

# THE EFFECT OF BLUE LIGHT ON MODERN SOCIETY

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## ABSTRACT

The blue light that goes from our eyes reaches the retina and melanopsin, which is a photopigment in the retina, used for controlling the circadian rhythm and the sleep-wake cycle, showcases one of the most significant and common effects of our blue light. This gives rise to the prevalence of sleep disorders, the poorer sleep quality linked to extreme exhaustion, and the disruption of social and familial relationships. Blue light, however, can be advantageous if consumed in the morning hours; it has been seen to relieve symptoms in people with neurocognitive diseases like Alzheimer's disease. Blue light increases dopamine release in the short term, while exposure to light for a prolonged time can reverse the effect and results in symptoms for example anxiety, mood swings, lack of insight, and self-awareness.

To prevent the dangerous effects of blue light, one needs to be aware of the equipment that affects us and the primary "enemy" present in our daily lives, right next to us: smartphones, tablets, and televisions.

**KEYWORDS:** Blue light, Photochemical toxicity, Vision impairment, Neurodegeneration and blue light filters

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## INTRODUCTION

At the wavelength is 300 nm, the tissues have varied penetrative effects on the light properties of the human eye's refractive medium. The iris or the pupil generally absorbs light at a wavelength of 300 and 400 nm passing through the cornea. The most dangerous short-wave blue light is at 415 and 455 nm in energy. Direct retinal crystal penetration results in photochemical damage in the retina that cannot be repaired (Zhao et al., 2018). Sunlight is the primary source of blue light, and other sources include computer glass screens, light-emitting diodes (LEDs), and fluorescent lighting (Coats et al., 2021). Whereas blue light exposure on the other side have proved to increase human alertness (Chen & Yeh, 2019). Retinal pigment epithelium cells undergo cell death when exposed to blue light because of its high photochemical energy (Moon et al., 2017). Children's big pupils and pure crystal lenses are predicted to make them more sensitive to light suppression than adults. But it's still unclear if light exposure in youngsters suppresses melatonin (Higuchi et al., 2014). The greatest sensitivity of melatonin suppression is not far from the short wavelengths of optical radiation that self-luminous electrical devices emit. The reduction of melatonin brought on by night-time light exposure has shown to be a higher risk of disease (Figueiro et al., 2011). Blue light reduces skin autofluorescence, indicating flavins are the photosensitizer. Exposure to sunlight's blue light decreased flavin autofluorescence, indicating that sunlight's visible portion has a physiologically important impact on human skin (Nakashima et al., 2017).

## LITERATURE REVIEW

### BLUE LIGHT EFFECT ON HUMAN DERMIS.

Our findings imply that blue light also has a role in skin ageing and carcinogenesis, especially when exposed to direct sunshine(Nakashima et al., 2017).

In general, studies showed that to high-energy blue light exposure for long time can accelerate the amount of DNA damage, cell and tissue death with injury, eye damage, skin barrier damage, and photoaging. Low-energy and short exposure durations to high-energy blue light can help prevent skin illness (Coats et al., 2021).

According to the current study's findings, visible blue light does not harm DNA or prematurely age skin. Blue light has brief melanogenesis and mysterious vacuolization without apoptosis as its biological effects on normal skin. In conclusion, it is safe to utilise visible blue light in dermatological procedures for a brief time period(Kleinpenning et al., 2010).

Melatonin suppression caused by light cathode ray tube (CRT) computer monitors was examined. Comparing the dark control of the computer monitor visible screens alone, melatonin levels were considerably lower during the exposure to the blue-light goggle experimental condition(Figueiro et al., 2011).

Dis- play gadgets which emits low levels of blue light can harm the eye, and the danger from blue light is probably due to how much of the short-wavelength is present. A2E, a blue light fluorophore and lipofuscin component, shows blue light-induced phototoxicity in RPE cells. (Moon et al., 2017).

The findings implies that melatonin has shown to be highly sensitive to visible light in children than in adults at night because of the proportion of melatonin suppressed by light in children which was nearly double that in adults(Higuchi et al., 2014).

### BLUE LIGHT EFFECT ON VISION

Blue-blocking spectacle lenses are newly available to the public claiming to overcome strain and discomfort to the eyes ( when using computers and other digital devices)and enhancing sleep quality, and providing the protection to retinal phototoxicity ranges from 10% to 100%(Lawrenson et al., 2017).

The findings suggest that corneal epithelial cells undergoing mitosis may be at risk in the near-ultraviolet (UV) range. Blue light was being produced using a continuous-wave laser system, indium gallium nitride laser diode (RV-1000, Richo Optical Industry, Hanamaki, Japan). It suggests that blue light in the near (UV) range can be harmful to epithelial cells of cornea going through mitosis. (Niwano et al., 2014).

Particularly short-wavelength light is linked to photochemical damage in retina. This report (Measurement-Evaluation section) also pens down significance when estimating risk from short-wavelength light (Taylor & S, 2013).

Tissues of retina, which are easily exposed to the blue light, is full of mitochondria, and the respiratory chain of mitochondria contains chromophores that absorb blue light. Due to photochemical effects, prolonged exposure to blue light destroys the soft balance between the oxidant and antioxidant systems of the mitochondria, causing ROS and oxidative stress(Tao et al., 2019)

The electroretinogram's results show that the action happens at a brain level close to the receptors, which is be direct or maybe mediated by horizontal cells(Willmer, 1961).

Blue light indirectly produces various inflammation reactions and responses causing photoreceptor cell damage along with cell apoptosis, destroying the blood retinal barrier. This was seen with respect to the resistance associated with the inflammation responses to control of the severity of photoreceptor cell degeneration (Zhao et al., 2018).

Blue light also affects body enzymes, but at sometimes demonstrates that the response is purely the result of the BL photoreceptor's action (s). (Chen & Yeh, 2019).

Smartphone usage over an extended period of time has been linked to inflammation, visual disruption, and blurred vision. Smartphone-emits short-wavelength visible blue light which has shown to be a growing major problem due to its widespread use (Lin et al., 2017).

Numerous public worries regarding the dangers of blue light have been sparked by the increase of synthetic light sources. Only over the threshold has blue light been proven to impact eye function through photochemical damage (Ouyang et al., 2020).

Age causes a reduction in both circadian photoentrainment and scotopic sensitivity. Older persons who use UV-blocking IOLs had the highest level of rhodopsin and melanopsin sensitivity. Thus, pseudophakes are requested to wear sunglasses in bright environments (Mainster, 2006)

The results of eight patients combined showed that people exposed to eight different narrowband blue LED irradiances has a greater suppression of melatonin with higher exposure levels. There is a good match between the data and a sigmoidal fluence-response curve (West et al., 2011)

### **BLUE LIGHT EFFECT ON NEURODEGENERATIVE DISEASES**

In these early phases of experimental study, observation suggests that virtual darkness therapy may be considered a strong intervention that should not be suggested carelessly. Establishing the ideal time and length of therapy in respect to the clinical condition will be crucial if the impact of blue-blocking on mania is confirmed in bigger clinical research (Henriksen et al., 2014).

The study shows unexpected finding that the blue light shows both retinal damage neurodegeneration in the brain. This was compared to the age-matched flies in D:D, where there was a substantial age-increase in vacuole's area suggesting brain cell death in the of B:D flies (Nash et al., 2019).

Our findings also provide fresh perspectives for studying and modifying E. coli taxis. Light is a universal stimulus, therefore it could offer a technique to measure interactions across various receptor types (Perlova et al., 2019).

Patients using lenses during the night-time needed to get informed of the dangers and relative cognitive impairment because early research evidence shows that the blue light is capable of improving the cognitive performance in patients. (Phelps, 2008).

When the response to antidepressants is delayed or insufficient, clinicians should think about adjunctive light treatment. Additionally, more investigation is required to define the mechanisms of action that work in conjunction with circadian rhythm phase shifting to produce the antidepressant effect (Terman & Terman, 2005).

In the concluding parts of the previous sections demonstrate, several cell like processes and parameters have been unlocked by UV-light-/BL-sensitive receptors which allows reversible, non-invasive, and spatiotemporally precise optogenetic intervention in a very short time period (Losi et al., 2018).

### **EFFECT ON AGE**

Despite the fact that our findings indicate that early blue light exposure causes there were so few people and sample locations, it was unable to draw any firm conclusions regarding how morning light affected PER2 expression (Jud et al., 2009). Since short-wavelength blue light is particularly sensitive to melanopsin, the main component for the circadian system, the high night time use of light producing gadgets like desktop, smart

phone, and televisions may have an impact on the age as well as the quantity and effectiveness of sleep (Revell et al., 2012).

The crystalline lens due to colour changes, gradually becomes more absorbent in the blue light spectrum.; this is caused by a number of things, including tryptophan oxidation products and lens protein glycosylation. With time, the crystalline lens turns more and more yellow, and its pigmentation finally serves as a barrier against blue light (Algere et al., 2006).

High levels of blue light from computer, e-reader, and smartphone screens may be a risk factor for sleep and circadian problems. According to epidemiological research, using electronics at night interferes with sleep (Hatori et al., 2017).

### **EFFECT ON SLEEP**

It is clear that maintaining a healthy circadian system requires two essential elements: an enhancement in the blue component of synthetic light during the day should be controlled by decreasing in the same blue part of synthetic light during the evening and night. A variety of features that affect the blue light emitting from displays are already available from electronic product manufacturers and software developers. The implementations reduce the quantity of blue light that is generally emitted by the devices, but they do not account for the remainder of white light's short wavelengths. A significant finding is that a pure blue light filter alone does not effectively suppress melatonin without also reducing brightness. (Wahl et al., 2019),

According to this systematic review, there isn't enough high-standard clinical evidence to support the use of blue light blocking eyeglasses in the life of common public to enhance visual function or sleep quality, lessen eye strain, or protect retinal health (Lawrenson et al., 2017).

Our research has revealed a significant incidence of young medical students of both sexes using blue light producing gadgets before bed moreover worrisome and harmful practises linked to bad sleep standards and compromising daytime functionality. Despite the belief that this bedtime usage causes sleep problems, we discovered a substantial correlation between poorer sleep patterns, lower sleep quality, increased weariness, and a use for leisure purposes alone (Jniene et al., 2019).

We may conclude that blue light is neither a blessing nor a curse, but something that we must learn to balance to preserve our eyes. Despite this, we can profit from its positive impact on non-visual processes. The circadian cycles must be respected, and the levels of the two hormones—melatonin and serotonin—must not be disturbed. Utilizing indirect lighting systems would prevent us from looking directly at blue light sources, which would help us shield ourselves from some of the negative effects of blue light. Changing the way we think about indoor spaces, especially the lighting system, is another strategy to ensure that we don't disregard our non-visual function (Gomes & Preto, 2015).

High night time use of light-emitting gadgets, such as laptops, tablets, and televisions, may have an impact on the circadian cycle as well as the timing and quality of sleep. According to these findings, melatonin is just as effective at causing phase shifts at dosages of few mg, as our blue light stimulus is. (Revell et al., 2012).

### **EFFECT ON DENTISTRY**

The use of light sources to photo cure resin composites has expanded significantly as a result of the fast development of aesthetic dental restorative procedures. Historically, the mainstay for photocuring has been a quartz-tungsten-halogen (QTH) source that has been filtered to produce blue light with wavelengths of between approximately 400 and 500 nm. (Wataha et al., 2004) Dentists should be aware that radiation exposure can result in a variety of phototoxic and photoallergic reactions in patients' oral mucosae as well as in operators' eyes, hands, and other endogenous and exogenous tissues. Although LED light sources have largely replaced conventional halogen light sources as the primary type of light used in dentistry, blue light-induced damage should be carefully considered when choosing light sources for dental treatment (Yoshino & Yoshida, 2018). Blue light affects vital cell activities by producing intracellular reactive oxygen species (ROS). Antioxidants may be employed to reduce undesirable side effects of blue light during therapeutic use if the biological effects are redox-mediated, and typical gingival fibroblasts may enhance cellular activity in response to blue light therapy (Lockwood et al., 2005).

## **REGULATION OF BLUE LIGHT**

Lutein play important part in filtering blue light and also act as antioxidant within the retina, however, it may also impact other parts of the body's immune and inflammatory responses Consuming lutein lowers the risk of developing cataracts or age-related macular degeneration (AMD). (Kijlstra et al., 2012).

For optimal health, blue light exposure is also important. High-energy visible light has been shown to improve mood, memory, and cognitive function. but it also causes many problems for them we can use Olive fruit extract hydroxytyrosol that shields skin keratinocytes and fibroblasts from LED-BL damage by preventing ROS formation, lowering MMP1 and MMP12 levels, maintaining collagen type I production, lowering 8OHdG formation and maintaining PCNA expression without affecting cell viability(Avola et al., 2019)

## **METHODOLOGY**

The literature search was limited to articles to articles 1950 to 2022. The search for articles was done online by using the search words “Blue light, Blue light, modern society, impact, Protection, Blue light spectacles, skin pigmentation, circadian rhythm, blue light depression, neurodegenerative diseases, blue light and impact on children, computer screen” in the title and the keywords in research databases at Wiley, Elsevier, ERIC, Springer, SAGE, Frontiers.

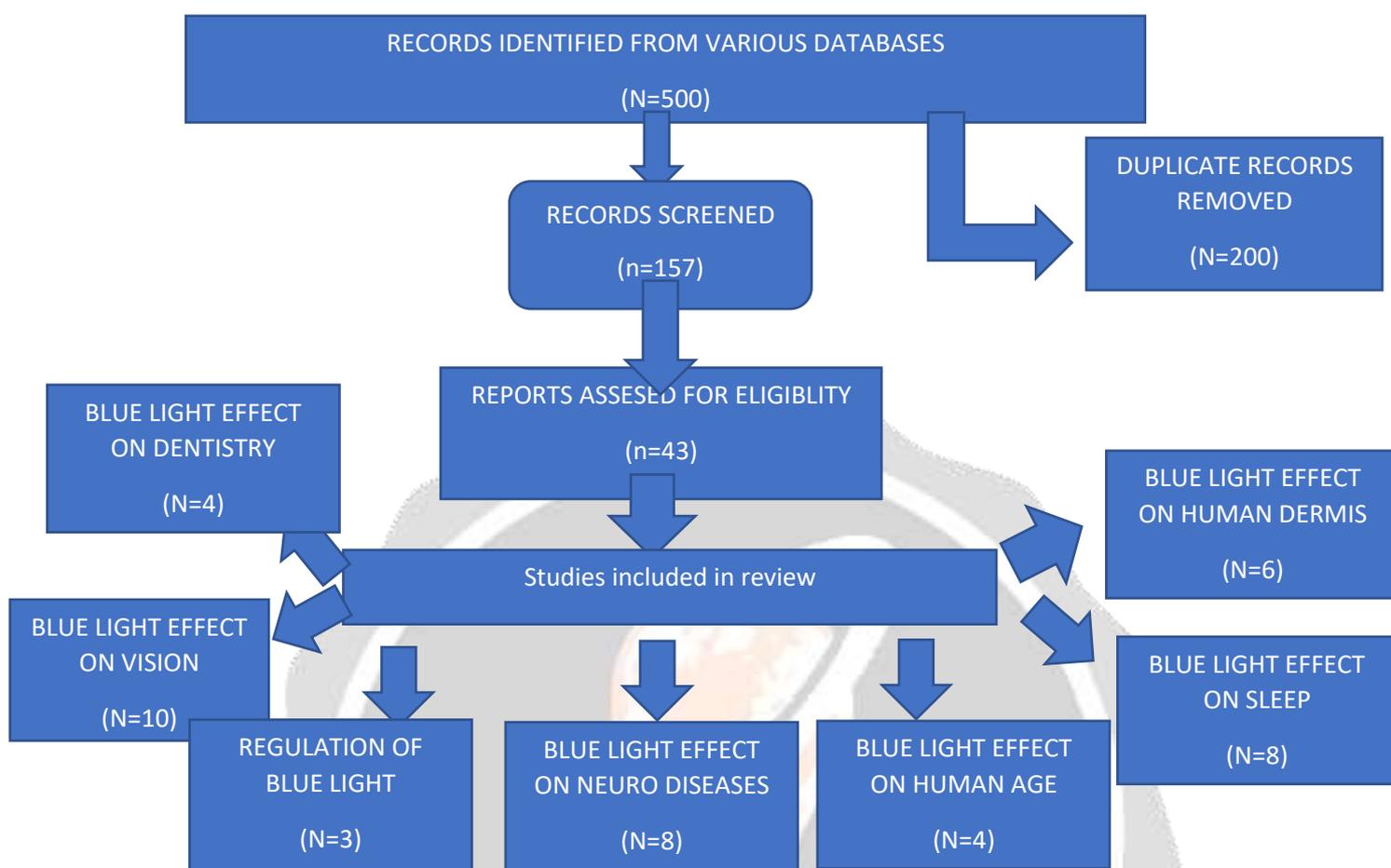
### **Analysis**

The articles have been passed to the process of selection and then reviewed for summarisation based on the objectives, year of publication, number of citations and suggestions for further research.

### **Inclusion & Exclusion criteria**

This included in current study, studies have to meet some criteria

(a) Studies have included some kind of selection criteria (Blue light, work, modern society). These criteria limited the number of studies (b) Accordingly excluded the studies in which it based on irrelevant information there is no proper Title, Abstract & Review.



## DISCUSSION

Blue light has a short wavelength and high energy, making it harmful in various situations. Blue light is one of the small bands of waves that fall under the category of visible light, which ranges in wavelength from 380 nano meters (ultraviolet light) to 700 nano meters (red light). The leading cause of vision issues is macular degeneration that develops with age, and blue light accelerates that process. The current research looked at the impact of blue light on modern society. Different kinds of effects of blue light were discussed, like on the dermis, on age, sleep cycle, vision, and in health care also. During SARS-CoV-2 (coronavirus lockdown ), The number of students attending online classes and the people who work from home online was exposed to blue light more and get affected in various ways. According to a study, to protect ourselves from the harmful effect of blue light, we can use lutein, Blue block lenses 1, Moreover light therapy can also be used for treating patients with depression. Furthermore, our results revealed How dangerous Blue light and how we can protect ourselves from blue light

## CONCLUSION

In light of the analysis, the Researchers have drawn the following conclusion As technology advances, everything is becoming digital. A study found that frequent smartphone or laptop users are more likely come in the contact of blue light, which impairs vision. For instance, blue light induces mitosis in corneal epithelial cells. Additionally, blue light affects the circadian system; moreover, prolonged exposure to it at night results in brain neurodegeneration. According to a study, blue light has a positive side as well. Blue light has been used in dentistry and has occasionally been shown to improve mood and memory. Therefore, how we utilize the blue light is up to us. We can use blue light-blocking eyewear and lutein-like antioxidants as preventative measures against the effects of blue light.

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