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Assessment of seasonal variations in dry eye syndrome prevalence among office workers

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ABSTRACT

Background: Dry eye syndrome (DES) is prevalent among office workers and influenced by various environmental and individual factors. This study assesses the prevalence, seasonal variations, symptom severity, and environmental influences on DES among office workers. **Aims and Objectives:** The study aimed to assess the prevalence of DES among office workers in Warangal, Telangana, India, and to evaluate the impact of seasonal variations, symptom severity, and environmental factors on DES. **Materials and Methods:** A cross-sectional study was conducted with 100 office workers aged 25–55 years old. Data were collected through questionnaires on DES symptoms, environmental conditions, and demographics. The prevalence of DES was calculated, and seasonal variations were analyzed. Symptom severity was recorded on a scale from 1 to 10. Environmental factors such as humidity, air-conditioning use, screen time, and indoor air quality were examined for their correlation with DES prevalence. **Results:** The overall prevalence of DES was 45%, with females showing a higher prevalence (50%) compared to males (37.5%). Seasonal variations showed the highest DES prevalence in winter (40%) and the lowest in summer (16%). Symptom severity scores were highest in winter (6.5 overall) and lowest in summer (3.8 overall). Low humidity in winter was associated with a 55% prevalence of DES, especially among females (65%). High air-conditioning use in summer correlated with a lower DES prevalence (12.5%). Increased screen time (>6 h/day) resulted in a 60% prevalence of DES, with seasonal peaks in winter (65%). Poor indoor air quality was reported by 70% of participants and linked to a 50% prevalence of DES. **Conclusion:** The study highlights significant gender differences, seasonal variations, and environmental factors impacting DES prevalence and severity among office workers. Interventions focusing on improving workplace conditions, managing screen time, and enhancing indoor air quality may mitigate DES symptoms.

Key words: Dry eye syndrome; Prevalence; Seasonal variations; Symptom severity; Environmental factors

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INTRODUCTION

Dry eye syndrome (DES) is a multifactorial disease of the tears and ocular surface that results in discomfort, visual disturbance, and tear film instability, with potential damage to the ocular surface.[1] It is a prevalent condition that affects millions of people worldwide, particularly those who spend long hours working on computers or in air-conditioned environments.[2] DES has become increasingly common among office workers due to prolonged exposure to computer screens, environmental conditions such as low humidity and air-conditioning, and other occupational factors.[3,4]

In Warangal, Telangana, India, the office environment and climatic conditions present unique challenges that may exacerbate DES symptoms. The region experiences significant seasonal variations, with hot summers and cool winters, which can impact the prevalence and severity of DES among office workers. In addition, the rapid adoption of digital technology in workplaces has led to increased screen time, contributing further to the incidence of DES.[5]

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Previous studies have highlighted the role of environmental factors such as humidity, air-conditioning use, and indoor air quality in the development and exacerbation of DES.[6,7] However, there is limited research specifically focusing on the office worker population in Warangal. Understanding the prevalence, seasonal variations, and environmental influences on DES in this specific demographic is crucial for developing effective interventions to mitigate the symptoms and improve the quality of life for affected individuals.

Aims and objectives

Aims

The study aimed to assess the prevalence of DES among office workers in Warangal, Telangana, India, and to evaluate the impact of seasonal variations, symptom severity, and environmental factors on DES.

Objectives

- To determine the overall prevalence of DES among office workers, with a focus on gender differences
- To analyze seasonal variations in DES prevalence among office workers
- To assess the severity of DES symptoms by season and gender
- To examine the impact of low humidity on DES prevalence during winter
- To evaluate the effect of high air-conditioning use on DES prevalence during summer
- To investigate the correlation between increased screen time and DES prevalence across different seasons
- To analyze the effect of poor indoor air quality on DES prevalence.

MATERIALS AND METHODS

Study design

This cross-sectional study was conducted to assess the prevalence, seasonal variations, symptom severity, and environmental influences on DES among office workers.

Study setting

The study was carried out at Kakatiya Medical College and Hospital, Warangal, Telangana, India.

Study period

The study was conducted over a period of 1 year, from May 2023 to April 2024.

Study population

The study included 100 office workers aged 25–55 years old, working in various corporate offices in Warangal, Telangana. The sample comprised 60 females and 40 males.

Data collection

Data were collected through structured questionnaires that were distributed to the participants. The questionnaire included sections on:

Demographic information

Age, gender, and occupation.

DES symptoms

Participants were asked about their experiences with dry eye symptoms, including discomfort, visual disturbance, and tear film instability.

Symptom severity

Participants rated the severity of their symptoms on a scale from 1 to 10, with 10 being the most severe.

Environmental conditions

Questions related to workplace environmental factors, such as humidity, air-conditioning use, screen time, and indoor air quality.

Assessment of DES

The prevalence of DES was determined based on the responses to the questionnaire. Participants who reported experiencing dry eye symptoms frequently or constantly were classified as having DES.

Seasonal variations

The data collected were analyzed to determine the prevalence of DES in different seasons: winter, spring, summer, and autumn.

Symptom severity analysis

The severity of DES symptoms was assessed across different seasons and genders. Participants' severity scores were averaged to determine overall and gender-specific severity in each season.

Environmental factors

The study examined the correlation between DES prevalence and various environmental factors:

Humidity levels

The impact of low humidity during winter on DES prevalence was analyzed.

Air-conditioning use

The effect of high air-conditioning use during summer on DES prevalence was evaluated.

Screen time

The relationship between increased screen time (>6 h/day) and DES prevalence was investigated across all seasons.

Indoor air quality

The prevalence of DES was analyzed in relation to reported indoor air quality, particularly the presence of pollutants and lack of ventilation.

Statistical analysis

Descriptive statistics were used to summarize the data. The prevalence of DES was calculated as a percentage of the total sample. Symptom severity scores were averaged for overall and gender-specific analyses. The influence of environmental factors on DES prevalence was examined using correlation analysis.

Ethical considerations

The study was approved by the Institutional Ethics Committee, Kakatiya Medical College and Hospital, Warangal (KMC/IEC/2023/08). Informed consent was obtained from all participants before data collection, ensuring confidentiality and voluntary participation.

RESULTS

The study assessed the prevalence of DES among 100 office workers in Warangal, Telangana, India, examining various factors including gender, seasonal variations, symptom severity, and environmental conditions. The findings are detailed below.

Prevalence of DES

Out of the 100 participants, 45 individuals were diagnosed with DES, resulting in an overall prevalence of 45%. Gender differences were notable, with females exhibiting a higher prevalence of 50%, compared to 37.5% in males (Table 1 and Figure 1).

Seasonal variations

DES prevalence showed significant seasonal variations. The highest prevalence was observed in winter (40%), followed by spring (24%), autumn (20%), and summer (16%) (Table 2 and Figure 2).

Symptom severity

Participants reported the severity of their symptoms on a scale from 1 to 10, with 10 being the most severe. The average symptom severity scores varied by season and gender. In winter, the overall severity was 6.5, with females reporting higher severity (7.0) compared to males (5.8). Symptom severity was lowest in summer (3.8 overall), with females at 4.0 and males at 3.5. In spring and autumn, the severity scores were 4.2 and 5.0 overall, respectively, with females consistently reporting higher severity than males (Table 3 and Figure 3).

Table 1: Prevalence of dry eye syndrome

Gender	Number of DES cases	Prevalence (%)
Females	30	50
Males	15	37.5
Total	45	45

DES: Dry eye syndrome

Environmental factors

The study examined the impact of various environmental factors on DES prevalence.

Low humidity (Winter)

During winter, 75% of participants worked in low-humidity environments, which correlated with a higher DES prevalence of 55%. Among these, 65% of females and 40% of males were affected (Table 4).

Air-conditioning use (Summer)

In summer, 80% of participants reported high air-conditioning use, which was associated with a lower DES prevalence of 12.5%. Specifically, 15% of females and 10% of males using high air-conditioning reported DES (Table 5).

Table 2: Seasonal variations in dry eye syndrome prevalence

Season	Number of DES cases	Prevalence (%)
Winter	18	40
Spring	11	24
Summer	7	16
Autumn	9	20

DES: Dry eye syndrome

Table 3: Symptom severity by season and gender

Season	Overall	Females	Males
Winter	6.5	7.0	5.8
Spring	4.2	4.5	3.8
Summer	3.8	4.0	3.5
Autumn	5.0	5.3	4.6

Table 4: Dry eye syndrome prevalence in low humidity (winter)

Humidity level	Number of participants	DES prevalence (%)	Females (%)	Males (%)
Low	75	55	65	40

DES: Dry eye syndrome

Table 5: Dry eye syndrome prevalence with high air-conditioning use (summer)

Air-conditioning use	Number of participants	DES prevalence (%)	Females (%)	Males (%)
High	80	12.5	15	10

DES: Dry eye syndrome

Screen time

Participants with more than 6 h of daily screen time exhibited a higher prevalence of DES across all seasons. The overall prevalence among high screen time users was 60%, with seasonal variations showing 65% in winter, 30% in spring, 20% in summer, and 25% in autumn (Table 6).

Indoor air quality

Poor indoor air quality, characterized by the presence of pollutants and lack of ventilation, was reported by 70% of participants and correlated with a higher DES prevalence of 50%. Among these participants, 55% of females and 42% of males reported DES (Table 7).

DISCUSSION

This study aimed to assess the prevalence of DES among office workers in Warangal, Telangana, India, and to evaluate the impact of seasonal variations, symptom severity, and environmental factors on DES. The findings revealed several important insights into the prevalence and contributing factors of DES in this population.

Prevalence of DES

The overall prevalence of DES among the study participants was 45%, with a higher prevalence observed in females (50%) compared to males (37.5%). This gender difference aligns with existing literature, suggesting that hormonal variations, particularly in females, may contribute to a higher susceptibility to DES (Verjee et al.[8] 2020; Uchino et al.[9] 2008).

Seasonal variations

The study found significant seasonal variations in DES prevalence. The highest prevalence was recorded in winter (40%), followed by autumn (20%), spring (24%), and summer (16%). These findings can be attributed to the low humidity levels and increased use of heating systems during winter, which can exacerbate dry eye symptoms. Conversely, higher humidity levels in summer, despite increased air-conditioning use, appeared to mitigate the prevalence of DES to some extent (Mandell et al.[10] 2020).

Symptom severity

Symptom severity was found to be highest in winter (6.5 overall), with females reporting higher severity scores (7.0) compared to males (5.8). The lowest severity scores were observed in summer (3.8 overall), with similar gender

Table 6: Dry eye syndrome prevalence by screen time

Screen time (h)	DES prevalence (%)	Winter (%)	Spring (%)	Summer (%)	Autumn (%)
>6	60	65	30	20	25

DES: Dry eye syndrome

Table 7: Dry eye syndrome prevalence by indoor air quality

Air quality	Number of participants	DES prevalence (%)	Females (%)	Males (%)
Poor (pollutants, lack of ventilation)	70	50	55	42

DES: Dry eye syndrome

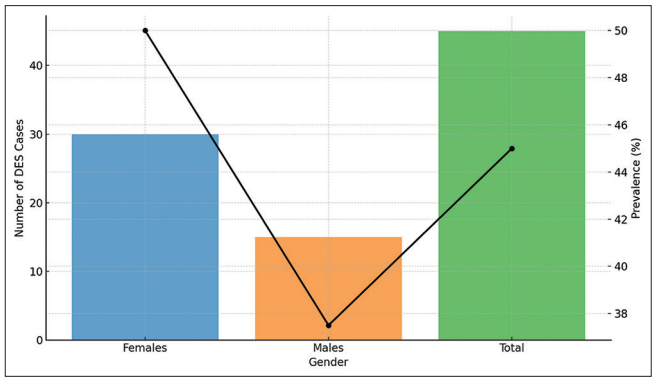

Figure 1: Prevalence of dry eye syndrome by gender

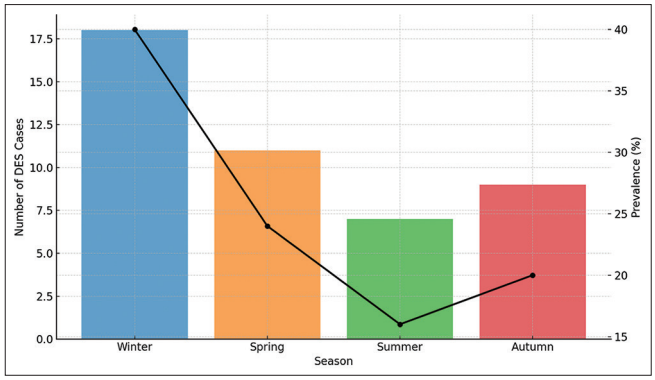

Figure 2: Seasonal variations in dry eye syndrome prevalence

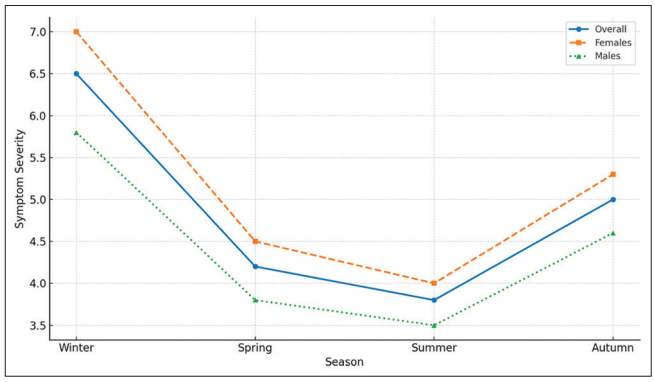

Figure 3: Symptom severity by season and gender

differences. These results highlight the need for targeted interventions during winter to alleviate the heightened symptom severity experienced by office workers.[11-13]

Environmental factors

Several environmental factors were significantly correlated with DES prevalence:

Low humidity in winter

Low humidity levels during winter were associated with a 55% prevalence of DES, with females (65%) being more affected than males (40%). This underscores the importance of maintaining adequate humidity levels in office environments during winter to reduce DES prevalence (Mandell et al. 2020).

High air-conditioning use in summer

High air-conditioning use during summer correlated with a lower DES prevalence (12.5%), with females (15%) and males (10%) showing reduced prevalence rates. Air-conditioning, while reducing humidity, might also decrease other environmental irritants, thereby partially mitigating DES symptoms (Huang et al.[14] 2020).

Increased screen time

Participants with more than 6 h of daily screen time exhibited a higher prevalence of DES (60%). This finding emphasizes the impact of prolonged screen exposure on eye health and the need for strategies to manage screen time effectively (Uchino et al.[9]).

Poor indoor air quality

Poor indoor air quality, reported by 70% of participants, was linked to a 50% prevalence of DES. The presence of pollutants and lack of ventilation can exacerbate dry eye symptoms, highlighting the need for improving air quality in office environments (Doughty et al.[15]).

Implications for workplace interventions

The findings of this study suggest several practical interventions that can be implemented in office settings to reduce the prevalence and severity of DES among workers:

Improving humidity levels

Using humidifiers during winter to maintain adequate humidity levels can help reduce DES prevalence.

Managing air-conditioning use

Ensuring that air-conditioning systems are well-maintained and used appropriately can help mitigate DES symptoms.

Reducing screen time

Implementing policies to limit continuous screen exposure and encouraging regular breaks can alleviate the impact of prolonged screen time on DES.

Enhancing indoor air quality

Improving ventilation and reducing indoor pollutants can significantly lower the prevalence of DES.

Limitations of the study

This study is limited by its cross-sectional design, which precludes establishing causality between environmental factors and DES. The self-reported nature of the data may introduce response bias. In addition, the sample size of 100 office workers may not be representative of the broader population. Seasonal variations in DES prevalence could be influenced by unmeasured confounding variables.

CONCLUSION

The study identified a significant prevalence of DES among office workers with notable gender differences. Seasonal variations indicated higher prevalence and symptom severity in winter compared to summer. Environmental factors such as low humidity, extensive air-conditioning use, increased screen time, and poor indoor air quality were found to significantly influence DES prevalence. These results underscore the importance of targeted interventions to address these environmental factors, potentially mitigating DES symptoms and improving the quality of life for office workers.

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Authors Contributions:
PR- Concept and design of the study, results interpretation, review of the literature, and preparing the first draft of the manuscript. Statistical analysis and interpretation, and revision of the manuscript; **VSS-** Concept and design of the study, review of literature, revision of the manuscript, and preparing the first draft of the manuscript; **RB-** Design of the study review of literature, revision of the manuscript, and preparing the first draft of the manuscript.

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