DRY EYE AND SLEEP QUALITY AMONG UNDERGRADUATE KAHS STUDENTS, IIUM KUANTAN

SITI NUR FATIMAH ISWAN, BOptom (Hons)

DEPARTMENT OF OPTOMETRY AND VISUAL SCIENCE, KULLIYYAH OF ALLIED HEALTH SCIENCES, INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA, JALAN SULTAN AHMAD SHAH BANDAR INDERA MAHKOTA 25200 KUANTAN, PAHANG, MALAYSIA.

sitinurfatimahiswan@gmail.com

ILYANON ZAHARI, PhD

DEPARTMENT OF OPTOMETRY AND VISUAL SCIENCE, KULLIYYAH OF ALLIED HEALTH SCIENCES, INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA, JLN SULTAN AHMAD SHAH BANDAR INDERA MAHKOTA 25200 KUANTAN, PAHANG, MALAYSIA

ilya@iium.edu.my

NOOR WAFIRAH SHAFEE, PhD

DEPARTMENT OF OPTOMETRY AND VISUAL SCIENCE, KULLIYYAH OF ALLIED HEALTH SCIENCES, INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA, JLN SULTAN AHMAD SHAH BANDAR INDERA MAHKOTA 25200 KUANTAN, PAHANG, MALAYSIA

wafirah@iium.edu.my

FIRDAUS YUSOF @ ALIAS, PhD

DEPARTMENT OF OPTOMETRY AND VISUAL SCIENCE, KULLIYYAH OF ALLIED HEALTH SCIENCES, INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA, JLN SULTAN AHMAD SHAH BANDAR INDERA MAHKOTA 25200 KUANTAN, PAHANG, MALAYSIA

yfirdaus@iium.edu.my

MUHAMMAD AFZAM SHAH ABDUL RAHIM, PhD (CORRESPONDING AUTHOR)

DEPARTMENT OF OPTOMETRY AND VISUAL SCIENCE, KULLIYYAH OF ALLIED HEALTH SCIENCES, INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA, JLN SULTAN AHMAD SHAH BANDAR INDERA MAHKOTA 25200 KUANTAN, PAHANG, MALAYSIA

afzamshah@iium.edu.my

ABSTRACT

Introduction: Dry eye disease (DED) is one of the most common ocular diseases that could be caused by either a decrease in tear production and/or an increase in the tear evaporation rate. DED can cause eye irritation, grittiness, blurred vision, and light sensitivity, negatively affecting individuals' quality of life. Poor sleep quality has become a common public health issue worldwide. It is reported decreased sleep quality are highly prevalent among individuals with DED and poor sleep quality can worsen DED symptoms. **Aim:** The purposes of this study was to observe the prevalence of DED and poor sleep quality in a sample of university students, to investigate the relationship between sleep quality and DED and to investigate if gender leads to differences in DED and sleep quality. **Methodology:** This cross-sectional study involved undergraduate students from Kulliyyah of Allied Health Science (KAHS), International Islamic University Malaysia (IIUM), Kuantan. Validated questionnaires, consisting of the Ocular Surface Disease Index (OSDI), were used to diagnose DED, and Pittsburgh Sleep Quality Index (PSQI) questionnaire was utilised to assess sleeping quality. Data collection and analysis were performed using the SPSS Statistics software (IBM, Armonk, NY). **Results:** A total of 148 undergraduate KAHS students of IIUM Kuantan participated in the study. Approximately 63.5% of the participants had DED, and 60.1% had poor sleep quality. The relationship between DED and poor sleep quality indicated a significant positive correlation. This study also revealed that females are more prone to DED and poor sleep quality compared to males. **Conclusion:** This study showed that participants with DED had a greater risk of poor sleep quality compared to non-DED and vice versa. Individuals with DED should be educated about the methods to improve their sleep patterns. Intervention and awareness to achieve good sleep quality also should be advocated to alleviate the occurrence of DED.

KEYWORDS: DED, sleep quality, OSDI, PSQI

INTRODUCTION

Dry eye disease (DED) is a multifactorial ocular surface and tear film disease that affects millions of people worldwide, with prevalence rates varying from 5% to 50% in different populations (Helayel et al., 2023; McCann et al., 2022; Papas, 2021; Rouen & White, 2018; Schjerven, Paaske, Snieder, Hammond, & Vehof, 2021). DED is a common ocular surface condition that causes eye irritation, grittiness, and vision problems (Hakim & Farooq, 2022; Mushriff, Agarwal, & Choyal, 2019; Zemanová, 2021). In addition to the symptoms above, individuals with DED also suffer ocular pain, blurred vision, light sensitivity and ocular burning, and they also experience a lower quality of life, with limited involvement in both work and social events, as well as difficulties with daily tasks like reading, watching television and driving (Guo & Akpek, 2020; Sayegh et al., 2021; Schjerven et al., 2021). The DED could be caused by either a decrease in tear production and/or an increase in tear evaporation rate, which causes ocular surface inflammation and, ultimately, leads to the destabilisation of the cornea–tear interface (Yu et al., 2019).

Sleeping is essential for well-being and general health (Wen et al., 2019). Sleep deficiency has become a common public health issue worldwide and was found to be due to shortened sleep periods, erratic sleep timing, poor sleep quality and sleep/circadian disturbance (Albqoor & Shaheen, 2021; Eleftheriou, Rokou, Arvaniti, Nena, & Steiropoulos, 2021; S. Li et al., 2018). Sleep deprivation has been linked to significant impairments in cognitive ability and attentiveness (Lee, Koh, Hyon, Wee, & Kim, 2014). Poor quality and short sleep duration have been shown to reduce the quality of life (Schjerven et al., 2021). In addition, previous studies had established that sleep deprivation impairs autonomic and endocrine functions, resulting in extensive changes in many parts of the body system and that sleep disorder is associated with an increased risk of diabetes, hypertension, and depression (Yu et al., 2019).

Alarmingly, recent studies had highlighted a possible association between sleep dysfunction and DED (Magno et al., 2021; Wen et al., 2019; Zhu et al., 2022). Further, the correlation between DED and sleep quality has recently received more attention due to the higher prevalence of DED and poor sleep quality in the general population (Yu et al., 2019). As such, this study investigated the occurrence of DED and poor sleep quality and signify if there was any relationship between the variables in a sample of university students. University students were chosen as the study population for DED because there were limited number of studies conducted on this population (Supiyaphun, Jongkhajornpong, Rattanasiri, & Lekhanont, 2021). Several studies also reported that females have a higher prevalence of DED and have poorer sleep quality than males (Ayaki et al., 2018). Therefore, this study will attempt to investigate this phenomenon to see if such trends exist.

MATERIALS AND METHODS

Study design and sample size

This study is a questionnaire-based, cross-sectional study design which consist of Kulliyyah of Allied Health Sciences (KAHS), International Islamic University Malaysia (IIUM) undergraduate students. Approximately 148 students (74 males and 74 females) from KAHS, were recruited using the convenience sampling technique. The sample size was considered adequate based on the Central Limit Theorem and its implications for sample size determination (Gravetter & Wallnau, 2013; Hays, 1988; Kirk, 1996; Maxwell & Delaney, 2004). An online questionnaire via Google Form was distributed among the students through Whatsapp, email and QR-code.

Data collection

This study complies with the Declaration of Helsinki (World Medical Association, 2013) and ethical approval was obtained from IIUM Research Ethics Committee (IREC). Informed consent was obtained from all participants prior to data collection. The inclusion criteria for this study were (i) undergraduate students of Kulliyyah Allied Health Sciences and (ii) aged between 19-25 years old. Participants with systemic diseases, history of refractive surgery and disorders of lid margin, nasolacrimal duct or cornea were excluded.

The Ocular Surface Disease Index (OSDI) questionnaire was used to diagnose DED (Yu et al., 2019), and the Pittsburgh Sleep Quality Index (PSQI) questionnaire was used to assess the sleeping quality (Schjerven et al., 2021).

a. The Ocular Surface Disease Index (OSDI) Questionnaire

The OSDI questionnaire is a validated questionnaire that is widely used to assess the self-reported severity of dry eye (Yu et al., 2019). The OSDI consists of 12 questions covering three subscales: ocular discomfort (OSDI-symptoms), which includes symptoms such as gritty or painful eyes; functioning (OSDI-function), which measures limitations in performance of typical activities such as reading and working on a computer; and environmental triggers (OSDI-triggers), which measures the impact of environmental triggers, such as wind or drafts, on dry eye symptoms (Cho et al., 2015). All three subscale scores were computed as an overall averaged scores (Cho et al., 2015). Based on the average OSDI scores, participants were classified into different severities of DED: normal, non-DED (scores 0–12), mild (scores 13–22), moderate (scores 23–32), and severe (scores 33–100) (Yu et al., 2019). OSDI scores of 0-12 is normal or non-DED and scores >12 is considered as having DED with different severity (Yu et al., 2019).

b. The Pittsburgh Sleep Quality Index (PSQI) Questionnaire

The PSQI is the most frequently used validated questionnaire for assessing sleep quality in clinical and research settings (Schjerven et al., 2021). It is an effective and valuable tool for measuring subjective sleep quality and sleep disturbances such as insomnia (Kawashima et al., 2016). This self-reported questionnaire assesses the average sleep quality of an individual over the last month (Schjerven et al., 2021). It consists of 19 questions in seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction (Kawashima et al., 2016; Schjerven et al., 2021; Yu et al., 2019). The scores for each component ranges from 0 to 3, and the sum of the scores of these seven components provided a global PSQI scores that ranged from 0 to 21 (Kawashima et al., 2016). Poor sleep quality is defined as PSQI scores >5 (Schjerven et al., 2021).

Data analysis

The data analysis had been conducted using Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM Corp., Armonk, NY, USA). Based on the histogram and Kolmogrov-Smirnov, all the parameters were not normally distributed ($p<0.05$) (Mishra et al., 2019). The Kolmogrov-Smirnov was chosen to assess the normality because the sample size in this study is larger ($n \geq 50$) (Mishra et al., 2019). Since all the data was non normally distributed, non-parametric tests were used to analysed the data. The prevalence of DED and sleep quality was analysed using descriptive analysis (Schjerven et al., 2021). The association between DED and sleep quality was analysed using correlation coefficient (Almutairi et al., 2022). The difference in DED and sleep quality between males and females was evaluated using the non- parametric test, Mann-Whitney U test (Karadimitriou, Marshall Reviewer, &

Knox Sheffield, 2022). A p-value of < 0.05 is considered statistically significant (Prajapati, Dunne, & Armstrong, 2010).

RESULTS

Demographic data

A total of 148 of undergraduate KAHS students of IIUM Kuantan participated in the study. Of the 148 participants, males constituted 50% (n=74) and females constituted 50% (n=74). Approximately 35.8% (n=53) of the participants were spectacle wearers and 9.5% (n=50) used contact lenses. None of the participants had history of refractive surgery, eye disorder or systemic disorder. Therefore, all participants met the inclusion criteria and were included in the analysis. Table 1 describes the demographic data of the study participants.

Table 1 Demographic data of study participants

Demographic data		Number of participants (n)	Percentage (%)
Gender	Male	74	50
	Female	74	50
	Total	148	100
Year of study	1	27	18.2
	2	28	18.9
	3	33	22.3
	4	60	40.5
	Total	148	100
Corrective measures	Spectacles	53	35.8
	Contact lenses	14	9.5
	Refractive surgery	0	0
	Not applicable	81	54.7
	Total	148	100
Previous eye disorder	Yes	0	0
	No	148	100
	Total	148	100
Previous systemic disorder	Yes	0	0
	No	148	100
	Total	148	100

Prevalence of DED and Poor Sleep Quality

The prevalence of DED and sleep quality were analysed using descriptive analysis. Overall, 63.5% (n=94) from 148 of the participants had a scores of OSDI more than 12 indicating the presence of DED. Among the 94 participants who had DED, 43.6% (n=41) were males and 56.4% (n=53) were females. For sleep quality, 60.1% (n=89) of the participants had a scores of PSQI of more than 5, indicating poor sleep quality. Among the 89 participants with poor sleep quality, 40.4% (n=36) were males, and 59.6% (n=53) were females. Table 2 shows the prevalence of DED and poor sleep quality in this study.

Table 2 Prevalence and Frequency of DED and poor sleep quality

Category	Frequency (n)	Prevalence (%)
DED (OSDI scores >12)*		
Total of population	94	63.5%
Male	41	43.6%
Female	53	56.4%

Poor Sleep Quality (PSQI scores >5)[^]		
Total of population	89	60.1%
Male	36	40.4%
Female	53	59.6%

* A presence of DED is considered when the OSDI scores is >12.

^ A presence of Poor Sleep Quality is considered when the PSQI scores is >5.

Association between DED and sleep quality

A Spearman's correlation coefficient was performed to assess the relationship between DED using OSDI scores and sleep quality using PSQI scores (Prajapati et al., 2010). Preliminary analysis showed the relationship to be monotonic, as assessed by visual inspection of a scatterplot in Figure 1. There was a statistically significant but weak positive correlation between OSDI scores and PSQI scores (r^2= 0.264, p= 0.001).
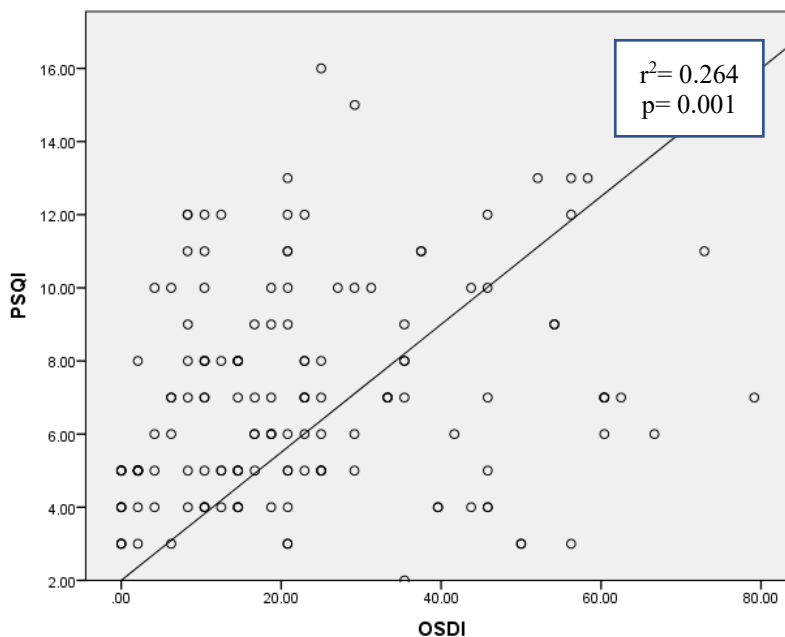

Figure 1 Correlation between OSDI scores and PSQI scores

Difference of DED and sleep quality between males and females

As suggested by Karadimitriou et al. (2022), Mann-Whitney U test was run to determine if there were differences in DED (presence or absence of DED based on OSDI scores) and poor sleep quality between males and females. Distributions of the OSDI scores for males and females were not similar, as assessed by visual inspection in Table 4. OSDI scores for females (mean rank = 85.18) were statistically significantly higher than for males (mean rank = 63.82), U = 1947.5, z = -3.034, p= 0.002 using an exact sampling distribution for U (Dinneen & Blakesley, 1973).

As for sleep quality, distributions of the poor sleep quality through PSQI scores for males and females were not similar, as assessed by visual inspection in Table 4. PSQI scores for females (mean rank = 84.11) were statistically significantly higher than for males (mean rank = 64.89), U = 2027, z = -2.748, p= 0.006 using an exact sampling distribution for U (Dinneen & Blakesley, 1973).

Table 4 The difference in DED and poor sleep quality across gender

	Gender	Mean Rank	U	z- score	p-value
OSDI scores	Female	85.18	1947.5	-3.034	0.002
	Male	63.82			
PSQI scores	Female	84.11	2027.0	-2.748	0.006

Male	64.89	

DISCUSSION

In this study, 63.5% of the participants had DED, and 60.1% had poor sleep quality (Table 2). A previous study by Sundar (2020) reported that 64.1% of engineering students studying at Saveetha Engineering College had DED, and 64.9% had poor sleep quality. Thus, our results were similar with regard to the prevalence of DED and poor sleep quality obtained from their study.

This cross-sectional study revealed a statistically significant but weak positive correlation between poor sleep quality and DED. Previous studies have shown that the association between poor sleep quality and DED is likely complex and bidirectional (Schjerven et al., 2021). Recent studies on sleep and DED have indicated that patients with DED have poorer sleep quality and that patients with sleep disorders are more likely to have DED (Schjerven et al., 2021).

Several studies speculated that DED could lead to poorer sleep quality (Ayaki et al., 2018; A. Li et al., 2022; Yu et al., 2019). Schjerven et al. (2021) reported that patients with DED had significantly poorer sleep quality across all the demographic data and this association persisted even after treatment for other related diseases. According to Schjerven et al. (2021), DED patients from Northern Europe were one and a half times more likely to be poor sleepers, and therefore, DED was found to be strongly correlated with reduced sleep quality. Patients with DED experience deteriorated quality of life, resulting in depression, anxiety, and sleep disorders, and it also has been shown that DED treatment can improve sleep quality (Yu et al., 2019). It is speculated that a psychological component, particularly depression due to DED, might be a major contributor to sleep disorder (Ayaki et al., 2016). Insomnia or sleeplessness could be triggered by dry eye symptoms and ocular pain due to nocturnal eye discomfort and its associated psychological distress that may interfere with sleep initiation (Galor, Seiden, Park, & Feuer, 2018).

This study indicated that the association is two-dimensional, indicating that poor sleep quality can also lead to DED. Several studies claimed that poor sleep quality could lead to DED (Kawashima et al., 2016; Lee et al., 2014; Wen et al., 2019; Yu et al., 2019). Poor sleep quality has been identified as one of the risk factors for DED (Kawashima et al., 2016). The lacrimal glands, which produce tears, are innervated by parasympathetic and sympathetic nerves (Mushriff et al., 2019). It is biologically reasonable that poorer sleep quality can result to dry eye because sleep disorders tend to be related to autonomic dysfunction, which affects the parasympathetic fibres in the lacrimal glands and decreases tear secretion (S. Li et al., 2018; Yu et al., 2019). Sleep deprivation induces a reduction in tear secretion, increases the tear osmolarity and shortens the tear film break-up time, which later can result in ocular surface diseases, primarily DED (Mushriff et al., 2019).

Furthermore, the current study had revealed that females are more prone to DED and poor sleep quality compared to males. There were statistically significant differences in OSDI and PSQI scores between males and females (Table 4). A study by Ayaki et al. (2018), reported that DED and sleep disorders were more prevalent in females than males, which agrees with this study. Females have been recognised as one of the risk factors for DED (Wen et al., 2019). Sex hormones play a major role in regulating ocular surface and adnexal tissues, contributing to the difference in DED prevalence between females and males (Versura, 2019). The results from Ayaki et al. (2016), indicate that sleep quality also deteriorated in women with DED. Individuals with DED have been shown to be depressed, and depression was a common psychological issue in women and is closely related to sleep disorders (Ayaki et al., 2016).

There are several strengths that can be highlighted in this study. As validated questionnaires were used to measure both DED and sleep quality, the data provided were reliable and solid on both outcome variables (Schjerven et al., 2021). Besides, this study also took into account all factors that might influence the DED and poor sleep quality in which several conditions such as history of refractive surgery, systemic diseases and eye disorder were excluded (Mushriff et al., 2019). Hence, these strengths lead to more reliable data and conclusions.

Nevertheless, the current study has several limitations. Since validated questionnaires were used to diagnose DED and poor sleep quality, the results possibly may have been influenced by some personal biases, whereby participants may not have answered all the questions honestly (Almutairi et al., 2022).

In addition, there was also a possibility that they did not fully understand the questions or some terms. Therefore, future research should be conducted by implementing objective tools to evaluate DED and poor sleep quality instead of just relying on questionnaires. In addition, the inclusion criteria of this study also resulted in a small study sample. A larger, prospective studies focusing on sleep quality and DED parameters are needed in order to establish a greater understanding of the impact of sleep quality on DED and vice versa (Schjerven et al., 2021).

CONCLUSION

In conclusion, this study found that DED had a significant positive correlation with poor sleep quality. Therefore, individuals with DED will have a greater risk of poor sleep quality compared to healthy individuals. Females also tend to develop DED and poor sleep quality compared to males. Individuals with DED should be educated on the techniques to improve their sleep patterns. Intervention and awareness to achieve good sleep quality should be advocated to alleviate the occurrence of DED. Since there were 63.5% of KAHS students had DED and 60.1% had poor sleep quality, awareness regarding DED and sleep quality should be further educated among the students to ensure their wellbeing. However, further studies are required to determine the directionality of this correlation and the efficacy of sleep hygiene interventions in alleviating DED and whether intensive DED alleviation methods could successfully improve sleep quality.

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