru. For the measurement of main variables, the Ocular Surface Disease Index (OSDI) and the Internet Addiction Test (IAT) were used. To study their relationship, the Poisson regression analysis was used, we consider a p-value <0.05 as significant.

Results: Data from 844 medical students were analyzed, 35.7% male and 64.3% female, with an average age of 21.8 ± 3.3 years. Likewise, the prevalence of DED was 70.9%, and the internet's controlled use was 85.3%. In the analysis adjusted for DED, the men showed significant differences in the controlled use of the internet (p <0.003), of which those who had PIU, 50% had severe DED, as well as 80% of those addicted to the internet. The adjusted model showed that the PIU increases the prevalence of DED in men (PR = 1.17, 95% CI: 1.06 - 1.29), however, in women, no association was found between both variables.

Conclusion: PIU and DED showed a significant association in male medical students from Peru.

Keywords: mental health, screen time, psychological stresses, ocular surface

Introduction

Dry eye disease (DED) is a common chronic multifactorial condition of the ocular surface, characterized by low production of quality tears or insufficient quantities to hydrate the eyes.[1] Prevalence rates vary about the place, in Asian countries, they are 50%, and in Europe 6%.[2] In Latin America there are few studies, one of them being in Chile where 81%,[3] was reported and in Brazil 34.4%;[4] however, in Peru, it has not been investigated.

Around the world, there are more than 7 billion people who are Internet users.[5] This tool has both benefits and harms, one of them being Problematic Internet Use (PIU), defined as the concern to use this tool irresistibly for longer periods than usual, as well as the presence of anguish that results from not doing it without arriving at behaviors of mania or hypomania.[6] The university population is one of the most susceptible to presenting PIU,[7] which have prevalence rates that differ according to place, being in Spain 6%,[8] China 8.4%,[9] Colombia 12%,[10] and in Peru 68.4%.[11]

Additionally, people with PIU have emotional dysregulation, lack of confidence, and social support.[12] These alterations generate a state of psychological stress that through the release of inflammatory cytokines such as IL-1β, IL-6 and IL-8 generate the instability of the tear film, as well as the suppression of tear production, generating DED.[13,14] The aforementioned would indicate the association between these variables, however, as far as we know, there are no investigations that report this relationship. In addition, considering that due to the COVID-19 pandemic, we remain in social isolation, which generates an active use of the internet, which generates the predisposition to develop our study variables.[15] Therefore, our objective is to determine the association between PIU and DED in medical students from Peru.

Material and methods

General characteristics of the study:

This cross-sectional analytical study collected data from 1203 Peruvian medical students, belonging to the 38 faculties of human medicine affiliated to the Peruvian Student Medical Society (SOCIMEP). The sending of the questionnaires began on December 7 and ended on February 12, 2021. The type of sampling carried out was non-probabilistic for convenience. Students over 18 years of age were included, and those with Sjögren's syndrome, refractive surgery procedures, glaucoma, uncorrected ametropia, use of contact lenses, active ocular surface disease, previous psychiatric illnesses, or who had the previous diagnosis of this.

Before the execution of the study, we had the approval of the Research Ethics Committee of the Universidad Peruana Union (Number 2020-CEUPeU-00029). Student participation was voluntary, manifested in the informed consent on the page before the data collection instrument.

Data collection instrument:

The data were collected in a self-administered questionnaire through the Google Forms platform. To determine the presence of DED, the Ocular Surface Disease Index (OSDI) questionnaire was used, which consists of 12 items divided into 3 dimensions: consequences of Internet use, cognitive-emotional, and time control; measured by Likert scale from 0 to 4 points. It has a Cronbach's alpha of 0.91. DED was considered to be a score greater than or equal to 13 points, the degree being mild from 13 to 22 points, moderate from 23 to 32 points, and severe from 33 to 100 points.[3] As for the PIU, it was evaluated through the Internet Addiction Test (IAT), which consists of 20 items, and can have values from 0 to 5 on a Likert scale, with a Cronbach's alpha of 0.77. To determine the presence of PIU, a score greater than or equal to 50 is required, and for internet addiction (IA) a score greater than or equal to 80.[10]

Other characteristics of the students that were recorded in the instrument were demographic data (age, sex and academic year), harmful habits (smoking or consuming alcohol in the last month), variables to add with the development of symptoms (screen time per day, rest while using the internet, glasses with blue light protection, screen light filter, screen brightness, screen viewing distance, room lighting),[16] and the 20-20-20 rule (every 20 minutes a 20-second break is taken, focusing with the eyes on an object at least 20 feet away).[17]

Data analysis

The statistical analysis was carried out using the programming language R version 4.0.2. (R Foundation for Statistical Computing, Vienna, Austria; http://www.R-project.org). The variables were distributed in graphs and tables with absolute and relative frequencies (%) for categorical variables, and means and standard deviation (±SD) for numerical variables. For comparative

analysis of DED and non-DED groups by sex, Mann Whitney U or Chi-square test depending on the distribution of the variables. Finally, to determine the association of PUI to DED, Poisson regression models were performed with robust variance in the overall population and stratified by sex. The first model was unadjusted, and the second model considering the adjusted by potential confounders. In all regressions calculated the prevalence ratios (PR) with their 95% confidence intervals (CI95%). A $p<0.05$ ($\alpha = 0.05$) was considered statistically significant.

Results

General characteristics of the participants

A sample of 1203 medical students was obtained, which after applying the exclusion criteria left 844, of which 301 (35.7%) were male and 543 (64.3%) were female, with an average age of 21.8 ± 3.3 years. Some characteristics of this population reveal an important frequency of unsuitable habits to visual health, as >6 hours connect to the internet (66.7%), not use blue light protector glasses (48.7%), set brilliant screen (41%), and maintain <40 cm of distance to the screen (56.9%), some of these variables presented significantly statistical differences by sex. On the other hand, the prevalence of DED was 70.9% and uncontrolled use of internet was 14.7% in medical students without significant differences by sex (Table 1).

Characteristics of participants by dry eye disease

The study population was stratified into DED and non-DED groups by sex. When comparing the characteristics of DED and non-DED groups, we found that some variables in men as rest during internet use, use of blue light protector glasses, use of light screen filter, screen brightness, and the severity of PUI presented significant differences in DED and non-DED groups. However, all variables compared in women no present significantly statistical differences in DED and non-DED groups (Table 2). To understand this, we focus on the distribution of DED and PUI severity groups.

DED and PUI severity groups showed different distribution patterns in both sexes. In men, more severity of PUI (addiction) presented a high frequency of severe DED (80%). However, in women paradoxically the more severe class of PUI (addiction) presented the same frequency of severe DED as the lowest severity class of PUI (average user) (Figure 1). These differences must take account in future research.

Association of internet use and dry eye disease

To determine the association between PUI and DED, Poisson regression models were performed (Table 3). The non-adjusted models showed that in the overall population (PR = 1.19, 95% CI: 1.08 - 1.31) and men (PR = 1.35, 95% CI: 1.16 - 1.57) increase 19% and 35% respectively, the prevalence of DED in uncontrolled use of internet compared to controlled use of the internet. In the same way, the adjusted models presented a significant association of PUI to DED in the overall population (PR = 1.17, 95% CI: 1.06 - 1.29) and men (PR = 1.27, 95% CI: 1.09 - 1.49). The regression models in women no-showed the association of PUI to DED in the bivariate or

multivariable analysis. Men with uncontrolled use of the internet in this study have more probability of DED.

Discussion

DED is a disease that affects tens of millions of people around the world,[2] one of the causes being the excessive use of screens and the internet, which have been very pronounced in university students.[18]

In this population of Peruvian medical students, we found a 70.9% prevalence of DED, compared to a study in Brazil, where only 34.4% of the students suffered from it.[4] This notorious difference may be due to the social confinement resulting from the COVID-19 pandemic, and the migration from university education to digital remote teaching, which have generated greater exposure to the use of the internet.[19]

On the other hand, the prevalence of PIU in students was similar to a study carried out in Colombia where 12% had problems with the use of the internet,[10] while a study in Spain found a prevalence of 6.04%.[8] These prevalences are attributed to unlimited access to devices without adequate control for the student's own needs.

We also observed in this study that most of the students remained in front of a screen for more than 6 hours a day. Similar results were obtained in Turkish university students, who spent more than 4 hours a day in front of a screen.[20] Despite these results, in the associative analysis, screen time per day was not associated with DED, indicating that it does not significantly influence the generation of DED.

Regarding harmful habits, the alcohol consumption and the smoking in the last month had not relation with DED, similar to an investigation which was conducted on African medical students.[21] However, other studies considered both as risk factors because they provoke tear film instability.[22,23] The difference could be because these harmful habits are not usually very prevalent in medical students, like have been reported previously.[23] Despite this, remains to be clarified which could be the physiopathology mechanism involved.

In relation to room illumination, there was no association with the DED variable. The aforementioned contrasts with other studies which reported that a bad illumination has a relation with the apparition of symptomatology compatible with DED.[24] This is due to a factor that influences independently of illumination, this is the activity of using video terminal screens.[25]

Besides, was identified that resting during the use of the internet, the use of blue-light protection glasses, the screen light filter, and the diminution of bright was associated with DED in men, from them the blue light has been associated with corneal damage and consequently with the apparition of dry eye.[25] Find in our study a high prevalence of DED in men who use blue light protection glasses, make us think that glasses protection is not effective to prevent DED,[26] or these glasses, in reality, had no protection for blue light. In addition, was observed that screen exposure for a prolonged time is associated with more risk to acquire DED,[27] because of this, the

association with resting during the use of the internet could be associated with a reduction of the risk to acquire DED, this has to be investigated.

The most relevant finding of the study was that PIU was associated with DED in male medical students. Similarly, men who had PIU had a higher percentage of DED, finding severity in those who manifested a picture greater than PIU (IA). Similarly, PIU was related to DED in male medical students. Currently, these results differ from the majority of mental health research related to DED, both emotionally and also in the psychiatric area; which have reported associations and higher prevalence predominantly in women.[28,29] The aforementioned is large because according to studies, men are more likely to develop symptoms of PIU due to the use they make of this resource when carrying out activities that can cause depression and anxiety, an example of this being video games where they have the probability of finding social support, unlike women who use it for other purposes.[8,30] On the other hand, the connection of this association probably occurs through the psychological stress generated by the PIU, which suppresses the production of the lacrimal gland and generates DED.[31–33] However, more research is required to determine the influencing factors in this association.

This study has some limitations, among them virtually sending the self-reported questionnaire did not allow the physical evaluation of complementary tests such as the Schirmer test strips, the measurement of the tear film break time and others related to the activities carried out during the test. Internet use; in addition to taking into account that because it is a cross-sectional study, the causality of the variables studied was not evaluated. Within the strengths, to our knowledge, this is the first multicenter study carried out in medical students of all years of studies and regions of Peru (coast, mountains, and jungle). In addition, the analysis performed for the study variables was adjusted for potential confounders.

The Internet has become the most popular medium used by the population, studies show that the percentage of students using the Internet has increased significantly;[34] and point out that Internet access is closely related to problematic use, affecting the correct development of daily life by reducing study time and/or obligations.[35,36] In addition, visual conditions have acquired critical importance for health, demonstrating the PIU to have a great impact on medical students, being influential in the generation of DED. Currently, due to the aforementioned, PIU has become a public health problem, which if left untreated can generate DED therefore, it deserves institutional policy implementations that incorporate strategies to promote mental health, as well as ocular health, focused on education of good visual habits and self-control, to improve the correct functioning and tear stability concerning the ocular surface, which will consequently prevent DED.

Conclusion

In conclusion, our results show that PIU and DED have a significant association in male medical students in Peru and that they can present severe degrees of this ocular pathology, the relationship is probably mediated by inflammatory mechanisms induced by mental health problems. shared by the main variables. There are still factors to study, but due to these results, we emphasize that strategies of good visual habits and self-control of the use of the Internet in students should be promoted.

Data Sharing Statement

The original data used to support the findings of this study are available from the corresponding authors upon request.

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Disclosure

The authors declare that they have no conflict of interest in this work.

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Table 1. General characteristics of population of study

Variables	Overall (n=844)	Men (n=301)	Women (n=543)	p
Age (years)	21.8 ± 3.3	22.2 ± 4.0	21.6 ± 2.9	0.005
Alcohol consumption in the last month				
Yes	231 (27.4)	102 (33.9)	129 (23.8)	0.002
No	613 (72.6)	199 (66.1)	414 (76.2)	
Smoking in the last month				
Yes	32 (3.8)	17 (5.6)	15 (2.8)	0.056
No	812 (96.2)	284 (94.4)	528 (97.2)	
Screen time per day				
<3 h	17 (2.0)	10 (3.3)	7 (1.3)	0.022
3-6 h	264 (31.3)	105 (34.9)	159 (29.3)	
>6 h	563 (66.7)	186 (61.8)	377 (69.4)	
Rest while using the Internet				
Yes	665 (78.8)	245 (81.4)	420 (77.3)	0.197
No	179 (21.2)	56 (18.6)	123 (22.7)	
Lenses with blue light protection				
Yes	433 (51.3)	140 (46.5)	293 (54.0)	0.045
No	411 (48.7)	161 (53.5)	250 (46.0)	
Screen light filter				
Yes	275 (32.6)	107 (35.5)	168 (30.9)	0.196
No	569 (67.4)	194 (64.5)	375 (69.1)	
Display brightness				
Dull	67 (7.9)	18 (6.0)	49 (9.0)	0.068
Very dull	391 (46.3)	130 (43.2)	261 (48.1)	
Bright	346 (41.0)	134 (44.5)	212 (39.0)	
Very bright	40 (4.7)	19 (6.3)	21 (3.9)	
Display viewing distance				
< 40 cm	480 (56.9)	134 (44.5)	346 (63.7)	<0.001

40 - 76 cm	343 (40.6)	159 (52.8)	184 (33.9)	
>76 cm	21 (2.5)	8 (2.7)	13 (2.4)	
Room lighting				
Dark	17 (2.0)	5 (1.7)	12 (2.2)	0.24
Low light	176 (20.9)	71 (23.6)	105 (19.3)	
Illuminated	537 (63.6)	192 (63.8)	345 (63.5)	
Very illuminated	114 (13.5)	33 (11.0)	81 (14.9)	
PIU				
Controlled	720 (85.3)	248 (82.4)	472 (86.9)	0.093
Uncontrolled	124 (14.7)	53 (17.6)	71 (13.1)	
DED				
Yes	598 (70.9)	201 (66.8)	397 (73.1)	0.063
No	246 (29.1)	100 (33.2)	146 (26.9)	

Notes: Data shown as mean ± SD or absolute frequency (%). PIU, Problematic Internet Use; DED, Dry Eye Disease.

Table 2. Characteristics of population by dry eye disease and sex

Variables	**Men**			**Women**		
	Non-DED (n=100)	**DED (n=201)**	**p**	**No-DED (n=146)**	**DED (n=397)**	**p**
Age (years)	22.0 ± 3.7	22.3 ± 4.1	0.617	21.3 ± 2.6	21.6 ± 3.0	0.242
Alcohol consumption in the last month						
Yes	30 (29.4)	72 (70.6)	0.381	36 (27.9)	93 (72.1)	0.853
No	70 (35.2)	129 (64.8)		110 (26.6)	304 (73.4)	
Smoking in the last month						
Yes	7 (41.2)	10 (58.8)	0.651	4 (26.7)	11 (73.3)	1
No	93 (32.7)	191 (67.3)		142 (26.9)	386 (73.1)	
Screen time per day						
<3 h	4 (40.0)	6 (60.0)	0.895	2 (28.6)	5 (71.4)	0.655
3-6 h	35 (33.3)	70 (66.7)		47 (29.6)	112 (70.4)	

>6 h	61 (32.8)	125 (67.2)		97 (25.7)	280 (74.3)	
Rest while using the Internet						
Yes	35 (25.0)	105 (75.0)	0.007	69 (23.5)	224 (76.5)	0.072
No	65 (40.4)	96 (59.6)		77 (30.8)	173 (69.2)	
Lenses with blue light protection						
Yes	35 (25.0)	105 (75.0)	0.007	69 (23.5)	224 (76.5)	0.072
No	65 (40.4)	96 (59.6)		77 (30.8)	173 (69.2)	
Screen light filter						
Yes	45 (42.1)	62 (57.9)	0.022	49 (29.2)	119 (70.8)	0.486
No	55 (28.4)	139 (71.6)		97 (25.9)	278 (74.1)	
Display brightness						
Dull	9 (50.0)	9 (50.0)	0.025	15 (30.6)	34 (69.4)	0.103
Very dull	50 (38.5)	80 (61.5)		81 (31.0)	180 (69.0)	
Bright	39 (29.1)	95 (70.9)		46 (21.7)	166 (78.3)	
Very bright	2 (10.5)	17 (89.5)		4 (19.0)	17 (81.0)	
Display viewing distance						
< 40 cm	46 (34.3)	88 (65.7)	0.518	85 (24.6)	261 (75.4)	0.222
40 - 76 cm	50 (31.4)	109 (68.6)		56 (30.4)	128 (69.6)	
>76 cm	4 (50.0)	4 (50.0)		5 (38.5)	8 (61.5)	
Room lighting						
Dark	1 (20.0)	4 (80.0)	0.231	2 (16.7)	10 (83.3)	0.79
Low light	25 (35.2)	46 (64.8)		26 (24.8)	79 (75.2)	
Illuminated	68 (35.4)	124 (64.6)		95 (27.5)	250 (72.5)	
Very illuminated	6 (18.2)	27 (81.8)		23 (28.4)	58 (71.6)	
PIU						
Controlled	92 (37.1)	156 (62.9)	0.003	132 (28.0)	340 (72.0)	0.188
Uncontrolled	8 (15.1)	45 (84.9)		14 (19.7)	57 (80.3)	

Notes: Data shown as mean ± SD or absolute frequency (%). PIU, Problematic Internet Use; DED, Dry Eye Disease.

Table 3. Poisson regression models of problematic use of internet and dry eye disease in medical students

Dry eye disease	PR	(CI95%)	p-value
Overall			
Model 1[a]	1.19	(1.08 - 1.31)	0.000**
Model 2[b]	1.17	(1.06 - 1.29)	0.002**
Men			
Model 1[a]	1.35	(1.16 - 1.57)	0.000**
Model 2[c]	1.27	(1.09 - 1.49)	0.002**
Women			
Model 1[a]	1.11	(0.98 - 1.27)	0.098
Model 2[c]	1.12	(0.99 - 1.28)	0.081

Notes:

[a] Non-adjusted. *p<0.05 or **p<0.001, statistically significant.

[b] Adjusted by sex, age, alcohol consumption, and smoking in the last month, rest while using the Internet, screen time per day. *p<0.05 or **p<0.001, statistically significant.

[c] Adjusted by age, alcohol consumption and smoking in the last month, rest while using the Internet, screen time per day. *p<0.05 or **p<0.001, statistically significant.

Figure 1. Percentage of DED by degree of intensity in people with and without PIU or IA