ISSN: 1607-8322, e-ISSN: 2220-5799 Anaesthesia, Pain & Intensive Care
Vol 30(3); March 2026 DOI: 10.35975/apic.v30i3.3169

ORIGINAL RESEARCH PERI-ANESTHESIA MEDICINE

The prevalence of dry eye syndrome in association with smartphone use in Saudi Arabia

Dina M. Abdulmannan, MD*

Author affiliation:

***Associate Professor, College of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia.

Correspondence: Dr. Dina M. Abdulmannan, Email: dmabdulmannan@uqu.edu.sa Mobile: 00966556363651; ORCID: https://orcid.org/0000-0003-2710-2288

ABSTRACT

Background: Dry eye syndrome (DES) is the leading eye disease globally. Studies on the association of DES with smart device use and prevalence are limited in Saudi Arabia. Therefore, this study aims to investigate the prevalence and predictors of DES.

Methodology: This online cross-sectional survey was conducted in Saudi Arabia between January and July 2023. Schaumberg et al.'s questionnaire tool was used in this study. DES was determined according to WHS criteria (persistent or recurrent) by severe symptoms of dryness and irritation or a prior clinical DES diagnosis. Predictors of DES were identified using binary logistic regression analysis.

Results: This study involved 440 participants. The most used device was the mobile phone (93.0%). Approximately one-third (29.8%) of participants reported using their smart devices for an average of 4-6 hours daily. Social media was the most documented cause of smart device utilization (74.3%). The total of study participants with DES is estimated to be 43.4%. The potential to have DES was higher in females, those aged 24-35 and 41-50 years, divorced, unemployed, spectacle wearers, and contact lens users than others ($P < 0.05$).

Conclusion: DES is a prevalent health issue among the general Saudi population. Additional research is mandated to determine other DES-associated risk factors. Future studies should focus on recognizing approaches that could assist in reducing the incidence of DES, which results from the unavoidable prolonged digital device usage by considerable social groups.

Keywords: Dry eye syndrome; General public; Saudi Arabia; Smartphone

Citation: Abdulmannan DM. The prevalence of dry eye syndrome in association with smartphone use in Saudi Arabia. Anaesth. pain intensive care 2026;30(3):319-326. **DOI:** 10.35975/apic.v30i3.3169

Received: October 08, 2025; **Revised:** March 02, 2026; **Accepted:** March 02, 2026

1. INTRODUCTION

Dry eye syndrome (DES) encompasses a diverse range of conditions, all linked by the common issue of insufficient lubrication of the eye's surface. DES is marked by the presence of symptoms such as discomfort and dryness in the eyes, which result from a lack of tears or tears that are of inadequate quantity or quality. These symptoms can significantly impact a person's quality of life.[1] DES can be divided into two primary categories: aqueous-deficient and evaporative conditions. In both categories, there is a heightened tear film osmolarity accompanied by ocular surface inflammation.[2] Indeed, hot, or windy weather conditions, the use of contact lenses, specific medications, medical issues like diabetes, the natural aging process, activities that diminish blinking frequency, and hormonal changes in women were mentioned as the main causes of DES.[3]

While the prevalence of DES falls within a range of 7% to 34%, and this variation can be attributed to factors such as the type of diagnostic criteria used, or the specific population being studied, recent studies indicated a significant prevalence of DES in Saudi Arabia, with higher rates among specific patient

populations and risk factors such as gender, duration of disease, and contact lens use.[4,5] Other major risk factor may include being Saudi Arabia with one of the most scorching desert climates, where temperatures can soar up to 50 degrees Celsius during the summer months, where this presents a significant risk factor for DES.[6]

The usage of smartphones is in a significant increase and many factors and events led to this increase, including the COVID-19 pandemic, where elevated the level of digital screen usage among people due to the necessity of staying indoors and the motivation to work, study, and socialize remotely.[7,8] As a response in the pandemic it was found that there is a significant increase of screen time including smartphone use in France,[9] Canada,[10] and Germany.[11] Lately, there is an extensive presence of smartphones and social media use in Saudi Arabia.[12] Along with its presence, many health hazards were found to be associated with smartphones usage including fatigue, headache, dizziness, tension, and sleep disturbance.[13] Besides, the increased prevalence of smartphones among young adult led to increased prevalence of smartphone addiction that is associated with musculoskeletal, upper limb, eye, and sleep complications.[14] Additionally, it was found that smartphone use was associated with ocular manifestations, including ocular pain and dryness.[15]

A previous study in Jordan and Iraq estimated that the prevalence of DES among university students is around 33.4%.[16] While the Saudi Arabian population faces an increased DES risk because of various epidemiological and environmental factors,[17] they also face an increased risk of DES due to increased screen use and smartphone usage. Increased smartphone use is correlated with an upsurge in the risk of severe symptoms and clinical diagnosis of dry eye disease.[18] The estimated prevalence of DES in individuals who use digital screens varied significantly, spanning from 9.5% to 87.5%,[19] and this suggests that this uptick in screen utilization and smartphone use could potentially result in a rise in the prevalence of dry eye symptoms.[8,20] Therefore, to fill the knowledge gap in Saudi Arabia, as limited research exists on this topic and its relationship with smart device use, this study aims to examine DES prevalence and its associated factors with smartphone use among the Saudi public.

2. METHODOLOGY

This online cross-sectional survey was conducted among the general public in Saudi Arabia between January to July 2023. The study sample was generated through convenience sampling. The survey link was distributed via social media platforms (Twitter, Snapchat, WhatsApp, and Facebook). This method of sampling can be considered under non-probability sampling. In this research all eligible people who met the inclusion criteria available at the time of conducting the study have been included. Based on previous research with a CI of 95%, SD of 0.5, and a margin of error of 5%, the minimum required sample size was 383 participants.

An informed consent form was the first page of the questionnaire, which had provided an option to stop there or to continue. The aims of the study were clearly explained to the participants so that they could understand the need for them to participate. The letter of invitation into the study outlined the inclusion criteria.

The inclusion criteria for this study were individuals who had smartphones, above the age of 18 years. The exclusion criteria were people who were not eligible or refused to participate and participants with any systemic conditions (e.g., diabetes mellitus and hypertension), any ocular diseases including (eye allergies), or participants using the following medications (e.g., menthol ointment, dopamine antagonists).

A previous developed questionnaire by Schaumberg et al. (Women's Health Study Questionnaire) was used to estimate the prevalence of DES among the study participants.[21] Besides, this study collected demographic data for the participants including gender, age group, marital status, education, employment, monthly income, smoking status. In addition, this study examined the use of medical glasses, use of eye lenses, average time using smart devices, the most common reason for using smart devices, the most commonly used applications, and the self-rated quality and comfort of sleep. DES was defined as the presence of clinically diagnosed DES or the presence of severe symptoms (both irritation and dryness constantly or often).

The questionnaire instrument was reviewed by clinicians at Umm Al-Qura University. They were asked about the clarity, understandability, face validity, and whether any of the questions were confusing. They stated the questionnaire was easy to read and answer. A pilot study with a few subjects was conducted beforehand for checking comprehension. The findings of the study demonstrated that the questionnaire is simple and easy to comprehend.

Statistical analysis

The Statistical Package for Social Science (SPSS) software (version 29) was used to analyse the data for this study. Categorical variables were presented as frequencies and percentages. Predictors of DES were identified using binary logistic regression analysis. DES was defined as having severe symptoms of dryness and irritation, either persistent or recurrent, or a prior clinical DES diagnosis. Statistical significance was defined as two-sided $P < 0.05$.

3. RESULTS

Table 1: Participants' demographic characteristics

Variable		Frequency (%)
Gender	Males	220 (50.0)
Age group	18-23 years	91 (20.7)
	24-30 years	65 (14.8)
	31-35 years	35 (8.0)
	36-40 years	32 (7.3)
	41-45 years	51 (11.6)
	46-50 years	60 (13.6)
	51 years and above	106 (24.1)
Marital status	Single	150 (34.1)
	Married	262 (59.5)
	Divorced	19 (4.3)
	Widowed	9 (2.0)
Education	Secondary school or lower	88 (20.0)
	Bachelor	288 (65.5)
	Higher education	64 (14.5)
Employment	Retired	72 (16.4)
	Unemployed	93 (21.1)
	Employed	186 (42.3)
	University student	89 (20.2)
Monthly income	Less than 2500 SAR	68 (15.5)
	2501-5000 SAR	50 (11.4)
	5001-7500 SAR	45 (10.2)
	More than 7500 SAR	277 (63.0)
Smoking		79 (18.0)
Any eye diseases?	Near-sightedness	161 (36.6)
	Far-sightedness	51 (11.6)
	Aberration in sight	49 (11.1)
Use of glasses		216 (49.1)
Use of eye lenses		86 (19.5)

This study involved a total of 440 participants. Around one-quarter of them (24.1%) were 51 years and over. More than half of them (59.5%) were married and hold bachelors' degree (65.5%). Around 42.3% of them were employed. The monthly income for 63.0% of the study participants was more than 7500 Saudi Arabia riyal (SAR). Around one-fifth of the study participants were smokers (18.0%). Almost one-third of them (36.6%) reported that they have near-sightedness. Around half of them (49.1%) reported that they ear eyeglasses and 19.5% use contact lenses.

Table 2: Smart devices utilisation pattern

Variable	Frequency (%)
The most commonly used device	
Mobile phone	409 (93.0)
IPad or tablet	92 (20.9)
Laptop or personal computer	104 (23.6)
Television	91(20.7)
Average time using smart devices (taken from device settings)	
Less than two hours	37 (8.4)
2-4 hours	88 (20.0)
4-6 hours	131 (29.8)
6-8 hours	104 (23.6)
8 hours and above	80 (18.2)
The most common reason for using smart devices	
Calling and texting	78 (17.7)
Social media	327 (74.3)
Gaming	35 (8.0)
Most commonly used applications	
Snap Chat	202 (45.9)
TikTok	160 (36.4)
YouTube	156 (35.5)
Instagram	146 (33.2)
Telegram	49 (11.1)
Facebook	35 (8.0)
Others	148 (33.6)
How do you rate your ability to sleep and your comfort during sleep?	
Weak	131 (29.8)
Good	309 (70.2)

Smart devices utilisation pattern

Table 2 presents smart devices utilisation pattern among the study participants. The most used device was the

Table 3: Dry eye syndrome symptoms assessment

Demographic variable	Frequency (%)			
1. Have you ever been diagnosed by a clinician as having dry eye syndrome?				
Yes			168 (38.2)	
If yes, do you use moisturizing eye drops to treat the problem of dry eyes?			158 (94.0)	
Frequency	**Constantly**	**Often**	**Sometimes**	**Never**
2. How often do your eyes feel dry (not wet enough)?	5.7)	13.9)	53.0)	27.5)
3. How often do your eyes feel irritated?	3.6)	13.2)	50.9)	32.3)

Table 4: Predictors of dry eye syndrome

Variable		OR (95% CI)	P-value
Gender	Females (Reference)	1.00	
	Males	0.35 (0.24-0.52)	<0.001
Age group	18-23 years (Reference)	1.00	
	24-30 years	2.44 (1.26-4.74)	0.008**
	31-35 years	2.51 (1.13-5.59)	0.024*
	36-40 years	2.09 (0.91-4.78)	0.080
	41-45 years	2.47 (1.21-5.01)	0.013*
	46-50 years	2.71 (1.38-5.34)	0.004**
	51 years and above	1.44 (0.79-2.61)	0.234
Marital status	Single (Reference)	1.00	
	Married	1.35 (0.90-2.04)	0.148
	Divorced	3.64 (1.31-10.11)	0.013*
	Widowed	2.10 (0.54-8.14)	0.284
Education	Secondary school or lower (Reference)	1.00	
	Bachelor	0.87 (0.54-1.41)	0.578
	Higher education	1.42 (0.75-2.72)	0.284
Employment	Retired (Reference	1.00	
	Unemployed	2.03 (1.09-3.79)	0.027*
	Employed	1.01 (0.58-1.76)	0.969
	University student	0.64 (0.34-1.23)	0.181
Monthly income	< 2500 SAR (Reference)	1.00	
	2501-5000 SAR	1.71 (0.82-3.58)	0.153
	5001-7500 SAR	1.41 (0.66-3.00)	0.378
	More than 7500 SAR	0.90 (0.53-1.54)	0.698
Are you a current smoker?	No (Reference)	1.00	
	Yes	0.81 (0.49-1.33)	0.410
Any eye diseases?	No (Reference)	1.00	
	Near-sightedness	1.43 (0.93-2.20)	0.108
	Far-sightedness	1.12 (0.59-2.10)	0.734
	Aberration in sight	1.66 (0.88-3.14)	0.118
Do you wear a medical glass?	No (Reference)	1.00	
	Yes	2.05 (1.40-3.01)	<0.001
Do you use eye lenses?	No (Reference)	1.00	
	Yes	1.76 (1.09-2.83)	0.020*

mobile phone (93.0)). Approximately one-third (29.8%) of participants reported using their smart devices for an average of 4-6 hours daily. Social media was the most documented cause of smart device utilization (74.3%). Snap Chat was the most used application among our study sample (45.9%). The majority of the study participants (70.2%) rated their ability to sleep and their comfort during sleep good.

Dry eye syndrome prevalence

The total estimation of participants with DES (who have severe symptoms of dryness and irritation, either persistent or recurrent, or a prior clinical DES diagnosis) is 43.4%. Most of the participants who were diagnosed with DES by a clinician reported that they use moisturizing eye drops (94.0%) (Table 3).

Predictors of dry eye syndrome

Table 4 presents predictors of DES identified by the binary

logistic regression analysis. The potential to have DES was higher in females, those aged 24-35 and 41-50 years, divorced, unemployed, spectacle wearers, and contact lens users than others ($P < 0.05$).

4. DISCUSSION

Dry eye syndrome includes various conditions characterized by insufficient eye lubrication. It leads to discomfort and dryness due to inadequate or low-quality tears, significantly affecting one's quality of life. Indeed, increased smartphone use is linked to an elevated risk of clinical diagnosis of DES and severe DES symptoms.[18] This implies that the increased screen time and smartphone usage may lead to a potential increase in the occurrence of dry eye symptoms.[8,20] Moreover, the Saudi Arabian population has an increased DES because of epidemiological and environmental factors.[17] Therefore, this research aimed to examine the prevalence of DES and its associated factors with smartphone use among the Saudi public.

One of the remarkable trends in eye care is the swift worldwide increase in myopia, commonly known as near-sightedness. The current investigation found that about one-third of participants (36.6%) reported experiencing near-sightedness. These results are close to the global prevalence, as near-sightedness affects more than 28% of the world's population, and projections indicate that around half of the world's population (totalling approximately five billion people) will experience some level of near-sightedness by 2050.[22] Near-sightedness can result in squinting, eye fatigue, headaches, and substantial visual impairment,[23] and dry eye patients exhibit impaired functional visual acuity as well, and this lead to an abnormal visual function. In matter of fact, dryness and ocular surface discomfort along with near-sightedness are a well-known symptoms experienced by computer users.[24]

Smartphones are currently the most popular form of mobile devices.[25,26] Therefore, as a parallel result, in this study, it was found that the mobile phone was the most frequently used device, with 93.0% of participants using it, with approximately one-third (29.8%) of the study participants reported using their smart devices for an average of 4-6 hours each day. This similar to a previous study that was conducted in China, where the average duration of mobile phone usage was 5.4 for males and 6.1 for females among university students,[27] and 6 hours in another study that was conducted in India as well.[27] Indeed, the frequency and duration of smartphone usage were found to be linked to personality traits and demographic factors, such as age and gender.[28]

The findings of this study showed that the primary reason for using smart devices was social media, reported by 74.3% of participants, as a matter of fact, social media has become a part of daily life people use.[29] The primary motivations for using social media services on mobile devices were to stay informed, maintain social connections, and find diversion or entertainment.[30] Moreover, social media became the primary reason for using smart devices [29] and this interprets the increased use of social media in smart devices. Additionally, among this study sample, Snapchat was the most frequently used application, with 45.9% of participants using it. Indeed, in 2015, Saudi Arabia had the eighth-highest users on Snapchat worldwide, where approximately 26% of Saudi teenagers uses Snapchat, even if the percentage of users is different than this study finding for sampling differences, there is a clear increase of mobile phone and social media usage among Saudis and a higher estimation of increasing number of users of social media and smart devices with time in Saudi Arabia.[31] Interestingly, Snapchat has gained growing popularity in Saudi Arabia, with a penetration rate of 13%.[32] Snapchat is commonly used for sharing videos, pictures, and text messages; approximately 30% of Saudi Arabian Snapchat users spend one hour every day on the app, and more than 30% spend two hours daily on it.[33]

Most of this study participants (70.2%) reported having a good ability to sleep and feeling comfortable during sleep. Indeed, there is a significant relationship between DES and feeling comfortable during sleep, where poor sleep quality was significantly associated with more severe dry eye symptoms.[34] Besides, shorter sleep duration is associated with a higher prevalence of DES.[35] However, the findings concerning that an increased sleep quality and comfort during sleep isn't inline to the findings of a previous study, where increased smartphone use can alter the quality of sleep.[36] Also, in Saudi Arabia, it was found that sleep disturbances and poor sleep quality are prevalent among Saudi adult.[37,38]

Additionally, the total estimation of participants with DES (who have severe symptoms of dryness and irritation, either persistent or recurrent, or a prior clinical DES diagnosis) is 43.4%. This finding is consistent with the literature. An earlier study conducted in the western region of Saudi Arabia indicated a high prevalence of DES among study participants.[39] Another earlier study from Riyadh found that 40.7% of participants were previously diagnosed with DES.[40] Indeed, several factors are associated to the incidence of DES including gender, duration of disease, climate, and contact lens use.[5] In this study, most participants (94.0%) diagnosed with DES indicated using moisturizing eye drops. Effectively treating this widely prevalent condition can significantly enhance individuals' quality of life and prevent harm to the eye's surface.[41] The use of moisturizers is significantly employed in the treatment of DES.

However, it is indicated that the first-line treatment of DES includes tear substitution with artificial tears, ointments, and gels to moisturize the eye's surface.[42,43] Other treatment options include moisture chamber use, therapeutic contact lenses, and punctual plug occlusion.[43]

After examining various demographic factors and their correlation with the likelihood of developing DES, the study identified that females, those aged 24-35 years and 41-50 years, divorced, unemployed, those who wear eyeglasses, and those who use contact lenses were more likely to have DES compared to others. In fact, gender differences may alter the prevalence of DES, where just like this study findings, females tend to have DES signs and symptoms more than males.[44] The increased prevalence of DES in females is highly related to the presence of a role of sex hormones in DES, where hormonal imbalances, particularly estrogen and androgen insufficiency, may contribute to the onset or worsening of DES, especially in menopausal women.[45] Similar to the findings of this study, DES was more prevalent in older individuals,[46] where aging-related factors (like oxidative stress, declined blink rates, androgen deficiency, and polypharmacy) can predispose older adults to DES.[47] Additionally, wearing eyeglasses is considered a risk factor for DES,[48] and wearing contact lenses is also for a long term may significantly increase the incidence of DES.[49] Contact lenses can disturb the tear film structure, adversely impact the eye's surface, and cause dryness.[50] Lastly, to mitigate the growing concern of DES exacerbated by increased smartphone usage in Saudi Arabia, it is imperative to launch public awareness campaigns promoting responsible screen time practices and advocating for regular eye examinations. Additionally, tailored interventions should be developed to address specific demographic groups, including females, older individuals, and contact lens wearers, in order to provide targeted support and effective management of DES within these populations.

5. Strengths and Limitations

This study is among the first few studies that examined the prevalence of dry eye syndrome in association with smartphone use in the general population in Saudi Arabia. This investigation has limitations, including the cross-sectional design, which limited the ability to explore the causal relationship between the study variables. Also, convenience sampling may have overlooked some members of the investigation population. Therefore, results need to be interpreted with caution.

6. CONCLUSION

This study underscores the rising trends of DES and the potential impact of increased smartphone usage on eye health in Saudi Arabia. It highlights the need for proactive measures to educate the public on responsible screen time and the importance of regular eye check-ups, particularly for at-risk groups. By addressing these issues, we can work towards enhancing eye health and overall well-being in the population. Future research should implement the longitudinal study design and random sampling technique to examine the causality across the study variables and enhance the generalizability. Furthermore, future research should involve medical examination to enhance the accuracy of the diagnosis of DES.

7. Data availability

All data are available on reasonable request.

8. Ethical Considerations

The research ethics committee approved the study protocol (REC- H-02-K-077-0320-274). Informed consent was obtained from the study participants prior to study commencement.

9. Competing Interests

None declared by the authors.

10. Funding

None.

11. Authors contribution

Dina M. Abdulmannan was the sole researcher and the author of this manuscript.

12. REFERENCES

1. McMonnies CW, Ho A. Patient history in screening for dry eye conditions. J Am Optom Assoc. 1987;58(4):296-301.
2. Definition and Classification Subcommittee. The definition and classification of dry eye disease: report of the Definition and Classification Subcommittee of the International Dry Eye WorkShop (2007). Ocul Surf. 2007;5(2):75-92.
3. Deepthi TB. Dry Eye Syndrome. The Journal of Nursing Trendz. 2017;8:34.
4. Dossari SK, Alkhars AZ, Albaqshi AA, et al. Prevalence of Dry Eye Disease and Its Risk Factors Among the General Population of Saudi Arabia: A Cross-Sectional Survey. Cureus. 2022;14(12):e32552.

5. Almutairi AH, Alalawi BS, Badr GH, Alawaz RA, Albarry M, Elbadawy HM. Prevalence of dry eye syndrome in association with the use of contact lenses in Saudi Arabia. BMC Ophthalmol. 2021;21(1):147.

6. Alshamrani AA, Almousa AS, Almulhim AA, et al. Prevalence and Risk Factors of Dry Eye Symptoms in a Saudi Arabian Population. Middle East Afr J Ophthalmol. 2017;24(2):67-73.

7. Vanderloo LM, Carsley S, Aglipay M, Cost KT, Maguire J, Birken CS. Applying Harm Reduction Principles to Address Screen Time in Young Children Amidst the COVID-19 Pandemic. J Dev Behav Pediatr. 2020;41(5):335-336.

8. Hussaindeen JR, Gopalakrishnan A, Sivaraman V, Swaminathan M. Managing the myopia epidemic and digital eye strain post COVID-19 pandemic - What eye care practitioners need to know and implement? Indian J Ophthalmol. 2020;68(8):1710-1712.

9. Rolland B, Haesebaert F, Zante E, Benyamina A, Haesebaert J, Franck N. Global Changes and Factors of Increase in Caloric/Salty Food Intake, Screen Use, and Substance Use During the Early COVID-19 Containment Phase in the General Population in France: Survey Study. JMIR Public Health Surveill. 2020;6(3):e19630.

10. Colley RC, Bushnik T, Langlois K. Exercise and screen time during the COVID-19 pandemic. Health Rep. 2020;31(6):3-11.

11. Schmidt SCE, Anedda B, Burchartz A, et al. Physical activity and screen time of children and adolescents before and during the COVID-19 lockdown in Germany: a natural experiment. Sci Rep. 2020;10(1):21780.

12. Alsubaie AQ, Lyndon N. The perceived impact of social media access on rural communities in Al-Ahsa region, Saudi Arabia. e-BANGI. 2020;17(9):61-74.

13. Al-Khlaiwi T, Meo SA. Association of mobile phone radiation with fatigue, headache, dizziness, tension and sleep disturbance in Saudi population. Saudi Med J. 2004;25(6):732-736.

14. Alkhateeb A, Alboali R, Alharbi W, Saleh O. Smartphone addiction and its complications related to health and daily activities among university students in Saudi Arabia: A multicenter study. J Family Med Prim Care. 2020;9(7):3220-3224.

15. Issa LF, Alqurashi KA, Althomali T, Alzahrani TA, Aljuaid AS, Alharthi TM. Smartphone Use and its Impact on Ocular Health among University Students in Saudi Arabia. Int J Prev Med. 2021;12:149.

16. Abdulmannan DM, Naser AY, Ibrahim OK, et al. Visual health and prevalence of dry eye syndrome among university students in Iraq and Jordan. BMC Ophthalmol. 2022;22(1):1-16.

17. Alharbi AJ, Alanazi N, Alhamad J, Alabdulqader R, Aljamea D, Abdulqader S. Prevalence of symptomatic dry eye and its risk factors among coastal population in Eastern Province of Saudi Arabia. EC Ophthalmol. 2019;10(6):503-509.

18. Al-Mohtaseb Z, Schachter S, Shen Lee B, Garlich J, Trattler W. The Relationship Between Dry Eye Disease and Digital Screen Use. Clin Ophthalmol. 2021;15:3811-3820.

19. Courtin R, Pereira B, Naughton G, et al. Prevalence of dry eye disease in visual display terminal workers: a systematic review and meta-analysis. BMJ Open. 2016;6(1):e009675.

20. Giannaccare G, Vaccaro S, Mancini A, Scorcia V. Dry eye in the COVID-19 era: how the measures for controlling pandemic might harm ocular surface. Graefes Arch Clin Exp Ophthalmol. 2020;258(11):2567-2568.

21. Schaumberg DA, Sullivan DA, Buring JE, Dana MR. Prevalence of dry eye syndrome among US women. Am J Ophthalmol. 2003;136(2):318-326.

22. Holden BA, Fricke TR, Wilson DA, et al. Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. Ophthalmology. 2016;123(5):1036-1042.

23. Sy Go M. Nearsightedness. In: All about Your Eyes, Second Edition, revised and updated.2020.

24. Murube J, Murube E. Near vision accommodation in horizontality with VDT: why low blinking and dry eye? Adv Exp Med Biol. 2002;506(Pt B):1205-1211.

25. Finley B, Soikkeli T. Multidevice mobile sessions: A first look. Pervasive and Mobile Computing. 2017;39:267-283.

26. Oliver E. The challenges in large-scale smartphone user studies. Paper presented at: Proceedings of the 2nd ACM International Workshop on Hot Topics in Planet-scale Measurement2010.

27. Li W, Cui Y, Gong Q, Huang C, Guo F. The Association of Smartphone Usage Duration with Physical Fitness among Chinese University Students. Int J Environ Res Public Health. 2022;19(1).

28. Beierle F, Probst T, Allemand M, et al. Frequency and duration of daily smartphone usage in relation to personality traits. Digital Psychology. 2020;1(1):20-28.

29. Yeo SF, Tan CL, Lim KB, Teng S. Wearable technology and social media: An insight of consumer buying behaviour. Paper presented at: Global Conference on Business and Social Sciences Proceeding2020.

30. Cui Y, Wang L. Motivations for accessing social networking services on mobile devices. Paper presented at: Proceedings of the International Working Conference on Advanced Visual Interfaces2012.

31. Statista. Smartphone Users in Saudi Arabia 2014–2019. 2016; http://www.statista.com/statistics/494616/smartphone-users-insaudi-arabia/. Accessed 6/10, 2017.

32. Statista. Saudi Arabia: Social Network Penetration 2015. http://www.statista.com/statistics/284451/saudi-arabia. Accessed 6/10, 2017.

33. Arab News. Saudi social media users ranked 7th in world. 2015; https://www.arabnews.com/saudi-arabia/news/835236. Accessed 6/10, 2017.

34. Yu X, Guo H, Liu X, et al. Dry eye and sleep quality: a large community-based study in Hangzhou. Sleep. 2019;42(11).

35. Lee W, Lim SS, Won JU, et al. The association between sleep duration and dry eye syndrome among Korean adults. Sleep Med. 2015;16(11):1327-1331.

36. Harahap AR, Parbo FP. Hubungan Antara Sikap Penggunaan Smartphone dengan Kualitas Tidur pada Siswa SMA Kartini Batam. Zona Kedokteran: Program Studi Pendidikan Dokter Universitas Batam. 2022;12(3):261-268.

37. Wali SO, Krayem AB, Samman YS, Mirdad S, Alshimemeri AA, Almobaireek A. Sleep disorders in Saudi health care workers. Ann Saudi Med. 1999;19(5):406-409.

38. Alamri[1] FA, Amer[1] SA, Almubarak A, Alanazi H. Sleep Quality among Healthcare Providers; In Riyadh, 2019. Age (y). 2019;20:30.

39. Kalakattawi RM, Al Rubaie SS, Alslaqi RM, Al-Shehri L, Alzahrani AA. Knowledge and Practice Regarding Dry Eye among General Population in Western Region of Saudi Arabia. J Basic Clin Pharm. 2018;9(1).

40. Almujalli AA, Almatrafi AA, Aldael AA, Aljudi TW, Abdulhalim B-EH. The prevalence and risk factors for symptomatic dry eye in adults in Riyadh, Saudi Arabia. The Open Ophthalmology Journal. 2021;15(1).

41. Kaštelan S, Tomić M, Salopek-Rabatić J, Novak B. Diagnostic procedures and management of dry eye. Biomed Res Int. 2013;2013:309723.

42. Lodén M, Maibach HI. Treatment of dry skin syndrome: the art and science of moisturizers. Springer Science & Business Media; 2012.

43. Módis L, Szalai E. Dry eye diagnosis and management. Expert review of ophthalmology. 2011;6(1):67-79.

44. Rapoport Y, Singer JM, Ling JD, Gregory A, Kohanim S. A Comprehensive Review of Sex Disparities in Symptoms, Pathophysiology, and Epidemiology of Dry Eye Syndrome. Semin Ophthalmol. 2016;31(4):325-336.

45. Versura P, Giannaccare G, Campos EC. Sex-steroid imbalance in females and dry eye. Curr Eye Res. 2015;40(2):162-175.

46. Chia EM, Mitchell P, Rochtchina E, Lee AJ, Maroun R, Wang JJ. Prevalence and associations of dry eye syndrome in an older population: the Blue Mountains Eye Study. Clin Exp Ophthalmol. 2003;31(3):229-232.

47. Sharma A, Hindman HB. Aging: a predisposition to dry eyes. J Ophthalmol. 2014;2014:781683.

48. Yao W, Davidson RS, Durairaj VD, Gelston CD. Dry eye syndrome: an update in office management. Am J Med. 2011;124(11):1016-1018.

49. Apostol S, Filip M, Dragne C, Filip A. Dry eye syndrome. Etiological and therapeutic aspects. Oftalmologia. 2003;59(4):28-31.

50. Lafosse E, Wolffsohn JS, Talens-Estarelles C, García-Lázaro S. Presbyopia and the aging eye: Existing refractive approaches and their potential impact on dry eye signs and symptoms. Cont Lens Anterior Eye. 2020;43(2):103-114.

