ORIGINAL ARTICLE

Computer vision syndrome and dry eye symptoms among breastfeeding women

Sabrina Subri, PhD[1], Adilah Mohd Ali, PhD[2], Siti Nasuha Md Salleh, Bachelor of Optometry[3]

[1]Center of Optometry, Faculty of Health Sciences, Universiti Teknologi MARA, UiTM Cawangan Selangor, Puncak Alam, Selangor, Malaysia, [2]Faculty of Medicine and Health Sciences, UCSI University, Cheras, Kuala Lumpur, Malaysia, [3]Focus Point Vision Care Group, 105 Jalan Sultan Abdul Jalil, Ipoh, Perak

ABSTRACT

Introduction: Breastfeeding women are susceptible to musculoskeletal symptoms and hormonal changes that can affect the ocular surface. As exposure to visual display units (VDU) that is known to cause symptoms of dry eye and computer vision syndrome (CVS) is increasing worldwide, including among breastfeeding women, it is unknown whether this group of VDU users would experience CVS more than non-breastfeeding women. Therefore, this study aimed to investigate the association between breastfeeding status and symptoms of CVS and dry eye.

Materials and Methods: In this cross-sectional study, self-reported CVS and dry eye symptoms were compared between 80 breastfeeding and 72 non-breastfeeding VDU users. Two questionnaires were administered online, which were the CVS-Questionnaire (CVS-Q) and the Ocular Surface Disease Index (OSDI) questionnaire, to evaluate symptoms of CVS and dry eye, respectively. Mann-Whitney test was used to compare CVS and OSDI scores between groups, while correlations between the scores were analyzed using Spearman's test.

Result: Results showed that OSDI scores were significantly higher in the non-breastfeeding group (U = 2263, z-score = -2.276, p = 0.023), indicating more dry eye symptoms experienced by respondents in this group, while no significant group difference was found in terms of CVS scores (U = 2772, z-score = -0.400, p = 0.689). Additionally, no significant association was observed between breastfeeding status and severity of dry eye symptoms as well as CVS symptoms.

Conclusion: This study reported the possible benefit of breastfeeding in reducing dry eye symptoms. The CVS symptoms found in the breastfeeding group were possibly due to VDU usage rather than caused by breastfeeding. Public education on preventive measures to reduce the occurrence of CVS symptoms and ocular dryness among VDU users is essential to improve the quality of life.

KEYWORDS:
Breastfeeding, computer vision syndrome, ocular dryness, dry eye, digital devices, estrogen

INTRODUCTION

Computer vision syndrome (CVS) is defined as a group of eye-related symptoms due to prolonged use of visual display units (VDU) such as computers, tablets, television, and smartphones.[1] Several factors may contribute to the increased risk of CVS, including the number of hours spent on digital devices, external factors such as improper lighting or position, as well as individual factors such as uncorrected refractive errors.[2-4] It has been suggested that a minimum of three hours of VDU usage per day can increase the risk of developing CVS, low back pain, tension headaches, and psychosocial stress.[5,6] This is expected to increase with longer exposure to VDU, where CVS symptoms and more pronounced visual problems were reported among computer users who spent more than seven hours per day on VDU at work.[7-9] These suggest that increasing demand for VDU usage in modern days may increase the prevalence of CVS in the community.

The symptoms of CVS can be broadly classified into three which are extraocular symptoms, accommodative symptoms, and ocular surface symptoms.[10,11] The extraocular symptoms of CVS are associated with musculoskeletal symptoms such as tingling and numbness of the fingers and arm, cervical stiffness, backache, and pain in the neck and shoulder. According to Gerr et al.[12], musculoskeletal symptoms are common among VDU users, whereby more than 50% of VDU users have reported experiencing the symptoms during the first year of starting a new job. These symptoms are usually associated with improper placement of computer screen and viewing distance of VDU, poor seating posture, and prolonged duration of VDU usage without a break.

On the other hand, the accommodative symptoms of CVS refer to fatigue or spasm of intraocular muscles following a sustained VDU usage. This may cause blurry vision, double vision, difficulty focusing at near, and increased time taken to change focus from near to distant target.[10,11] Another group of symptoms is related to changes to the ocular surface, particularly to the tears and cornea following prolonged use of VDU. Research has shown that extended period of computer usage reduced blinking rates, possibly due to increased cognitive demand.[13] This will cause ocular dryness symptoms such as irritation, burning sensation, and grittiness, which collectively contribute to CVS symptoms.

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Corresponding Author: Sabrina Subri
Email: sabrinasubri@uitm.edu.my

Ocular dryness was also found in several conditions with hormonal imbalances indicative of the influence of hormonal changes on the ocular surface.[14] Among the hormones that can influence ocular dryness are estrogen, androgen, insulin, and thyroid hormones.[15] Although the effects of estrogen and progesterone on tears are less understood, studies have shown that estrogen and progesterone hormone replacement therapy in menopausal women did worsen ocular complaints and increase the incidence of dry eye.[16,17] Apart from hormonal treatment, practising breastfeeding could also lead to natural hormonal changes in women,[18] which in turn could influence the tears' quality and quantity. These changes could result in ocular dryness which can be aggravated by prolonged VDU usage.[19,20]

In a study conducted on medical and engineering students, neck and shoulder pains were among the common musculoskeletal symptoms reported by VDU users.[21] Similar musculoskeletal problems were also experienced by breastfeeding mothers due to improper positions during breastfeeding.[22] Various positions are practised during breastfeeding including sitting on a chair, on a mat, on the bedside, and side-lying. Among these positions, sitting on a chair has been described to have the least prevalence of musculoskeletal pain compared to other positions.[22]

Since breastfeeding women are more susceptible to hormonal changes that can cause ocular dryness, and are more likely to experience musculoskeletal symptoms, it is unknown if CVS and dry eye symptoms are more prevalent among breastfeeding women who are also VDU users compared to non-breastfeeding VDU users. Therefore, the current study aimed to investigate the association between CVS, dry eye, and breastfeeding by comparing self-reported symptoms of CVS and dry eye between breastfeeding and non-breastfeeding VDU users.

MATERIALS AND METHODS

Study Design and Sample Population

A cross-sectional study was conducted on a sample of breastfeeding and non-breastfeeding women in Malaysia to investigate the association between breastfeeding status and self-reported symptoms of CVS and dry eye. G*Power[23] was utilized to calculate the estimated sample size for this study. The effect size used in the calculation was derived from Nkiru et al. (24) which compared OSDI scores between the third trimester and post-partum phases. As no study comparing OSDI scores between breastfeeding and non-breastfeeding groups was found, the effect size from the former comparison was deemed relevant for our sample size estimation. For a power of 0.80 and an alpha level of 0.05 for a two-sided test, the sample size needed for each group was 60. Considering attrition rate and that the calculation was based on a slightly different sample, a higher number of participants for each group was aimed in this study. All respondents recruited through purposive sampling were Malaysian citizens aged between 18 to 45 years old, using any kind of VDU devices for a minimum of three hours per day in at least five days per week and were able to understand either English or Malay to answer the questionnaires. Women in the control group must be non-breastfeeding, while women in the breastfeeding group must be currently breastfeeding a baby of six months and below. Pregnant and menopausal women, as well as women with any systemic diseases, currently having active eye diseases, has history of eye surgery or taking any medications that could affect the tears, were excluded from the study.

Materials

Data were collected using a questionnaire consisting of five sections namely: Section A for socio-demographic data, Section B for health background, Section C fro breastfeeding practice, Section D for CVS Questionnaire, and Section A for Ocular Surface Index (OSDI) questionnaire.

Computer Vision Syndrome Questionnaire (CVS-Q)

The CVS questionnaire (CVS-Q) was adopted from Seguí et al.[25] to assess 16 visual and ocular symptoms associated with VDU exposure including burning, itching, foreign body sensation, tearing, and excessive blinking. Scoring was done according to the guidelines of the author. Responses were collected using the Likert scale to determine the frequency of occurrence of each symptom with 0 indicating never, 1 indicating occasionally (sporadic episodes or once a week), 2 indicates often (two or three times a week) while 3 indicates very often or always (almost every day). If respondents reported having the symptoms for at least 'occasionally', they were asked to rate the intensity of the symptoms as either 'moderate' or 'intense' with a score of 1 or 2 respectively. The total score for each symptom was then calculated as frequency x intensity, with a score of 0 recoded as 0, a score of 1 or 2 recoded as 1, and a score of 4 recoded as 2. The total scores from all symptoms were calculated giving a range of total scores between 0 to 24. Total scores of 6 or more indicate suffering from CVS symptoms.

Ocular Surface Disease Index (OSDI)

Ocular Surface Disease Index (OSDI) is a 12-item questionnaire developed by the Outcomes Research Group at Allergan (Irvine, California, USA) to assess symptoms, functional limitations, and environmental factors related to dry eye syndrome. Both the original version of the questionnaire in English[26] and the translated version in Malay were used in this study.[27] This questionnaire was used in the study to quantify the symptoms of ocular dryness, which were graded according to the author's guidelines. The presence of specific dryness symptoms was graded on a scale of 0 to 4, whereby 0 indicates none, 1 indicates some of the time, 2 indicates half of the time, 3 indicates most of the time while and 4 indicates all the time. The total OSDI score was then calculated and categorized according to the severity with 0 to 12 points indicating normal or not having dry eye, while OSDI scores of 13 to 22, 23 to 32, and 33 to 100 indicate mild, moderate, or severe dry eye, respectively.[28]

Research Procedures

The questionnaire was administered online between March 2022 and July 2022 using Google Form distributed through social media such as WhatsApp and Telegram. Prior to the actual questionnaire, an online consent form was completed by all participants. Questions to screen for the inclusion and exclusion criteria were included in sections A and B of the

Table I: Demographic data of the participants in each group

Characteristics	Non-Breastfeeding (n=72)	Breastfeeding (n=80)
Age (years)	M=28.08 (SD=6.38)	M=31.06 (SD=4.80)
Digital devices usage (hours)	M=8.29 (SD=4.31)	M=7.22 (SD=4.64)
Breastfeeding categories, n (%)		
• Exclusive Breastfeed		51 (64%)
• Mixed Feeding		29 (36%)
Baby's age (months)		M=6.68 (SD=0.62)

Note. M and SD represent the mean and standard deviation of the samples respectively.

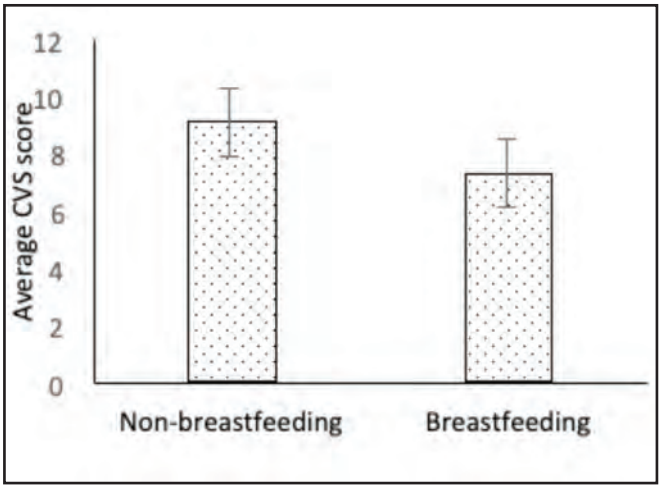

Fig. 1: The average CVS score by group. Error bars represent standard errors

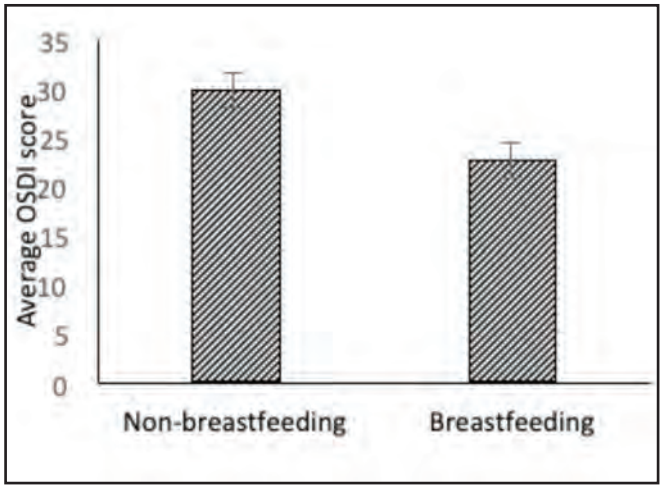

Fig. 2: The average OSDI score by group. Error bars represent standard errors

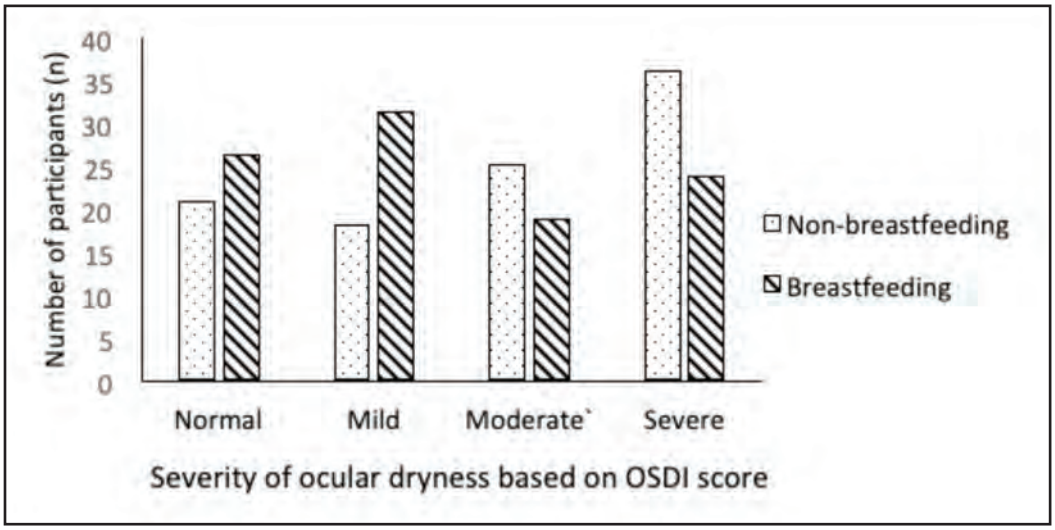

Fig. 3: Number of participants in each group according to the severity of ocular dryness based on OSDI score

questionnaire to determine if the respondents were eligible to participate in the study. The whole online questionnaire including the consent form took not more than 10 minutes to complete. This study was conducted in accordance with the Declaration of Helsinki and was approved by the ethical committee (FERC/FSK/MR/2022/0074) of the Universiti Teknologi MARA Selangor.

Data Analysis

The statistical analyses were performed using IBM SPSS statistics version 28 (SPSS Inc., Chicago IL). Kolmogorov-Smirnov test showed that the data obtained were not normally distributed, therefore non-parametric tests were used to analyze the data. A Mann-Whitney test was used to compare CVS and OSDI scores between breastfeeding and non-breastfeeding groups. In addition, Pearson's chi-squared test was used to find the association between CVS, dry eye, and breastfeeding. Finally, the association between the CVS score and OSDI score was tested using Spearman's correlation test. All tests conducted were two-tailed with an alpha value of 0.05.

RESULTS

A total of 80 breastfeeding women and 72 non-breastfeeding women participated in the study with the age range of 21 to 45 years. Duration of VDU usage was not significantly different between groups, with an average of seven to nine hours per day in both groups (U=4053, Z=-2.276, p=0.23). Most participants in the breastfeeding group practised exclusive breastfeeding, while the rest were mixed feeding (a combination of breastfeeding and formula feeding). The demographics of the participants in each group are summarized in Table I.

The average CVS score across groups was 8.11 (SD=8.31), while the average OSDI score across groups was 25.89 (SD=17.83). CVS scores were slightly higher in non-breastfeeding group compared to breastfeeding group (Figure 1). However, Mann-Whitney test showed that this difference was not statistically significant between groups (U = 2772, z-score = -0.400, p = 0.689). In contrast, group difference was found in OSDI score (U = 2263, z-score = -2.276, p = 0.023) with a slightly higher score found in the non-breastfeeding group indicating more ocular dryness symptoms experienced by respondents in this group (Figure 2).

Additionally, a Pearson chi-square was conducted to compare the presence of CVS and dry eye based on the scores between breastfeeding and non-breastfeeding groups. Results showed no significant difference in the percentage of CVS between breastfeeding and non-breastfeeding VDU users ($c(1) = 0.05$, $p = 0.823$) indicating that there was no association between the presence of CVS and breastfeeding. Similarly, Pearson chi-square showed no significant difference in the percentage of all categories of dry eye between the groups indicating that the severity of ocular dryness was not associated with breastfeeding ($c(3) = 5.746$, $p = 0.125$) (Figure 3). Furthermore, Spearman's correlation test demonstrated a moderate positive correlation between CVS and OSDI scores ($r = 0.41$, $p < 0.001$) indicating a moderate association between the two.

DISCUSSION

This study aimed to investigate the association between breastfeeding and self-reported symptoms of CVS and dry eye by comparing the CVS-Q and OSDI scores between breastfeeding and non-breastfeeding women. It was hypothesized that CVS and OSDI scores will be higher among breastfeeding compared to non-breastfeeding VDU users indicating more symptoms reported in the former. However, results showed no significant association between breastfeeding and CVS symptoms, meanwhile, a higher OSDI score was found to be associated with the non-breastfeeding group.

A previous study has reported that CVS was more prevalent in females than males, possibly due to a lower androgen level in the former.[29] The meibomian gland, lacrimal gland, and goblet cells on the ocular surface are important components in tears production and are highly influenced by the androgen levels. Androgen helps to increase the quality and quantity of the meibomian gland's lipids composition, therefore, promoting tear film stability. Additionally, it encourages the secretion of protein, electrolytes, and water, all of which contribute to the aqueous layer of the tear film as well as enhance the function of goblet cells in mucin production.[30] In females, androgen level is dropping in the third trimester of pregnancy towards several months after birth during the lactation process.[31] The decreasing androgen level post-partum explains the increase in ocular dryness as indicated by higher OSDI score with increasing baby's age as found in the current study.

Temporary ocular surface dryness is believed to be associated with estrogen, progesterone, and prolactin released from the placental tissues, ovaries, and pituitary gland respectively.[15,32] Estrogen has the biggest impact on ocular surface dryness by inhibiting androgen's actions, which consequently reduces lipid synthesis and promotes meibomian gland dysfunction, increasing dry eye symptoms.[33] Estrogen level is lower in pregnant women starting from the third trimester which falls rapidly after delivery, until a few months after breastfeeding as compared to pre-pregnancy level, causing an increase in prolactin levels within the blood in preparation for milk secretion. The current study revealed that the OSDI scores were higher in non-breastfeeding compared to the breastfeeding group indicating a more prominent ocular dryness in the former group. This finding supports the earlier claim that decreasing estrogen levels in breastfeeding women would have an impact on reducing the symptoms of dry eye in this group.

Although the OSDI scores were significantly lower in breastfeeding compared to the non-breastfeeding group, it is unknown if the score changes with the breastfed baby's age since the range of baby's age was restricted in this study. According to Nkiru et al. [24], the prevalence of dry eye and its symptoms both substantially rose from the second to the third trimester of pregnancy but then declined to the lowest value six weeks after delivery. However, they also stated that objective tears assessment using tear break-up time and Schirmer's test showed moderate values during the post-partum period suggesting that dry eye symptoms persisted even until six weeks after delivery. No previous evidence suggests whether the symptoms will decline or rise again after six weeks post-delivery. As the estrogen level continues to rise while the androgen level decreases post-partum, ocular dryness symptoms may get worse in breastfeeding mothers with increasing babies' age after six weeks.

According to Stapleton et al. [19], one of the risk factors for dry eye is the use of a computer or other VDU displays. The present study found a moderate positive correlation between CVS and OSDI scores in line with the previous reports.[34,35] When using digital devices, the decreased blink rate and frequent incomplete eye closure during the tasks lead to ocular surface dryness, hence increasing both the OSDI and CVS scores. Parihar et al. [36] emphasized that the mechanism by which the images are seen in the VDU unintentionally decreases blinking, thus reducing tear secretion, decreasing meibomian gland expression, and preventing the proper distribution of the tear lipid; each of which leads to the occurrence of dry eye syndrome.

As estrogen aggravates dry eye symptoms, breastfeeding women can potentially benefit from lower estrogen level that reduces dry eye symptoms, although they are more

susceptible to musculoskeletal disorders. Musculoskeletal problems might contribute to overall discomfort when using VDU, but its impact on CVS seems to be less than the influence of ocular surface dryness on CVS. Findings in this study suggest that increased eye dryness has more impact on CVS than the musculoskeletal problem, which leads to a higher CVS score indicating intensified symptoms. Lower OSDI in the breastfeeding group, despite the absence of group difference in CVS score, suggests that there are other factors that contribute to CVS symptoms in addition to dry eye in the breastfeeding group such as accommodation factors and ergonomic aspects.

Although CVS and dry eye are not vision-threatening problems, increasing symptoms of these conditions can remarkably affect VDU users' productivity and quality of life, resulting in a substantial economic burden.[37] The major limitation of this study was the low response rate which caused difficulty in getting enough participants to achieve the required sample size that represents the population of breastfeeding mothers in Malaysia. However, the results provide useful insight into the association between breastfeeding and ocular symptoms. Since this study only involved self-reported symptoms of dry eye, future studies involving clinical data would be useful to confirm the benefit of breastfeeding to the ocular surface of the mother.

CONCLUSION

To conclude, the present study reported the association between breastfeeding and a lower OSDI score but not the CVS symptoms, suggesting a potential benefit of breastfeeding in reducing ocular dryness; however, the causal relationship between the two was not established in the study. A possible reason for this is a lower estrogen level in breastfeeding compared to the non-breastfeeding women. Although the breastfeeding group had lesser dry eye symptoms, CVS symptoms were comparable between groups indicating both groups were equally affected by VDU. As CVS and dry eye can negatively impact one's productivity and quality of life, health education on the risk and the preventive measures of CVS are recommended to reduce the prevalence of CVS and eye dryness among the community and maintain good health alongside the demand for VDU usage.

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