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Prevalence, Risk factors of Videoconference Fatigue, and Its Relation to Psychological Morbidities Among Ain Shams Medical Students, Egypt

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Key Words: COVID-19, medical students, fatigue, videoconferencing, zoom exhaustion, and psychological morbidities.

A B S T R A C T

Background: Driven by the need for online learning, the COVID-19 pandemic led to increase in the use of videoconferencing tools. Emerging phenomenon of feeling exhausted and fatigued during virtual meetings have been reported. Objective: To measure the prevalence of videoconference fatigue among medical students, to determine associated factors, and lastly to find out associated psychological morbidities including stress, anxiety, and depression. **Method**: A cross-sectional study was conducted among 325 medical students selected by convenience sampling in a public medical university in Egypt between May and July 2022. Data was collected using structured self-administrated questionnaire including demographic and academic parameters, the standardized English version of Depression, Anxiety and Stress scale-21 (DASS-21), and the standardized English version of Zoom & Exhaustion Fatigue scale (ZEF). **Results** Mean age of the students was 21.31±1.5. Females represented 59.1%. More than half of the students (53.5%) experienced high levels of videoconference fatigue. Gender, duration of videoconference meeting and poor ergonomics during online sessions were significantly associated with high levels of videoconference fatigue. The total ZEF score was 31.7 ± 9.4. Fatigue was significantly associated with stress, anxiety, and depression ($p<0.001$, $p=0.001$, and $p=0.002$, respectively). The majority (86.8%) of the students with high zoom fatigue were stressed, 98.3% were anxious, and 96.9% were depressed. **Conclusion:** Videoconference fatigue is relatively prevalent and may be taking its toll on medical students. Developing strategic interventions that can protect or mitigate the impact of fatigue during virtual meetings is needed.

INTRODUCTION

Since the first coronavirus disease 2019 case was reported on March 2nd, 2020, social and physical segregation have been rigidly enforced. The COVID-19 pandemic has created challenges and caused disruption across the higher education sector. University campuses closed, and face-to-face teaching and assessment shifted to an online format. As a result, all activities began to be developed through computer programs, mobile applications, and video chats. The continuation of education has become essential by tools like Zoom, Google Hangouts, and Skype.[1]

The overuse of videoconferencing in educational section has exposed vulnerabilities and raised concerns about the relatively new experience of physical and mental exhaustion during virtual

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meetings among medical students.[2] It takes a lot of energy to pay closer attention to online events, which makes people feel conflicted .[3] This novel phenomenon is called videoconferencing fatigue or more popularly known as "Zoom fatigue", which refers to the feeling of exhaustion and tiredness associated with using videoconferencing.[4]

A study was conducted among university students in Philippine found that 46% of participants experienced high level of zoom fatigue.[5] Moreover, a recent study conducted in Indonesia found that students with higher mental distress experienced higher zoom fatigue level.[6] The likelihood of zoom fatigue may be predisposed by a number of risk factors; age, mental distress and disparity in sex hormones may increase fatigue susceptibility.[6] Moreover, Poor sleep quality and physical fitness can deteriorate cell functions and anaerobic respiration and increase fatigue level .[7]

To our knowledge, the current study is among the earliest to measure prevalence of videoconference fatigue among Egyptian medical students in the COVID-19 pandemic, also to determine demographic and academic parameters associated with it, and lastly to find out if there is any association between videoconference fatigue and psychological morbidities including stress, anxiety and depression among the studied group. Examining videoconferencing fatigue in educational settings is necessary to carefully plan educational strategies in online learning to support teaching and learning activities while safeguarding the physical and mental health of the students. The objectives of the current study were to measure the prevalence of videoconference fatigue among medical students, to determine associated factors, and lastly to find out associated psychological morbidities including stress, anxiety, and depression.

METHOD

A cross sectional study was conducted from May to July 2022 in the faculty of medicine, Ain Shams University.

Undergraduate students who were exposed to online learning from May to July 2022 (first-year students were not included since they did not have online learning).

Using PASS 15 program for sample size calculation, at confidence level at 95% and margin of error at 5%. It is estimated that sample size of at least 325 students will be needed to detect an expected prevalence rate of high videoconference fatigue of 69.7%.[8]

A Convenience sample technique was used.

Table (1): Subscales of zoom fatigue and its prevalence among the study participants (n=325)

Variables	Mean ± SD	
General subscale	8.5 ± 2.6	
Visual subscale	7.3 ± 3.1	
Social subscale	7.2 ± 3.2	
Motivational subscale	8.7 ± 2.8	
Emotional subscale	7.4 ± 2.9	
ZEF total score	31.7 ± 9.4	
Level of zoom fatigue:	**N**	**%**
Low fatigue	151	46.5
High fatigue	174	53.5

Data collection tools and Validation: An English anonymous self-administered questionnaire was used and consisted of five sections. The first section was about Socio-demographic characteristics such as age, gender, residency, and family income status. The second section was about academic parameters as: grade, videoconferencing duration and frequency per day, static head down and bent or twisted back postures, use of comfortable back support, internet stability, and self-reported academic performance. The third section was about health-related conditions as: practicing physical activity, smoking status, and sleeping hours per day. Body mass index (BMI) was calculated as weight in kilograms divided by the square of the height in meters (kg/m2) and classified as: Underweight (<18.5 kg/ m2), Normal weight (18.5–24.9 kg/ m2), Overweight (25–29.9 kg/m2), and Obese (≥30 kg/m2).[9] The fourth section was the English version of Zoom Exhaustion and Fatigue scale (ZEF) scale. ZEF is a reliable tool and consists of five subscales: general, visual, social, motivational, and emotional domains with 5 Likert scale questions (1="not at all/never" to 5= "extremely/always"). There are 15 items total. Participants were divided into low and high fatigue level according to median. High fatigue level is considered when equal or more than median. The Cronbach's alpha of the entire ZEF scale was 0.95. The reliability coefficients of the ZEF scale were as the following: entire scale (Cronbach's alpha

Table (2): Sociodemographic and health-related characteristics of the study participants and its relation to zoom fatigue (n=325)

Characters	No (%)	Low zoom fatigue	High zoom fatigue	P	OR (95% CI)[a]
Age (mean ± *SD*)	21.31±1.5	21.42±1.5	21.21±1.5	0.2 [b]	(-0.1-0.6)
Gender					
Male	133 (40.9)	81 (60.9)	52 (39.1)	<0.001	2.7 (1.7-4.3)
Female	192 (59.1)	70 (36.5)	122 (63.5)		
Residency					
Urban	264 (81.2)	124 (47)	140 (53)	0.7	1.1 (0.6-1.9)
Rural	61 (18.8)	27 (44.3)	34 (55.7)		
Family income					
Not enough	29 (8.9)	9 (31)	20 (69)	0.08	0.5 (0.2-1.1)
Enough	296 (91.1)	142 (48)	154 (52)		
Practicing physical exercise					
No	217 (66.8)	94 (43.3)	123 (56.7)	0.1	0.7 (0.4-1.1)
Yes	108 (33.2)	57 (52.8)	51 (47.2)		
Having chronic diseases					
No	305 (93.8)	141 (46.2)	164 (53.8)		
Yes	20 (6.2)	10 (50)	10 (50)	0.7	0.9 (0.3-2.1)
Smoking Status					
Never smoke	315 (96.9)	145 (46)	170 (54)		
Current smoker	7 (2.2)	4 (57.1)	3 (42.9)	0.7	
Ex-smoker	3 (0.9)	2 (66.7)	1 (33.3)		
BMI					
Underweight	11 (3.4)	6 (54.5)	5 (45.5)		
Normal weight	190 (58.5)	90 (47.4)	100 (52.6)		
Overweight	85 (26.2)	40 (47.1)	45 (52.9)	0.5	
Obese	31 (9.5)	10 (32.3)	21 (67.7)		
Morbid Obesity	8 (2.5)	5 (62.5)	3 (37.5)		
Sleeping hours per day					
≤ 6hours	65 (20)	31 (47.7)	34 (52.3)		
7-8 hours	209 (64.3)	104 (49.8)	105 (50.2)	0.1	
≥9 hours	51 (15.7)	16 (31.4)	35 (68.6)		
Caffeine consumption					
No	118 (36.3)	62 (52.5)	56 (47.5)	0.09	1.5 (0.9-2.3)
Yes	207 (63.7)	89 (43)	118 (57)		

BMI: body mass index [a]: OR: odds ratio; CI: confidence interval, [b]: Independent t test.

α=0.91), general (α =0.89), visual (α=0.89), social (α=0.78), motivational (α=0.70), and emotional (α=0.87).[10] The fifth section was The Depression, Anxiety and Stress Scale-21 Items (DASS-21). It's a validated tool to measure the psychological discomfort.[11] Each of the three DASS-21 scales has seven items. The cut-off scores are as follows: (normal, abnormal): normal (stress [S] 0-14, anxiety [A] 0-7, & depression [D] 0-9), abnormal [S] ≥ 15, [A] ≥ 8, & [D] ≥ 10). Previous research on the reliability of the DASS-21 revealed that its outstanding Cronbach's alpha values for the subscales of depression, anxiety, and stress were 0.81, 0.89, and 0.78, respectively.[12]

Statistical analyses: Data entry, cleaning, and analysis were done using the Statistical Package for Social Science version 25. Descriptive statistics were calculated as mean and standard deviation for continuous variables and as frequency and percentages for categorical variables. Chi-square ($\chi 2$) test was used as the test of significance for categorical variables, while independent t- test was used for quantitative variables. Statistical significance level was considered when P-value is ≤0.05.

Table (3): Academic parameters among the study participants and its relation to zoom fatigue (n=325)

Academic parameters	N (%)	Low zoom fatigue	High zoom fatigue	p	OR (95%CI)[a]
Grade					
Second year	78 (24)	33 (42.3)	45 (57.7)	0.3	
Third year	74 (22.8)	33 (44.6)	41 (55.4)		
Fourth year	71 (21.8)	32 (45.1)	39 (54.9)		
Fifth year	46 (14.2)	28 (60.9)	18 (39.1)		
Sixth year	56 (17.2)	25 (44.6)	31 (55.4)		
Videoconference duration per day(hours)					
< 1	23 (7.1)	10 (43.5)	13 (56.5)	0.02	
1-3	95 (29.2)	53 (55.8)	42 (44.2)		
4-5	106 (32.6)	53 (50)	53 (50)		
> 5	101 (31.1)	35 (34.7)	66 (65.3)		
Static head down posture					
No	86 (26.5)	53 (61.6)	33 (38.4)	0.001	2.3 (1.4-3.8)
Yes	239 (73.5)	98 (41)	141 (59)		
Back bent or twisted posture					
No	73 (22.5)	44 (60.3)	29 (39.7)	0.007	2.1 (1.2-3.5)
Yes	252 (77.5)	107 (42.5)	145 (57.5)		
Comfortable back support					
No	213 (65.5)	82 (38.5)	131 (61.5)	<0.001	0.4 (0.2-0.6)
Yes	112 (34.5)	69 (61.6)	43 (38.4)		
Internet stability					
Not stable	94 (28.9)	39 (41.5)	55 (58.5)	0.3	0.8 (0.5-1.2)
Stable	231 (71.1)	112 (48.5)	119 (51.5)		
Self-reported academic performance					
Excellent	102 (31.4)	53 (52)	49 (48)	0.1	
Very good	122 (37.5)	52 (42.6)	70 (57.4)		
Good	81 (24.9)	41 (50.6)	40 (49.4)		
Weak	20 (6.2)	5 (25)	15 (75)		

[a]*: OR: odds ratio; CI: confidence interval*

RESULTS

Table 1 showed that more than half of the students experienced high videoconference fatigue (zoom fatigue) (53.5%), while 46.5% had low level of zoom fatigue. The total ZEF score was 31.7 ± 9.4. Participants had the highest level in the motivational fatigue subscale (8.7 ± 2.8), while the least was social fatigue (7.2 ± 3.2).

Table (2) showed that mean age of the students was 21.31±1.5. Females represented 59.1%, 80.2% were from urban areas, and 91.1% had enough family income. Most of the students didn't have any chronic diseases (93.8%), never smoke (96.9%), didn't practice physical activity (66.8%), and sleeping about 7-8 hours daily (64.3%). There was a statistically significant association between gender and zoom fatigue. Females had a higher level of zoom fatigue than males (p<0.001). Otherwise, as regards other sociodemographic and health-related characteristics, there were no significant associations between them and zoom fatigue.

Table 3 showed that second-year students being the most involved in this study (24%). The duration of videoconferencing per day was about 4-5 hours in 32.6% of the students. About three quarter (73.5%) had static head posture, 77.5% had bent or twisted back posture, 65.5% didn't use comfortable back support during the videoconference, and 71.1% had stable internet connection. In addition, as regard their academic performance, more than third of the participants reported very good degree (37.5%).

Table (4): Prevalence of stress, anxiety, and depression among the study participants and its associations with zoom fatigue (n=325)

Variables	N (%)	Low zoom fatigue	High zoom fatigue	p	OR (95%CI)
Stress					
No	76 (23.4)	53 (69.7)	23 (30.3)	<0.001	3.6 (2-6.2)
Yes	249 (76.6)	98 (39.4)	151 (60.6)		
Anxiety					
No	18 (5.5)	15 (83.3)	3 (16.7)	0.001	6.3 (1.8-22.2)
Yes	307 (94.5)	136 (44.3)	171 (55.7)		
Depression					
No	25 (7.7)	19 (76)	6 (24)	0.002	4 (1.6-10.4)
yes	300 (92.3)	132 (44)	168 (56)		

Moreover, statistically significant associations were found between zoom fatigue and the duration of videoconference (p= 0.02), static head posture (p=0.001), bent or twisted back posture (p=0.007) were found. Students who had longer duration of videoconferences, static head, and bent back postures during online learning had higher level of fatigue. Furthermore, students who had comfortable positions and back support during the videoconference experienced less zoom fatigue (p<0.001), OR (95%CI) =0.4(0.2-0.6).

Table (4) showed that zoom fatigue had a statistically significant associations with stress, anxiety, and depression (p<0.001, 0.001, and 0.002 respectively). Most of the students with high zoom fatigue (86.8%) were stressed, 98.3% were anxious, and 96.9% were depressed.

DISCUSSION

Videoconference fatigue was prevalent and a real phenomenon among medical students in the period of online learning to combat the rapid transmission of COVID-19. This study found that more than half of the students (53.5 %) had high level of videoconference fatigue. This is nearly similar to a study conducted among medical university students in Brazil found that 56% of participants experienced high level of zoom fatigue.[2] The study also found that among the five constructs of the zoom exhaustion fatigue scale (ZEF scale), students had the highest level of fatigue in motivational fatigue subscale, followed by general and emotional fatigue subscales, while social and visual fatigue were the least. These results agreed with the study of Fauville, et al., 2021[4] who noted that the highest mean score was in motivational fatigue subscale followed by general fatigue. However, a study conducted among university students found that participants suffered mostly from high level of visual fatigue.[13] The highest score of motivational fatigue subscale noted in this study might indicate that medical students were not satisfied with medical online courses. Siddhartha et al., (2022)[14] found that satisfaction level of undergraduate medical students regarding distant preclinical and clinical teaching was low, this finding also points to the importance of carefully identifying how to strategically interact with students to make them more active and motivated during online sessions. We suggest using medical teaching formats such as team-based/problem-based learning. This online teaching platform not only allows students to digest information in their own time but also allow students to constructively discuss this educational material with peers. Prior research found positive learning outcome with such methods.[15]

With regards to socio-demographic variables, the present study revealed that female students experienced significantly higher videoconference fatigue than males. This study result confirmed the findings of a prior research conducted by Fauville, et al., (2021).[4] This could be explained by the fact that females are more self-focused and experience higher emotional reactions than males. Additionally, females are likely to have greater mirror anxiety associated with the self-view in videoconferencing compared to males.[16]

The study found no significant association between videoconference fatigue and age, residency, and family income. Similar results were found in a study conducted among nursing student in Philippine.[8] However, an American study reported that zoom fatigue was higher among older participants and those with lower annual income.[17] This discrepancy in

results might be due to different study population. Also, the current study found no statistically significant association between videoconference fatigue and physical activity, BMI, and smoking habit. This contradicted a recent Indonesian study that noted a high zoom fatigue level among students who were smokers and those with irregular physical exercises.[6]

Based on the intensity of use of videoconferences, the study revealed that duration of videoconference was significant factor for zoom fatigue. It was found that the longer the videoconference, the higher the fatigue experienced. This goes in line with studies of Salim et al., (2022)[6] and Rome el al., (2022).[18.] This finding could be explained that the extensive usage of videoconferencing may lead to information overload which may lead to zoom fatigue. It's highly recommended that university staff should consider the length of virtual meetings when using videoconferencing tools for teaching. It is also worth to note that the current study found that students with static head and bent or twisted back postures during online sessions experienced higher videoconference fatigue. This was similar to the result of Fauville, et al., (2021). [4] This finding indicated that good ergonomics played a crucial role in decreasing videoconference fatigue. Thus, visual ergonomics should be addressed intensively in the undergraduate educational curriculum.

The study found no significant association between internet instability, self-reported academic performance, and videoconference fatigue. This is contradicted a study conducted among nursing students that found participants with low academic performance experienced higher fatigue level.[8] Another Indian study concluded that poor connectivity and high data cost were barriers to online education in information technology faculty during the pandemic.[13] This discrepancy in results could be attributed to different study settings and population.

Interestingly, our results revealed that psychological distress was significantly associated with videoconference fatigue, those who reported higher stress, anxiety, and depression level experienced higher fatigue. This finding confirms the results of an Indonesian study who noted that students with higher level of stress, anxiety and depression had higher zoom fatigue.[6] In addition, a recent study conducted in the United States found positive association between depressive symptoms and zoom fatigue, however no significant association was found between general anxiety disorders and zoom fatigue.[17] This finding intensifies the importance of periodic screening of medical students for psychological morbidities and providing vulnerable individuals with stress management skills such as time management, setting priories, and relaxing techniques such as meditation and breathing exercises.

Study limitation

A convenience sample was used, and students were only selected from Ain Shams University in Egypt. So, generalization of data cannot be made for all under-graduate medical students. Second, while we found some associated variables linked to videoconference fatigue in this study, the cross-sectional study design cannot determine cause-and-effect between variables.

CONCLUSION

This research highlight that zoom fatigue was prevalent among medical students. Female gender, longer videoconference duration, and poor ergonomics during online meetings were significantly associated with zoom fatigue. Also, respondents with higher psychological morbidities experienced higher zoom fatigue level. Knowing these factors may help develop guidelines in the use of videoconferencing platforms in education. While it may be difficult to escape videoconferencing fatigue, establishing basic meetings rules like turning on cameras only when necessary, taking breaks in between sessions, splitting the learning process into shorter sessions to make it more cognitively and psychologically less stressful, and providing stress intervention program for mentally distressed students are some suggested ways to combat fatigue during video calls.

Ethical Considerations

The approval was obtained from the ethical committee from Ain Shams Faculty of Medicine to perform this study (IRB no:000017585).

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Conflict of Interest

All authors 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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