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Demographic Characteristics and ABO Blood Group Genotypes Influence Susceptibility to Computer Vision Syndrome (CVS) in Lagos, Nigeria

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Abstract

Background: Computer devices have become an important part of human life because they make work easier and thus increase output. However, the use of computer devices has led to the occurrence of computer vision syndrome (CVS). The current study was aimed at determining the demographic characteristics, influence of ABO blood groups, and diseases associated with CVS in Lagos, Nigeria.
Materials and Methods: Structured questionnaires were used to collect demographic information from 153 CVS patients at Unique Eyes Center, Lagos. The data collected includes age, gender, educational level, ethnicity, religion, type of device use, duration spent on devices, marital status, and diseases frequently expressed. The ABO blood groups of the participants were thereafter collected from their medical records.
Results: The results showed that 89 (58.70%) of the respondents were males, while 64 (41.83%) were females. Most of the respondents were > 40 years old, with 78 members (50.98%), followed by age class 21–40 with 48 members (31.37%) and age class 10–20 with 27 members (17.65%).With respect to respondents educational status, 2(1.31%) had primary education, 28(18.30%) had secondary education while the majority 123(80.39%) had tertiary education. Regarding the marital status, married participants were 72 (47.06%) in number, others included singles 48 (31.37%), divorced 18 (11.76%), and widowed 15 (9.80%). There were 81 (52.94%) Christians, and 72(47.06%) Muslims. The Yoruba ethnic group made up 78 (50.98%), while others were Igbo 43 (28.10%), and Hausa/Fulani were 32 (20.92%). A total of 110 (71.90%) used desktops, 28 (18.30%) used androids, and 15 (9.80%) used laptops or iPads. One hundred and sixteen (75.82%) participants used computer devices continuously, while 37 (24.13%) used them intermittently. People with non-O blood types constituted the majority, of which those with type A blood were the most affected, having accounted for 51 (33.33%) of the overall population. Headache, blurred vision, eye strain, double vision, and neck/shoulder/back pain were strongly associated with CVS in the study area.
Conclusion: The results suggest that demographic characteristics and ABO blood groups genotypes influence susceptibility to CVS among computer users in Lagos. Non-O blood group individuals, mainly type A blood are particularly at risk. People are advised to limit time spent on computer devices and get regular eye tests.

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Introduction

In the twenty-first century, the use of computers as a tool in the workplace, academia, recreation facilities, and homes for vocational or non-vocational purposes has become very common.[1] The use of computer devices such as desktops, laptops, e-readers, and smart phones facilitates the performance of complicated tasks and processes, making their use an integral part of human life.[2] As of April 2022, there were more than five billion internet users worldwide (63.1% of the global population), all of whom used computer-related devices.[3] On average, an internet user spends almost seven hours per day on the internet across all devices.[4] All computer-related devices have a screen, called video display terminals (VDT).[5]

However, frequent or prolonged use of computer devices may cause unintended visual and health challenges, most often when safety rules are not followed. These visual and health problems are collectively referred to as "Computer Vision Syndrome" (CVS), otherwise known as "digital eye strain".[6] Symptoms of CVS include dry and irritated eyes, eye strain or fatigue, blurred vision, red eyes, burning eyes, excessive tearing, double vision, headache, light or glare sensitivity, slowness in changing focus, and changes in color perception.[7] Constant use of computer devices for three hours or more per day can cause CVS.[8] CVS is the most common recurring stress injury caused by VDT and is the number one occupational hazard of the 21st century.[9,10] Thus, CVS can be tagged as a rising non-communicable "disease," having the capacity to be a public health concern if not curtailed.[6] At least 60 million people have CVS, with one million new cases diagnosed each year.[8] Moreover, its symptoms affect almost 70% of all computer users.[8] CVS causes reduced work efficiency and productivity, a higher rate of errors, poor job satisfaction, and a reduced quality of life for the computer worker.[11,12]

9CVS can reduce productivity by up to 40%.[12]

Mechanistically, CVS is caused by the constant effort taken by the eyes to focus when viewing a computer screen.[5] Visual effort is greater when looking at the computer screen as compared to when looking at a piece of paper.[9] This is because humans blink about 22 times per minute when reading paper texts, compared to 7 blinks per minute when visualizing a computer screen.[9] This causes eye dryness, which strains the eyes when attempting to maintain focus.[9] CVS is caused primarily by the visual effects of VDT, such as lighting, glare, display quality, refresh rates, radiation, and the positioning of computer monitors.[5] Factors that increase the risk of CVS include personal factors such as age, poor sitting position, improper viewing distances, diseases, taking frequent breaks, and duration of computer usage.[8] Some environmental factors, like poor workstations and lighting for computers, an imbalance of light between the computer screen and work environment, and low contrast, can also make CVS more likely.[8] There is a dearth of studies on the influence of ABO blood group genotypes on CVS; however, studies such as Oladele et al.,[13] Yahaya et al.,[14] and Jajosky et al.[15] have shown that ABO blood group genotypes influence susceptibility to diseases. Thus, the relationship between ABO blood group genotypes and CVS is worth investigating.

Studies have been conducted worldwide on the prevalence of CVS and its associated factors. However, literature shows that there is a dearth of such studies in Nigeria, particularly in Lagos State. In addition, there is a lack of awareness of the threat posed by CVS in the country. This study, therefore, aimed to determine the association of ABO blood group and demographic characteristics with the prevalence of CVS.

Methods

Description of study location

This study was conducted at the Unique Eyes Center in Victoria Island, Lagos, Nigeria. Lagos is located at latitude 6° 27' 14.65" N and longitude 3° 23' 40.81" E.[16] Lagos is one of the fastest growing megacities in the world, with several academic institutions, offices, industries, artisanal work, and recreational facilities, among others, all of which make use of computer devices. With over 18.94 million internet users, Lagos has the highest number of internet users in Nigeria.[17] Thus, there is likelihood that CVS will be prevalent in the city. Yet, literature searches show that no study has been conducted on the threat posed by the syndrome in Lagos. This necessitated the current study to determine the involvement of ABO blood groups and demographic characteristics in the prevalence of CVS in Lagos.

Study population and data collection

A retrospective, random sampling of CVS patients who attended Unique Eyes Center in Victoria Island, Lagos, between September 2021 and September 2022 was conducted. Information relevant to the studies objectives were collected from the patients' medical records using a structured checklist. The checklist has three sections. Section A contained socio-demographic information such as age, sex, religion, educational level, average time spent on computer devices, and ethnicity. Section B had health conditions associated with CVS while section C contains the ABO blood groups of the participants.

Sample size determination

The sample size for the study was calculated using equation 1 [18].

$n = N/(1+[(Ne)]^2)$

Note: in equation 1, n represents the sample size; N is the number of individuals with CVS who attended the Unique Eyes Center; e is the level of precision, which is between 0.10 and 0.01 (i.e., 10% to 1%).
Using a level of precision (e) of 5% and a population size (N) of 250,

$n = 250/(1+250\ [(0.05)]^2)$, n= 153.80 (~ 153).

Therefore, the sample size used was 153.

Eligibility criteria

The criteria for inclusion were the eligible medical records of all patients diagnosed with CVS between September 2021 and September 2022. Individuals who did not meet the stated duration criteria and those with incomplete records were excluded.

Data analysis

The Statistical Package for the Social Sciences (SPSS) version 24 was used to analyze the data, and the results were shown in percentages and frequency distribution tables. The chi-square test was used to test the relationship between variables at a 5% significance level ($p \leq 0.05$).

Results

Demographic data of the participants

Table 1 shows the overall demographic data distribution among CVS patients at Unique Eyes Center, Lagos. The male-female ratio was 1.4 with male participants numbered 89, representing 58.17%, while females were 64, representing 41.83%. The observed age groups were 10–20 years, 27 participants (17.65%), 21–40 years 48 (31.37%), and 40 years and above 78 (50.98%). participants. The reported religions were as follows: Christianity had the highest participants with 81, representing 52.94%, followed by Islam with 72 participants (47.06%). For the educational qualifications, participants with a primary education made up 2 (1.31%) of the total, while those with a secondary education made up 28 (18.30%), and those with a tertiary education made up 123 (80.39%). There was no participant with no formal education. For the marital status, 72 (47.06%) of the participants were married, 48 (31.37%) single, 18 (11.76%) divorced, and 15 (9.80%) were widowed.

The most common ethnic group was Yoruba, with 78 participants (50.98%), followed by Igbo with 43 participants (28.10%) and Hausa/Fulani with 32 participants (20.92%). The types of computer devices used by the participants were as follows:

Table 1: Demographic data and device distribution among computer vision syndrome (CVS) patients at Unique Eyes Center, Lagos

Demographic data	Frequency	Percentage (%)
Gender		
1. Male	89	58.17
2. Female	64	41.83
Age Group (years)		
3. 10 - 20	27	17.65
4. 21 - 40	48	31.37
5. >40	78	50.98
Religion		
6. Christianity	81	52.94
7. Islam	72	47.06
8. Traditional	0	0.00
Education Level		
9. No formal education	0	0.00
10. Primary Education	02	1.31
11. Secondary Education	28	18.30
12. Tertiary Education	123	80.39
Marital Status		
13. Married	72	47.06
14. Single	48	31.37
15. Divorced	18	11.76
16. Widowed	15	9.80
Ethnic Group		
17. Yoruba	78	50.98
18. Igbo	43	28.10
19. Hausa/Fulani	32	20.92
Computer Devices Owned		
20. Desktop	110	71.90
21. Laptop/IPad	15	9.80
22. Android mobile	28	18.30

ddesktops were the most commonly used, accounting for 110 (71.90%) of the total, followed by Androids with 28 (18.30%), and laptops with 15 (9.80%).

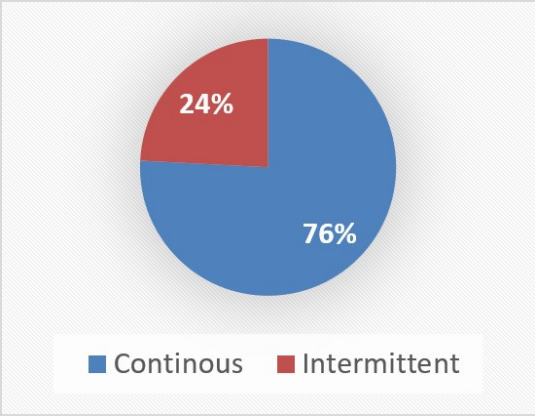

Figure 1: Duration spent on computer screen by computer vision syndrome (CVS) participants at Unique Eye Center, Lagos

Table 2: Distribution of ABO blood groups among computer vision syndrome (CVS) participants at Unique Eyes Center, Lagos

Blood group types	Frequency n (%)	Percentage (%)
A positive (A^+)	51	33.33
A Negative (A^-)	13	8.50
B Positive (B^+)	29	18.95
B Negative (B^-)	11	7.19
AB Positive (AB^+)	18	11.76
AB Negative (AB^-)	12	7.84
O Negative (O^+)	09	5.88
O Positive (O^-)	10	6.54
Total	153	100%

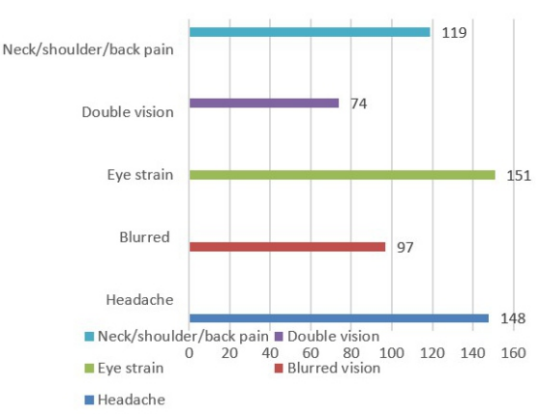

Figure 2: Common diseases suffered by computer vision syndrome (CVS) patients at Unique Eye Center, Lagos

Duration spent on computer screen by participants

Figure 1 displays the duration spent on the computer screen by the participants. Participants who used computer devices continuously (without breaks) were 116 (75.82%) in number, while those who used them intermittently (with breaks in-between) were 37 (24.13%).

Common diseases among participants

Common diseases suffered by the participants are displayed in Figure 2. Of the 153 CVS participants, 148 complained about headaches, 97 had blurred vision, 151 had eye strain, 74 experienced double vision, and 119 complained about neck/shoulder/back pain.

Discussion

The current study was conceptualized to determine the demographic characteristics, influence of ABO blood group genotypes, and diseases associated with computer vision syndrome (CVS) at Unique Eyes Center in Lagos, Nigeria. The majority of the participants were male, which could be because males are more likely than females to engage in extracurricular activities and so may tend to spend more time on computer devices than females.[12] In addition, males tend to be more technologically proficient, which could be why there was a preponderance of males.[19] The results of the current study are consistent with those of Tesfaye et al.,[12] who reported more males than females among CVS patients in some academic institutions in northwest Ethiopia. In a cross-sectional study of medical students in India, more boys suffered from CVS than girls.[20] In a study by Colley and Comber,[21] more males used computer devices than females. However, the results obtained are inconsistent with the results of a study carried out in Sri Lanka by Ranasinghe et al.,[11] in which a preponderance of female gender was reported. Similarly, in a study conducted in four tertiary institutions in Anambra, Nigeria, by Umezulike and Ile.[22] more females than males used computer devices. In contrast, gender differences were not found with the use of computer devices in a study conducted in Ibadan and Ekiti by Bamidele and Adekanmbi[23] and another in Rivers State by Fomsi and Ordual.[24] According to Sheppard and Wolffsohn,[25] dry eye is generally more prevalent among females, which could explain why more females experienced CVS than males in some

studies.

The current study revealed that people aged 40 and above experienced CVS more frequently than lower age groups. This could be because, as humans age, the probability of developing CVS also increases.8 Moreover, long years of using a device equals more accumulated stress on the eyes, which might raise the risk of developing CVS.[12] The finding of the current study is in line with that of Zenbaba et al.,[8] in which being 44 years old or older was associated with CVS in a web-based cross-sectional study of university instructors in Ethiopia. Likewise, in a study of bank workers in Addis Ababa, Ethiopia, by Derbew et al.,[26] higher age groups suffered from CVS than lower age groups. Agbonlahor[6] also reported more CVS among older participants than younger ones in Abuja, Nigeria. In contrast, the preponderance of younger age groups was reported among CVS patients in northwest Ethiopia.[12] Similarly, in a study conducted in Malaysia, younger age groups were at a higher risk of developing CVS.[27]

The demographic characteristics of the participants further showed that the majority were married, had an almost equal proportion of Christians and Muslims, and were dominated by the Yoruba ethnic group, followed by Igbos, and Hausa/Fulani. However, these mentioned variables might reflect the ethnic and religious population in Lagos, and so might not have an influence on CVS. Regarding educational qualifications, the majority of the participants had tertiary education, which could be that people with advanced education tend to use computer devices more at work and at home, for sending information and interacting with colleagues. It could also point to their higher socio-economic status compared to individuals with lower education. However, more studies are needed to verify these claims.

Continuous use of computer devices without breaks was also associated with CVS in the present study. This might be because computer devices release electromagnetic radiation or high-energy blue light, which stresses the ciliary muscle in the eye, so continued exposure to a computer screen causes eye stress.[8] On the other hand, taking breaks, whether short or long, promotes the relaxation of the eye muscles, thus preventing eye fatigue or tiredness.[28,29] The result of the present study is in line with that of a study carried out in Saudi Arabia in which long hours of computer monitor use were a predictor of CVS and its severity.[30] In other studies, conducted in Sri Lanka and Saudi Arabia, a longer duration of computer use was associated with CVS among medical students.[11,31] Nwankwo et al. in Northwestern Nigeria,[5] reported that the risk of CVS was significantly associated with the duration of computer use, hours of computer use per day, and taking breaks during computer use. Moreover, in a study conducted by Coronel-Ocampos et al.[32] in a private university in Paraguay, taking breaks when using computer devices at least every 20 minutes and every 1 hour reduced CVS. Regarding the influence of types of computer devices, a preponderance of CVS was seen among users of desktops in the current study, which might be linked with longer hours of use. Compared to other computer devices, desktops are commonly used in offices, where employees spend hours working, most often continuously. Unfortunately, there is no documented study to compare with this finding. Thus, studies will be needed to verify this claim.

Non-O blood types were observed in the present study to suffer from CVS more than O blood types. Unfortunately, there is scarce literature on the influence of ABO blood types on eye diseases, including CVS, to compare with the current study. However, people with blood types A, B, or AB are at an increased risk of developing blood clots compared to people with blood type O.[33] Non-O blood types have higher levels of blood-clotting factors and cholesterol in their blood, which increases the risk of blood clots, which in turn increases the risk of eye diseases.[34] However, more research will be needed to establish the nature of the link between ABO blood types and CVS.

In the current study, headache, blurred vision, eye strain, double vision, as well as neck, shoulder, and back pain, were linked to CVS. When seated in front of a computer for an extended period of time, blinking may drop by 60%, which contributes to poor tear production and temporarily stresses the cornea, resulting in dry eyes.[35] Working non-stop for more than 4 hours has been associated with eye strain.[36] Prolonged use of the computer causes muscular discomfort, which causes neck, back, and shoulder pains.[37] Using computer devices for a long time can trigger a computer screen headache, caused

by the constant need to adjust the eyes by contracting the extraocular muscles and ciliary muscles to maintain the lens in the accommodating phase, leading to eye muscle fatigue and causing headaches.[31] The findings of the current study are consistent with those of a study carried out by Logaraj et al.[35] among students in Chennai, India, in which headaches, neck and shoulder pain, burning sensation, blurred vision, and dry eyes were associated with CVS. In a systematic review carried out in Ethiopia by Adane et al.,[38] the most commonly reported symptoms of CVS were blurred vision, eye fatigue, watery eyes, a burning sensation, and a headache. Nwankwo et al.[5] also reported headaches, eye strain, and blurred vision among CVS patients in Nigeria.

Conclusion

The results showed that computer vision syndrome (CVS) is prevalent in Lagos, and the majority of the affected are married males, aged 40 years and above, and are either Christians or Muslims. Moreover, the majority of them have tertiary education, and the proportion of each ethnic reflects ethnic populations in Lagos in the order of Yoruba, Igbo, and Hausa/Fulani. Most of the CVS patients used computer devices continuously without breaks in between, and desktops were the most frequently used computer device. People with non-O blood types constituted the majority, of which those with type A blood were the most affected. Headache, blurred vision, eye strain, double vision, as well as neck/shoulder/back pain were strongly associated with CVS in the study area.

Based on the findings of the current study, computer device users should minimize duration of exposure. In addition, users should take breaks in between work to reduce exposure and relax eye muscles. People aged 40 years and above and individuals with non-O blood types are specifically advised to modulate their use of computer devices. Computer device users should go for periodic eye tests to detect and manage CVS early.

Declarations

Ethics approval and consent to participate

This study was approved by the ethics committee of Office of the Study Center, National Open University of Nigeria, Lagos. The guidelines for conducting research on humans as outlined by the Center were strictly followed. Written informed consent was obtained before accessing the medical records of the patients. For participants under the age of 16, informed consent was obtained from their parents.

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