ORIGINAL ARTICLE

KNOWLEDGE AND AWARENESS OF COMPUTER VISION SYNDROME (CVS) AND THEIR CONTRIBUTING FACTORS AMONG UNDERGRADUATE UNIVERSITY STUDENTS

Nurhazirah Zainul Azlan[1,2]*, Amalia Kamaruddin[1], Noratikah Othman[1,2] and Muhammad Lokman Md. Isa[2]

[1]Department of Basic Medical Sciences for Nursing, Kulliyyah of Nursing, International Islamic University Malaysia (IIUM), Bandar Indera Mahkota Campus, 25200 Kuantan, Pahang, Malaysia.
[2]Institute of Planetary Survival for Sustainable Well-being (PLANETIIUM), Level 2, International Islamic University Malaysia, Jalan Hospital, 25100 Kuantan, Pahang, Malaysia.

***Corresponding author: Nurhazirah Zainul Azlan**
Email: nurhazirah@iium.edu.my

ABSTRACT

The surge in the use of digitization in daily life has led to a condition known as computer vision syndrome (CVS), which is at risk of becoming a major health issue involving the vision and musculoskeletal systems. Thus, this study will determine the level of knowledge and awareness of CVS among International Islamic University Malaysia (IIUM) Kuantan students. A quantitative cross-sectional study with convenience sampling was conducted among 216 undergraduate students at the IIUM Kuantan Campus from October to November 2021. Around 79.2% of respondents never heard of the term CVS. The majority of the respondents use mobile phones (52.3%) compared to other digital devices and spend more than 3 hours in front of the screen per day (48.6%). In addition, most of them experience neck, back, or shoulder pain (77.8%), fatigue (65.3%), headaches (64.4%), and eyestrain (74.1%). The respondents also complained of joint pain in the fingers and wrists (52.3%) and shoulder pain (60.6%). The majority of the respondents had a high level of knowledge regarding CVS (94.9%) but had a moderate level of awareness regarding CVS (65.7%). As current education and lifestyle are more interrelated to digital device usage, it is recommended that more educational and awareness programmes on CVS be promoted.

Keywords: *Knowledge, awareness, computer vision syndrome (CVS), university students, digital device.*

INTRODUCTION

In the 21st century, modern technology and visual interfaces have a significant impact on everyone's daily routines. Electronic devices that are commonly used in everyday life include digital devices, smartphones, tablets, electronic book readers, and computers. Human interaction has become virtual in the form of online meetings, audio and video conferencing, recreational activities such as online gaming, blogging, and social networking, resulting in a rapid upsurge in increased digitization in every aspect of human life[1]. Education platforms like Google Classroom, Zoom, and Microsoft Teams are widely used not only in primary and secondary schools but also in higher institutions as online teaching and learning platforms. Owing to technological advancements, computer-based learning has become the preferred choice among students. They decide to utilise computers, laptops, smartphones, and tablets for both educational and recreational purposes[2]. Vision, musculoskeletal problems, and communication barriers are the disadvantages that occur due to the prolonged use of computer devices[3].

Computer vision syndrome (CVS) is a condition where a person experiences one or more of the symptoms due to excessive computer use, such as eye strains, headaches, and back pain[4]. CVS is also defined as a condition in which a computer user experiences one or more eye symptoms because of prolonged working hours on a computer or digital devices[5]. CVS is a significant health concern as it is associated with both visual and musculoskeletal problems. Globally, it is estimated that about 60 million people suffer from CVS, with about a million new cases of CVS occurring every year in worldwide data[6-7]. A national survey reported by an ophthalmologist revealed that more than 14% of patients had vision-related problems[8]. Although digital devices offer many benefits to the community, such as ease of work and reduction of burden, individuals may also be at risk of developing CVS if they use such devices for an extended period of time.

Around 71.6% of respondents had at least one of the symptoms that were associated with CVS, such as headaches, blurred vision, redness of the eyes, and others[9]. About 89.9% of students from five universities in Malaysia, aged between 18 and 25 years old, experience at least one symptom of CVS, with the most common symptoms including headaches (19.7%) and eye strains (16.4%). The study also reported that most of the symptoms of CVS occur due to spending more than 2 hours on a digital screen[10].

Despite that, the level of awareness regarding CVS among students is still low. Merely 17.7% of university students possess knowledge of CVS, indicating a significantly low level of awareness regarding CVS[11].

Another study also reported that 80% of university students were unaware of the CVS syndrome[8]. Heavy dependence on the use of digital devices and limited awareness about the contributing factors might result in CVS, which can deteriorate if left untreated. Studies on the knowledge and awareness levels of CVS and its contributing factors among undergraduate students are still lacking in Malaysia. Thus, the objective of this study is to determine the contributing factors that lead to CVS and the knowledge and awareness level of CVS among undergraduate university students in Kuantan, Pahang, Malaysia. The study's rationale is due to the fact that most students nowadays use e-learning as a learning method and spend most of their time on digital devices.

METHODS

The study was conducted using a quantitative cross-sectional study between October and November 2021. The sample was selected among students at IIUM Kuantan Campus, Pahang, using a convenience sampling method. This study involved 216 students from five different Kulliyyah (faculties) that included the *Kulliyyah* of Nursing, the *Kulliyyah* of Medicine, the *Kulliyyah* of Pharmacy, the *Kulliyyah* of Dentistry, the *Kulliyyah* of Allied Health Science, and the *Kulliyyah* of Science. The Raosoft, Inc. software sample size calculator was used in this study, with a 5% margin of error, a confidence interval of 85%, a total population size of 3342, and a 50% response rate. The required minimum sample size for this study was 216 respondents, with an additional 10% dropout rate. The respondents were recruited based on the inclusion and exclusion criteria. The inclusion criteria were undergraduate students, aged between 19 and 26 years old, and full-time students at IIUM Kuantan. The exclusion criteria were students who were on semester break during the data collection period.

The questionnaire was adapted from two sets of established questionnaires: "Computer Vision Syndrome Survey among the Medical Students in Sohag University, Egypt"[12] and "Uptake of conventional interventions, level of awareness, and perception of computer vision syndrome: a cross-sectional study among university students, Kenya"[13]. The questionnaire for the present study comprises five main sections in the English language. Section A consists of sociodemographic data, which includes age, gender, *kulliyyah*, and year of study. Sections B and C consist of information regarding the factors that contribute to CVS. For this particular section, the respondents were required to answer the questionnaire related to their history of eye diseases and usage of digital devices. For Section C, the respondents were required to respond to the presentation of CVS symptoms. For Section D, the respondents were required to respond to their own awareness of CVS, categorised into low, medium, and high awareness based on their total marks. Section E consists of information regarding respondents' perceptions of CVS, including risk factors, consequences, and preventive measures against CVS. The questionnaires were distributed among respondents by Google Form Survey as well as a physical paper form survey personally provided to the respondents.

Ethical approvals were obtained from the Kulliyyah of Nursing's Postgraduate Research Committee (KNPGRC) and the IIUM Research Committee (IREC), with an approval number of IREC 2021-KON/UG13. Informed consent was first obtained from the respondents who volunteered to participate in this study. The respondents can freely decide to participate in the study but can withdraw consent or decline to answer the questionnaire at any time if they wish to do so.

Statistics

The data was analysed using Statistical Package for Social Science (SPSS) version 26.0. Descriptive statistical tests were used to measure the frequency and percentage of variables.

RESULTS

Sociodemographic Data

In Table 1, the majority of the respondents were 20 years old (21.3%), female (69.9%), from *Kulliyyah* of Nursing (39.4%), and Year 4 students (29.6%). For history of eye disease, the majority of the respondents had their last eye check-up in 1 year to 5 years (36.6%), had only random frequency of eye check-up (67.1%), were not diagnosed with dry eye disease (88.9%), did not use eye drops (89.4%), did not experience any refractive error (72.2%), and have been wearing spectacles (56.0%). Most of the respondents also spent more time on their mobile phones (52.3%), used computer digital screens more than 4 times per day (63.4%), spent about 3 to 6 hours on computers per day (48.6%), spent about 1 to 2 hours watching digital screens in a dark room (25.9%), used 26–50% brightness level of digital screen in a well-lit room (29.6%), spent most of their screen time during the day (62.0%), and 40.7% of respondents spent this way on the screen with a duration of more than 4 years (40.7%). A greater number of respondents reported frequent use of touch screens (56.0%), interrupted hours spent on digital screens (71.3%), clear details of objects seen after prolonged use of digital devices (62.5%), the distance of the computer screen's view is at an

arm's length (54.6%), taking a break after more than 20 minutes of using electronic devices (72.7%), adjusting their phones' contrast with the surroundings (94.4%), not using any antiglare measures at the computer screen (73.1%), agreeing that digital screens affect lifestyle and eye health (84.3%), and not knowing the term CVS (79.2%).

Table 1a: Sociodemographic data, history of eye diseases, and digital devices usage (n = 216)

Variable		Frequency (n)	Percentage (%)
Age	< 19 years old	21	9.7
	20 years old	46	21.3
	21 years old	43	19.9
	22 years old	39	18.1
	23 years old	34	15.7
	24 years old	14	6.5
	> 24 years old	19	8.8
Gender	Female	151	69.9
	Male	65	30.1
Kulliyyah of study	Nursing	85	39.4
	Science	21	9.7
	Pharmacy	27	12.5
	Dentistry	10	4.6
	Medicine	41	19.0
	Allied Health Science	32	14.8
Year of study	Year 1	20	9.3
	Year 2	52	24.1
	Year 3	57	26.4
	Year 4	64	29.6
	Year 5	23	10.6
Last eye check-up	1-6 months ago	45	20.8
	6 months to 1 year ago	46	21.3
	1 year to 5 years ago	79	36.6
	> 5 years ago	15	6.9
	Never	31	14.4
Frequency of eye check-ups	Every 6 months	3	1.4
	Annually	8	8.3
	Every 5 years	19	8.7
	Randomly	145	67.1
	Never	31	14.5
	Others	0	0
Previously diagnosed with dry eye disease	Yes	24	11.1
	No	192	88.9
Using eye drops	Yes	23	10.6
	No	193	89.4
Experiencing any refractive error	Yes	60	27.8
	No	156	72.2
Wearing spectacles, contact lens, or none	Spectacles	121	56.0
	Contact lens	5	2.3
	None	90	41.7
Types of digital screen usage	Mobile phone	113	52.3
	Laptop	74	34.3
	Tablet/iPad/note	25	11.6
	Computer screen	4	1.9
	Others	0	0
The frequency of using computer digital screens per day	Once	5	2.3
	2-3 times	38	17.6
	3-4 times	36	16.7
	More than 4 times	137	63.4
Hours spent on computers per day	< 3 hours	21	9.7
	3-6 hours	105	48.6
	> 6 hours	50	41.7
Hours spent watching digital screens in a dark room	0 h	10	4.6
	< 1h	52	24.1
	1-2h	56	25.9
	2-3h	50	23.1
	3-4h	29	13.4
	4-6h	11	5.1
	> 6h	8	3.7

Table 1b: Sociodemographic data, history of eye diseases, and digital devices usage (n = 216)

The digital screens' level of brightness in a well-lit room	≤ 10%	67	31.0
	11–25%	58	26.9
	26–50%	64	29.6
	51–75%	18	8.3
	76–100%	9	4.2
The time of day spent on most of the screen time	Day	134	62.0
	Night	82	38.0
The number of years spent this way on the screen	Nearly 1 year	18	8.3
	Nearly 2 years	40	18.5
	Nearly 3 years	33	15.3
	Nearly 4 years	37	17.1
	≥ 4years	88	40.7
Frequently used devices	Touch screen	121	56.0
	Mouse and keyboard	78	36.1
	Touch pad	4	1.9
	Note pen	13	6.0
Hours spent on digital screens	Continuous	62	28.7
	Interrupted	154	71.3
Details of objects seen after prolonged digital screen use	Clear	135	62.5
	Blurred	60	27.8
	Hazy	21	9.7
Distance of the digital screen's view	An arm's length	118	54.6
	Less than an arm's length	81	37.5
	More than an arm's length	17	7.9
Usage duration of electronic devices before taking a break	> 20 minutes	157	72.7
	< 20 minutes	59	27.3
Adjusting the phone's contrast with the surroundings	Yes	204	94.4
	No	12	5.6
Using antiglare measures on the computer screen	Yes	58	26.9
	No	158	73.1
Do digital screens affect lifestyle and eye health?	Yes	182	84.3
	No	34	15.7
Ever heard of the term computer vision syndrome?	Yes	45	20.8
	No	171	79.2

Note: Descriptive Analysis

Presentation of Computer Vision Syndrome's symptoms

Based on Table 2, the majority of the respondents experienced neck, back, and shoulder pain (77.8%), fatigue (65.3%), headache (64.4%), eyestrain (74.1%), joint pain in the fingers and wrists (52.3%), and shoulder pain (60.6%). However, most of the respondents also reported not experiencing blurred, distant vision (56.5%), dry eyes (65.7%), trouble refocusing the eyes (62.5%), excessive tearing (84.3%), eye twitching (69.4%), double vision (86.6%), eye redness (68.5%), blurred near vision (77.3%), watery eyes (66.7%), slowness of focus change (69.9%), difficulty writing with pain (87.0%), and inability to hold objects well (92.1%).

Knowledge on Computer Vision Syndrome

Based on Table 3, the majority of the respondents agreed that the risk factors for CVS were viewing a computer screen at a distance less than an arm's length (51.9%), prolonged duration of computer (50.9%), inappropriate seating position (42.6%), and poor contrast of the computer screen and the surrounding brightness (45.4%). Around 44.0% of respondents did not know that keeping the computer screen above eye level is a risk factor for CVS. Respondents also agreed that the consequences of CVS were headache (55.6%), eyestrain (74.0%), irritation of the eye (53.2%), eye fatigue (54.2%), redness of the eye (45.4%), dry eyes (48.6%), reduced job productivity (43.5%), increased error rate (41.2%), and increased health expenditure (45.4%). Many respondents agreed that maintaining a proper contrast while using computers (55.1%), using computer spectacles (48.1%), viewing a computer screen at a distance less than an arm's length (32.4%), and applying artificial tears while using the computers (38.0%) can reduce the symptoms of CVS. However, 38.9% of respondents did not know that keeping the computer screen below eye level can reduce the symptoms of CVS.

Table 2: CVS symptoms (n = 216)

Items		Frequency (n)	Percentage (%)
Neck, back, or shoulder pain	Yes	168	77.8
	No	48	22.2
Fatigue	Yes	141	65.3
	No	75	34.7
Headaches	Yes	139	64.4
	No	77	35.6
Eyestrain	Yes	160	74.1
	No	56	25.9
Blurred, distant vision	Yes	94	43.5
	No	122	56.5
Dry eyes	Yes	74	34.3
	No	142	65.7
Trouble refocusing the eyes	Yes	81	37.5
	No	135	62.5
Excessive tearing	Yes	34	15.7
	No	182	84.3
Eye twitching	Yes	66	30.6
	No	150	69.4
Double vision	Yes	29	13.4
	No	187	86.6
Eye redness	Yes	68	31.5
	No	148	68.5
Blurred near vision	Yes	49	22.7
	No	167	77.3
Watery eyes	Yes	72	33.3
	No	144	66.7
Slowness of focus change	Yes	65	30.1
	No	151	69.9
Joint pain in the fingers and wrists	Yes	113	52.3
	No	103	47.7
Shoulder pain	Yes	131	60.6
	No	85	39.4
Difficulty writing with pain	Yes	28	13.0
	No	188	87.0
Inability to hold objects well	Yes	17	7.9
	No	199	92.1

Note: Descriptive Analysis

Awareness of Computer Vision Syndrome

Table 4 shows that a majority of the respondents were moderately aware that CVS is caused by a prolonged period of computer use (36.1%), poor seating position during computer use (29.6%), and viewing a computer screen at a distance less than an arm's length (35.8%). A computer user can reduce CVS by taking regular breaks during computer use (32.4%) and by maintaining a balanced contrast between the computer screen and room illumination (30.1%). Additionally, the majority of respondents stated that they were somewhat aware that CVS is a result of viewing computer screens at an angle below eye level (27.8%) and in circumstances where the screen brightness is higher than the ambient light (27.8%). A computer user can reduce CVS by viewing the computer screen below eye level (27.8%), using computer spectacles with antiglare features (31.0%), and correcting short-sightedness or long-sightedness (27.3%).

Knowledge and Awareness level of Computer Vision Syndrome

Table 5 shows that most of the respondents have a high level of knowledge of CVS (94.9%), but only have a moderate level of awareness of CVS (65.7%).

Table 3: Risk factors, consequences, and preventive measures of CVS (n = 216)

Items	Strongly disagree n (%)	Disagree n (%)	Do not know n (%)	Agree n (%)	Strongly agree n (%)
Viewing a computer screen from a distance less than an arm's length is a risk factor for CVS	2 (0.9)	3 (1.4)	40 (18.5)	112 (51.9)	59 (27.3)
Prolonged computer use increases the risk of developing CVS	1 (0.5)	4 (1.9)	21 (9.7)	110 (50.9)	80 (37.0)
The inappropriate seating position is a risk factor for CVS	5 (2.3)	8 (3.7)	56 (25.9)	92 (42.6)	55 (25.5)
Keeping the computer screen above eye level is a risk factor for CVS	1 (0.5)	20 (9.3)	95 (44.0)	63 (29.2	37 (17.1)
Poor contrast between the computer screen and the surrounding brightness is a risk factor for CVS	2 (0.9)	6 (2.8)	44 (20.4)	98 (45.4)	66 (30.6)
Headaches are a consequence of CVS arising from computer use	1 (0.5)	4 (1.9)	33 (15.3)	120 (55.6)	58 (26.9)
Eye strain is a consequence of CVS due to computer use	0 (0)	4 (1.9)	24 (11.1)	114 (74.0)	74 (34.3)
Irritation of the eye is a consequence of CVS	0 (0)	3 (1.4)	41 (19.0)	115 (53.2)	57 (26.4)
Eye fatigue is a consequence of CVS	0 (0)	1 (0.5)	26 (12.0)	117 (54.2)	72 (33.3)
Redness of the eyes is a consequence of CVS	0 (0)	5 (2.3)	60 (27.8)	98 (45.4)	53 (24.5)
Dry eyes are a consequence of CVS	0 (0)	7 (3.2)	40 (18.5)	105 (48.6)	64 (29.6)
Reduced job productivity is a consequence of CVS	4 (1.9)	9 (4.2)	57 (26.4)	94 (43.5)	52 (24.1)
An increased error rate is a consequence of CVS	3 (1.4)	10 (4.6)	68 (31.5)	89 (41.2)	46 (21.3)
Increased health expenditure is a consequence of CVS perceived	4 (1.9)	6 (2.8)	55 (25.5)	98 (45.4)	52 (24.1)
Maintaining proper contrast while using computers can reduce the symptoms of CVS	0 (0)	3 (1.4)	24 (11.1)	119 (55.1)	70 (32.4)
Keeping the computer screen below eye level can reduce the symptoms of CVS	1 (0.5)	14 (6.5)	84 (38.9)	70 (32.4)	47 (21.8)
Using computer spectacles can reduce the symptoms of CVS	2 (0.9)	2 (0.9)	45 (20.8)	104 (48.1)	63 (29.2)
Viewing a computer screen at a distance less than an arm's length is a way of reducing the symptoms of CVS	24 (11.1)	31 (14.4)	37 (17.1)	70 (32.4)	54 (25.0)
Applying artificial tears while using computers can reduce the symptoms of CVS	0 (0)	10 (4.6)	78 (36.1)	82 (38.0)	46 (21.3)

Note: Descriptive Analysis

Table 4: Awareness of CVS (n = 216)

Items	Not at all aware, n (%)	Slightly aware, n (%)	Somewhat aware, n (%)	Moderately aware, n (%)	Extremely aware, n (%)
CVS is caused by a prolonged period of computer use	14 (6.5)	23 (10.6)	51 (23.6)	78 (36.1)	50 (23.1)
CVS is caused by poor seating position during computer use	31 (14.4)	41 (19.0)	51 (23.6)	64 (29.6)	29 (13.4)
CVS is caused by viewing a computer screen at a distance less than an arm's length	13 (6.0)	28 (13.0)	45 (20.8)	77 (35.8)	53 (24.5)
CVS is caused by viewing a computer screen below eye level	42 (19.4)	53 (24.5)	60 (27.8)	43 (19.9)	18 (8.3)
CVS is caused by a situation where the screen brightness is higher than that in the room	19 (8.8)	29 (13.4)	60 (27.8)	56 (25.9)	52 (24.1)
A computer user can reduce CVS by taking regular breaks during computer use	16 (7.4)	25 (11.6)	55 (25.5)	70 (32.4)	50 (23.1)
A computer user can reduce CVS by viewing the computer screen below eye level	48 (22.2)	47 (21.8)	60 (27.8)	38 (17.6)	23 (10.6)
A computer user can reduce CVS by using computer spectacles with antiglare features	23 (10.6)	32 (14.8)	67 (31.0)	56 (25.9)	38 (17.6)
A computer user can reduce CVS by maintaining a balanced contrast between the computer screen and room illumination	18 (8.3)	31 (14.4)	63 (29.2)	65 (30.1)	39 (18.1)
A computer user can reduce CVS by correcting short-sightedness or long-sightedness	37 (17.1)	40 (18.5)	59 (27.3)	45 (20.8)	35 (16.2)

Note: Descriptive Analysis

Table 5: Knowledge and awareness level of CVS (n = 216)

Variable	Categories	Score	Frequency (n)	Percentage (%)
Knowledge	Low	19–57	11	5.1
	High	58–95	205	94.9
Awareness	Low	20–40	24	11.1
	Moderate	41–79	142	65.7
	High	80–100	50	23.1

Note: Descriptive Analysis

DISCUSSION

The frequency of eye examinations is most commonly influenced by an individual's age, specific conditions, and abnormal findings on an eye examination[14]. In this study, 14.4% of respondents never went for an eye check-up. The results are concerning as a significant proportion of students have not undergone an eye examination, potentially resulting in delayed detection of any vision impairment. Regarding the historical aspect of eye disease, the majority of respondents reported no instances of dry eye or the use of eye drops. It is consistent with a previous study, which found that 87% of students refrained from using any eye medication to treat dry eye since most of them did not experience dry eye[12].

Computer vision syndrome can be attributed to a range of variables: personal factors, environment factors, and computer-related factors[3]. In this study, most of the respondents expressed a preference for using smartphones over other devices. This preference is a result of the convenience and portability that smartphones offer, as well as their affordability within their means. A prior study likewise documented that most of their respondents used smartphones as a result of their benefits[3]. The majority of respondents agreed that the usage of digital device can have an impact on their visual well-being and lifestyle, even though most of them were unfamiliar with the term CVS. The lack of awareness of CVS and its implications among students, despite their extensive use of digital devices, might be the reason behind this. A separate previous study also reported that the majority of medical students possess a high level of awareness of the potential for future vision and musculoskeletal problems resulting from excessive or prolonged use of digital devices[12].

CVS is associated with long-term ocular and musculoskeletal complaints that affect the health of the eyes and the body[12]. In this study, it is demonstrated that some of the CVS symptoms are neck, back, or shoulder pain (77.8%), headaches (64.4%), dry eyes (34.3%), and excessive tearing (15.7%). In a previous study conducted at King Abdulaziz University, Jeddah, Saudi Arabia, it was reported that their undergraduate medical students also experienced neck, back, and shoulder pain (39.7%), headaches (30.1%), dry eyes (20.3%), and excessive tearing (20.6%)[14]. In another study conducted among university students in Egypt, it was reported that the students experienced neck, back, and shoulder pain (24.0%), headaches (26.0%), and dry eyes (28.0%)[12]. The symptoms of neck, back, or shoulder pain and headaches are significantly associated with the short distance from the screen[14]. Headache symptoms in CVS are due to the constant need for the eyes to adjust by contracting the extraocular muscles and ciliary muscles to maintain the lens in the accommodating phase[14].

This study reported that most of the undergraduate students experienced neck, back, or shoulder pain, fatigue, headaches, eyestrain, and joint pain in their fingers and wrists. This indicated that they have experienced more than two CVS symptoms after prolonged use of digital devices. Another reason for these symptoms might be the way they spend their time with digital devices. Hours spent each day in front of the computer as well as poor body alignment may contribute to neck, back, and shoulder pain. Other factors, such as hours spent on a computer in a dark room, the level of digital screen brightness, adjusting the digital device's contrast with the surroundings, and using antiglare measures, might be attributed to headaches and eyestrain. Joint pain in the fingers and wrists may have resulted from the frequent use of touch screens and the frequent use of computers per day. Despite that, in a study conducted in Malaysia, only 6.8% of respondents reported experiencing backaches since most of them adjusted the computer angle to 15° lower than the horizontal level, thus reducing musculoskeletal discomfort such as neck pain and back pain[10]. Another study conducted at King Abdulaziz University in Jeddah, Saudi Arabia, revealed that the most frequently reported ocular symptoms were excessive tearing and a feeling of dryness[14].

The respondents demonstrated a significant level of knowledge (94.9%), and a majority of them concurred that the risk factors for CVS included viewing a computer screen at a distance closer than the length of an arm, extended periods of computer usage, improper seating position, inadequate contrast of the computer screen, and excessive surrounding brightness. The majority also concurred that CVS resulted in headaches, eyestrain, eye irritation, eye fatigue, redness of the eye, dry eyes, reduced work productivity, increased error rates, and greater healthcare costs. In addition, the majority of respondents also acknowledged that adhering to suitable contrast levels when using computers, using computer spectacles, viewing the computer screen at a distance less than an arm's length, and applying artificial tears while using computers might alleviate the symptoms of CVS. However, most of the respondents were unaware that positioning the computer screen above eye level increases the likelihood of CVS, whereas positioning it below eye level helps alleviate the symptoms of CVS. This indicates that the majority of the respondents possess awareness of the risk factor CVS, maybe as a result of prior experience with eye health issues such as dry eye disease. However, they lack information regarding the optimal eye level for computer screens[7].

The majority of the respondents are moderately aware that CVS is caused by a prolonged period of computer use, poor seating position during

computer use, and viewing a computer screen at a distance less than an arm's length. In addition, the majority of the respondents also reported being somewhat aware that CVS is due to viewing a computer screen below eye level and having a higher screen brightness compared to the room. With regards to the precautions against CVS, a greater number of the respondents are moderately aware that CVS can be reduced by taking regular breaks during computer use and maintaining a balanced contrast between the computer screen and room illumination. Furthermore, they are also somewhat aware that CVS can be reduced by viewing the computer screen below eye level, using computer spectacles with antiglare features, and correcting short-sightedness or long-sightedness. Based on these results, it can be deduced that a larger number of students had a moderate level of awareness of CVS (65.7%). Therefore, this demonstrates that a considerable number of university students are still unaware of the risk factors and preventive steps against CVS. A previous study conducted among students in Kenya also reported that 47.8% of respondents had a low level of CVS awareness[13]. Another study conducted in Nepal reported that 77.1% of medical students were not aware of CVS and its effects[9].

The majority of students possess a considerable amount of information regarding CVS, although they lack awareness of the factors that might lead to CVS due to their failure to implement proper procedures and incorporate them into their daily routines. Another study revealed that students had an inadequate degree of knowledge of CVS, which is a subtle and insidious illness. This lack of awareness is attributed to the low importance assigned to CVS by computer users and healthcare practitioners[13]. Another possible reason for the low awareness of CVS is the limited studies and reports on the prevalence of the symptoms and their risk factors. A high level of awareness and understanding of risk factors as well as preventive measures for CVS are crucial to enabling digital device users to know their symptoms, as preventive decisions can be made since this condition and its causes are amenable to primary prevention[13].However, the present study was only conducted on one campus. Thus, the findings cannot be generalised to all undergraduate students in Malaysia, as students from different backgrounds spend their time on digital devices differently. For instance, architecture students might spend more time on digital devices for drawing or learning different software associated with their assignments compared to nursing students, who are more focused on their clinical skills.

Therefore, it is essential to raise awareness of CVS among students, particularly young pupils, in order to avert potential adverse outcomes in the future, such as vision impairment and musculoskeletal issues. Students can acquire knowledge about CVS by promoting and cultivating strategies for both preventing and managing CVS, along with understanding the underlying rationale for each preventive and management measure. A recommended preventative and management strategy for CVS is for students to adhere to the 20-20-20 rule. This rule entails taking a 20-second break every 20 minutes of screen time and directing their attention to an item positioned at least 20 feet away. This practice helps alleviate eye strain and promotes relaxation of the eyes. To mitigate CVS, one can tune the brightness and font size settings to enhance reading comfort and minimise ocular fatigue[15]. While there are no enduring consequences associated with CVS, the pain and ocular fatigue it causes might potentially impair one's performance both at home and in the workplace[16,17].

CONCLUSION

The present study indicates that most of the respondents reported several symptoms of CVS as a result of extended usage of digital devices. This study also demonstrates that the majority of respondents possess an in-depth understanding of knowledge pertaining to CVS, encompassing risks, consequences, and preventive measures. Nevertheless, the degree of knowledge about CVS among undergraduates remains moderately high. Implementing health education on CVS prevention is a crucial element that should be prioritised among students. Furthermore, it is imperative to perform further research on the knowledge and awareness of CVS in order to enhance the community's comprehension of this condition.

ACKNOWLEDGMENT

This research was funded by IIUM Research Management Centre Grant 2020 (RMCG20-030-0030). The authors would also like to thank all undergraduate students who participated in this study.

Conflict of interest
The authors declare no conflict of interest.

REFERENCES

1. Noreen K, Ali K, Aftab K, Umar M. Computer vision syndrome (CVS) and its associated risk factors among undergraduate medical students in midst of covid-19. *Pak J Ophthalmol*. 2021;**37**(1):102-108.

2. Pulla A, Asma, Samyuktha N, Kasubagula S, Kataih A, Banoth D, Addagatla H. A cross sectional study to assess the prevalence and associated factors of computer vision syndrome among engineering students of Hyderabad, Telangana. *Int J Community Med Public Health*. 2018;**6**(1):308-313.

3. Peiris V, Mahendran PS, Faiz MA, Rajasekharan R, Ameresekera K. Prevalence and associated factor of computer vision syndrome among undergraduate students of Malaysia during the COVID 19 pandemic. *Int J of Biomed and Clinical Sciences*. 2020;**5**(4):399-407.

4. Arif KM, Alam, MJ. Computer Vision Syndrome. *Faridpur Medical College Journal*. 2015;**10(**1):33–35.

5. Kausar S, Sughra U, Khan WA, Nabeel K. Prevalence of computer vision syndrome (CVS) symptoms and its awareness among software engineering students of Twin Cities. *Al-Shifa Journal of Ophthalmology*. 2018;**14**(1):28-33.

6. Ranasinghe P, Wathurapatha WS, Perera YS, Lamabadusuriya DA, Kulatunga S, Jayawardana N. Katulanda P. Computer vision syndrome among computer office workers in a developing country: an evaluation of prevalence and risk factors. *BMC Res Notes*. 2016;**9**(1):1–9.

7. Dessie A, Adane F, Nega A, Wami SD, Chercos DH. Computer vision syndrome and associated factors among computer users in Debre Tabor Town, Northwest Ethiopia. *J Environ Public Health*. 2018;1-8.

8. Kumar SB. A study to evaluate the knowledge regarding computer vision syndrome among medical students. *Biomed Pharmacol J*. 2020;**13**(1): 469–473.

9. Kharel Sitaula R, Khatri A. Knowledge, attitude and practice of computer vision syndrome among medical students and its impact on ocular morbidity. *J Nepal Health Res Counc*. 2018;**16**(3):291-296.

10. Reddy SC, Low CK, Lim YP, Low LL, Mardina F, Nursaleha MP. Computer vision syndrome: a study of knowledge and practices in university students. *Nepal J Ophthalmol*. 2013;**5**(2):161-168.

11. Mandal R, Sirin A. To assess the knowledge and awareness about computer vision syndrome among IT professionals and college students. *International Journal of Scientific and Research Publications (IJSRP)*. 2020;**10**(7):620–630.

12. Iqbal M, El-Massry A, Elagouz M, Elzembely H. Computer vision syndrome survey among the medical students in Sohag University Hospital, Egypt. *Ophthalmology Research: An International Journal*. 2018;**8**(1):1–8.

13. Muma S, Aduda DO, Onyango PO. Uptake of conventional interventions, level of awareness and perception on computer vision syndrome: a cross-sectional study among university students, Kenya. *Ophthalmol J*. 2021;**6**:1–9.

14. Abudawood GA, Ashi HM, Almarzouki NK. Computer vision syndrome among undergraduate medical students in King Abdulaziz University, Jeddah, Saudi Arabia. *Journal of Ophthalmology*. 2020;1–7.

15. Yadav VS and George J. Understanding computer vision syndrome among school children: causes, effects and prevention. *International Journal of Research Publication and Reviews*. 2023;4(12):2552-2554.

16. Watson S. What is Computer Vision Syndrome? [Internet]. WebMD. 2008. Available from: https://www.webmd.com/eye-health/computer-vision-syndrome (accessed 10 Feb 2024).

17. Computer Vision Syndrome. Https://WwwPennmedicineOrg/for-Patients-and-Visitors/Patient-Information/Conditions-Treated-a-to-z/Computer-Vision-Syndrome#:~:text=Although%20CVS%20has%20not%20been,CVS%20from%20affecting%20computer%20users (accessed 10 Feb 2024).