



KARYA TUGAS AKHIR

NARRATIVE REVIEW

EFEK PENGURANGAN *BLUE LIGHTS* TERHADAP RITME

SIRKADIAN MANUSIA

Oleh:

Firda Syaviera Maharani

NIM. 201810330311123

FAKULTAS KEDOKTERAN

UNIVERSITAS MUHAMMADIYAH MALANG

2024



KARYA TUGAS AKHIR

NARRATIVE REVIEW

EFEK PENGURANGAN *BLUE LIGHTS* TERHADAP RITME
SIRKADIAN MANUSIA

Oleh:

Firda Syaviera Maharani

NIM. 201810330311123

FAKULTAS KEDOKTERAN

UNIVERSITAS MUHAMMADIYAH MALANG

2024

HASIL KAJIAN PUSTAKA
EFEK PENGURANGAN *BLUE LIGHTS* TERHADAP RITME
SIRKADIAN MANUSIA

Karya Tugas Akhir

Diajukan kepada

Universitas Muhammadiyah Malang
Untuk Memenuhi Salah Satu Persyaratan
dalam Menyelesaikan Program Sarjana
Fakultas Kedokteran

Oleh:

Firda Syaviera Maharani

NIM. 201810330311123



FAKULTAS KEDOKTERAN
UNIVERSITAS MUHAMMADIYAH MALANG

2024

LEMBAR PENGESAHAN

KARYA TUGAS AKHIR

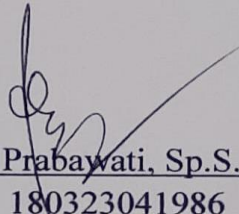
Telah Disetujui Sebagai Karya Tugas Akhir Untuk Memenuhi Persyaratan

Pendidikan Sarjana Fakultas Kedokteran

Universitas Muhammadiyah Malang

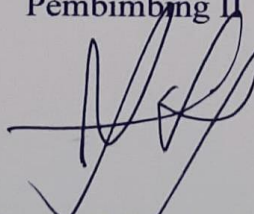
Tanggal : 5 April 2024

Pembimbing I



dr. Risma Karlina Prabawati, Sp.S., M.Biomed.
NIP. 180323041986

Pembimbing II



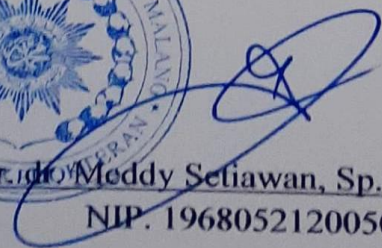
dr. Yoyok Subagio, Sp.BS.
NIP. 11309070522

Mengetahui,

Fakultas Kedokteran Universitas Muhammadiyah Malang

Dekan,




Dr. dr. Meddy Seliawan, Sp.PD., FINASIM
NIP. 196805212005011002

PERNYATAAN ORISINALITAS

Karya tugas akhir ini adalah karya saya sendiri, dan semua sumber baik yang dikutip maupun dirujuk telah saya nyatakan dengan benar.

Nama : Firda Syaviera Maharani

NIM : 201810330311123

Malang, 5 April 2024

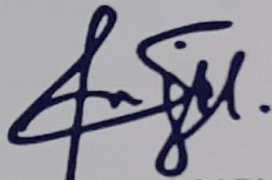


Firda Syaviera Maharani

LEMBAR PENGUJIAN

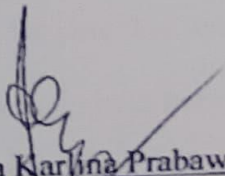
Karya Tugas Akhir oleh Firda Syaviera Maharani ini
Telah Diuji dan Dipertahankan di Depan Tim Penguji
Pada tanggal, 5 April 2024

Penguji



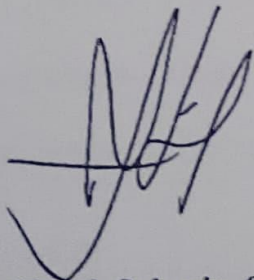
dr. Desy Andari, M.Biomed.
NIP. 11307040460

Ketua



dr. Risma Karlina Prabawati, Sp.S., M.Biomed.
NIP. 180323041986

Anggota



dr. Yoyok Subagio, Sp.BS.
NIP. 11309070522

Anggota

KATA PENGANTAR

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Alhamdulillah rabbilalamin, puji syukur kepada Allah SWT atas rahmat dan ridhoNya penulis dapat menyelesaikan *narrative review* ini yang berjudul “Efek Pengurangan *Blue Lights* Terhadap Ritme Sirkadian Manusia” dengan baik dan lancar. Sholawat serta salam senantiasa tercurahkan kepada Rasulullah SAW beserta keluarga, sahabat, dan pengikut beliau yang telah membimbing kita keluar dari zaman kegelapan.

Karya tugas akhir ini diajukan untuk memenuhi persyaratan kelulusan Pendidikan Sarjana Fakultas Kedokteran Universitas Muhammadiyah Malang. Selain itu, penulis juga berharap semoga karya tulis ini dapat menjadi memberikan manfaat bagi pembaca dan kalangan umum masyarakat.

Penulis menyadari bahwa karya tulis akhir ini masih jauh dari kesempurnaan. Oleh sebab itu, kritik dan saran dari semua pihak demi kesempurnaan karya tulis akhir ini sangat diperlukan.

Malang, 5 April 2024

Penulis

UCAPAN TERIMA KASIH

Pada kesempatan kali ini, penulis ingin menyampaikan terima kasih yang sebesar-besarnya kepada:

1. Dr. dr. Meddy Setiawan, Sp.PD, selaku Dekan Fakultas Kedokteran Universitas Muhammadiyah Malang atas bimbingannya selama di Fakultas Kedokteran UMM.
2. Dr. dr. Ruby Riana Asparini, Sp.BP-RE (K), selaku Wakil Dekan I Fakultas Kedokteran Universitas Muhammadiyah Malang atas bimbingannya selama di Fakultas Kedokteran UMM.
3. dr. Sri Adila Nurainiwati, Sp.KK, selaku Wakil Dekan II Fakultas Kedokteran Universitas Muhammadiyah Malang atas bimbingannya selama di Fakultas Kedokteran UMM.
4. dr. Indra Setiawan, Sp.THT-KL, selaku Wakil Dekan III Fakultas Kedokteran Universitas Muhammadiyah Malang atas bimbingannya selama di Fakultas Kedokteran UMM.
5. dr. Risma Karlina Prabawati, Sp.S, M.Biomed, selaku dosen pembimbing I yang selalu mendukung dan membimbing dengan sabar dan ikhlas meluangkan waktu sehingga penulis dapat menyelesaikan tugas akhir ini.
6. dr. Yoyok Subagio, Sp.BS, selaku dosen pembimbing II yang telah menyempatkan waktunya untuk membimbing dan mengajari penulis dalam menyelesaikan tugas akhir ini.

7. dr. Desy Andari, M.Biomed, selaku penguji yang telah berkenan meluangkan waktu dan memberikan banyak masukan, kritikan, saran, dan arahan dalam menyempurnakan tugas akhir ini.
8. Kedua orang tua penulis, Alm. Bapak Bambang Purwantojo dan Ibu Vemi Mujiati yang tak henti-hentinya mengerahkan segala dukungan berupa asuhan, do'a, petuah, serta ridho kepada penulis selama penulis berproses di Fakultas Kedokteran UMM.
9. dr. Hanna Cakrawati, M.Biomed, selaku Dosen Wali yang telah sabar memberikan semangat dan motivasi selama penulis berada di FK UMM dan menyelesaikan tugas akhir ini
10. Seluruh jajaran dosen dan staff akademika FK UMM yang telah membantu memberikan ilmu dalam setiap tahap proses tugas akhir ini hingga selesai.
11. Kepada teman-teman yang selalu berkenan untuk membantu dan menemani penulis menyelesaikan tugas akhir: Amira Nurfy, Anzalina Wulida, Kartika Dyah, Fairuz Din, Fair Nur Rendra, Ulya dan Yusuf, serta teman dekat dan kerabat penulis yang senantiasa mendukung penulis dalam menyelesaikan tugas akhir.
12. Kepada idola penulis, Stray Kids dan Zerobaseone melalui lagu-lagunya yang telah menemani penulis selama menyelesaikan tugas akhir ini.
13. Semua pihak yang terlibat langsung maupun tidak langsung, yang tidak bisa disebutkan satu-persatu, terima kasih atas dukungan dan do'a yang diberikan dalam proses penyusunan tugas akhir ini.

RINGKASAN

Maharani, Firda Syaviera. 2024. Efek Pengurangan *Blue Lights* Terhadap Ritme Sirkadian Manusia. Tugas Akhir, Universitas Muhammadiyah Malang Fakultas Kedokteran. Pembimbing: (I) Risma Karlina Prabawati * (II) Yoyok Subagio **

Latar Belakang: *Blue light* (BL) adalah bagian dari spektrum cahaya tampak dengan panjang gelombang yang pendek dan energi yang besar sehingga sering disebut sebagai *High-Energy Visible light (HEV Light)*. Pancaran BL dapat mengganggu siklus tidur manusia melalui penurunan produksi hormon melatonin sehingga menunda rasa kantuk dan permulaan tidur. Dalam jangka panjang, hal ini dapat mengacaukan ritme sirkadian dan mengurangi produktivitas. **Tujuan:** Mengetahui efek pengurangan paparan *blue light* terhadap ritme sirkadian manusia. **Metode:** *Narrative Review* dengan literatur yang dicari melalui penelusuran internet pada situs NCBI PubMed dan *Google Scholar* dicari sesuai kata kunci dengan indeks Scopus Q1/Q2 dan diterbitkan antara tahun 2019-2023. **Hasil:** Didapatkan 13 jurnal dengan materi sesuai tujuan penelitian dan lolos kriteria inklusi. Hasil analisis menunjukkan pengurangan *blue light* tidak memberi dampak objektif secara signifikan, namun secara subjektif partisipan melaporkan perbaikan kualitas tidur. Pengurangan *blue light* dapat memberi efek jauh lebih signifikan pada pasien psikiatri. **Kesimpulan:** Pengurangan *blue light* tidak memberi perubahan signifikan terhadap ritme sirkadian manusia.

Kata Kunci: Sinar Biru, Sirkadian, Melatonin, Pola Tidur, WFH

*) dr. Risma Karlina Prabawati, Sp.S, M.Biomed

***) dr. Yoyok Subagio, Sp.BS

SUMMARY

Maharani, Firda Syaviera. 2024. The Effect of Blue-Light-Exposure Reduction on Human Circadian Rhythm. Thesis. Faculty of Medicine, University of Muhammadiyah Malang. Advisor: (I) Risma Karlina Prabawati * (II) Yoyok Subagio **

Background: Blue light (BL) is part of visible light spectrum with short wavelength and large energy, often called as HEV Light (High-Energy Visible Light). BL exposure may disrupt human sleep cycle by reducing melatonin level, thereby delaying drowsiness and sleep onset. This can cause circadian disruption and reduce productivity in the long term. **Objectives:** To determine the effect of blue light exposure reduction on human circadian rhythm. **Method:** Narrative Review with literature conducted from NCBI PubMed and Google Scholar sites searches with keywords were selected with the criteria of reputable international journals and have been indexed by SCOPUS Q1 and Q2, published around 2019 until 2023. **Results:** 13 journals were obtained with subjects that matched the purpose of this study and passed the inclusion criteria. The analysis results showed that BL reduction makes no significant objective differences, but participants subjectively report better sleep quality. This intervention could give a better result on psychiatric patients. **Conclusion:** Blue light reduction makes no significant difference on human circadian rhythm.

Keywords: Blue Light, Circadian, Melatonin, Sleep

*) dr. Risma Karlina Prabawati, Sp.S, M.Biomed

***) dr. Yoyok Subagio, Sp.BS

DAFTAR ISI

HALAMAN JUDUL	i
PRASYARAT GELAR.....	ii
LEMBAR PENGESAHAN	iii
PERNYATAAN ORISINALITAS.....	iv
LEMBAR PENGUJIAN.....	v
KATA PENGANTAR.....	vi
UCAPAN TERIMA KASIH	vii
RINGKASAN	ix
SUMMARY	x
DAFTAR ISI.....	xi
DAFTAR TABEL	xiii
DAFTAR GAMBAR.....	xiv
DAFTAR SINGKATAN.....	xv
DAFTAR LAMPIRAN	xvi
BAB I PENDAHULUAN	1
1.1 Latar belakang masalah.....	1
1.2 Rumusan Masalah	4
1.3 Tujuan Penulisan.....	4
1.4 Manfaat Penulisan	4
BAB 2 TINJAUAN PUSTAKA.....	6
2.1 Konsep <i>Blue Light</i>	6
2.1.1 Pengertian <i>Blue Light</i>	6
2.1.2 Manfaat dan Bahaya <i>Blue Light</i>	8
2.1.3 Pengurangan Paparan <i>Blue Light</i>	11
2.2 Fisiologi Tidur.....	14
2.2.1 Homeostasis Tidur	14
2.2.2 Ritme Sirkadian	20
BAB 3 KERANGKA TEORI.....	29

BAB 4	METODE PENCARIAN LITERATUR.....	32
4.1	Desain Pencarian Literatur.....	32
4.2	Prosedur Pencarian Literatur.....	32
4.3	Skema Penelusuran Artikel.....	34
BAB 5	PEMBAHASAN.....	35
5.1	Metode Pengurangan Paparan <i>Blue Light</i>	35
5.1.1	Kacamata <i>Blue Blocking Lens</i> (BBL).....	35
5.1.2	<i>Room Light Setting</i> / Pengaturan Lampu Ruangan.....	36
5.1.3	<i>Blue Light Filter</i> / <i>Night-Mode</i> pada Gadget.....	37
5.2	Efek Pengurangan Paparan <i>Blue Light</i> Pada Sirkadian.....	37
5.3	Perbedaan Efek Pengurangan Paparan <i>Blue Light</i> di Pagi dan Malam Hari.....	40
5.4	Efek Ritme Sirkadian dalam Kehidupan Sehari-Hari.....	41
BAB 6	PENUTUP.....	42
6.1	Simpulan.....	42
6.2	Saran.....	43
6.2.1	Akademis.....	43
6.2.2	Klinis.....	43
6.2.3	Masyarakat.....	43
	DAFTAR PUSTAKA.....	44
	LAMPIRAN.....	50

DAFTAR TABEL

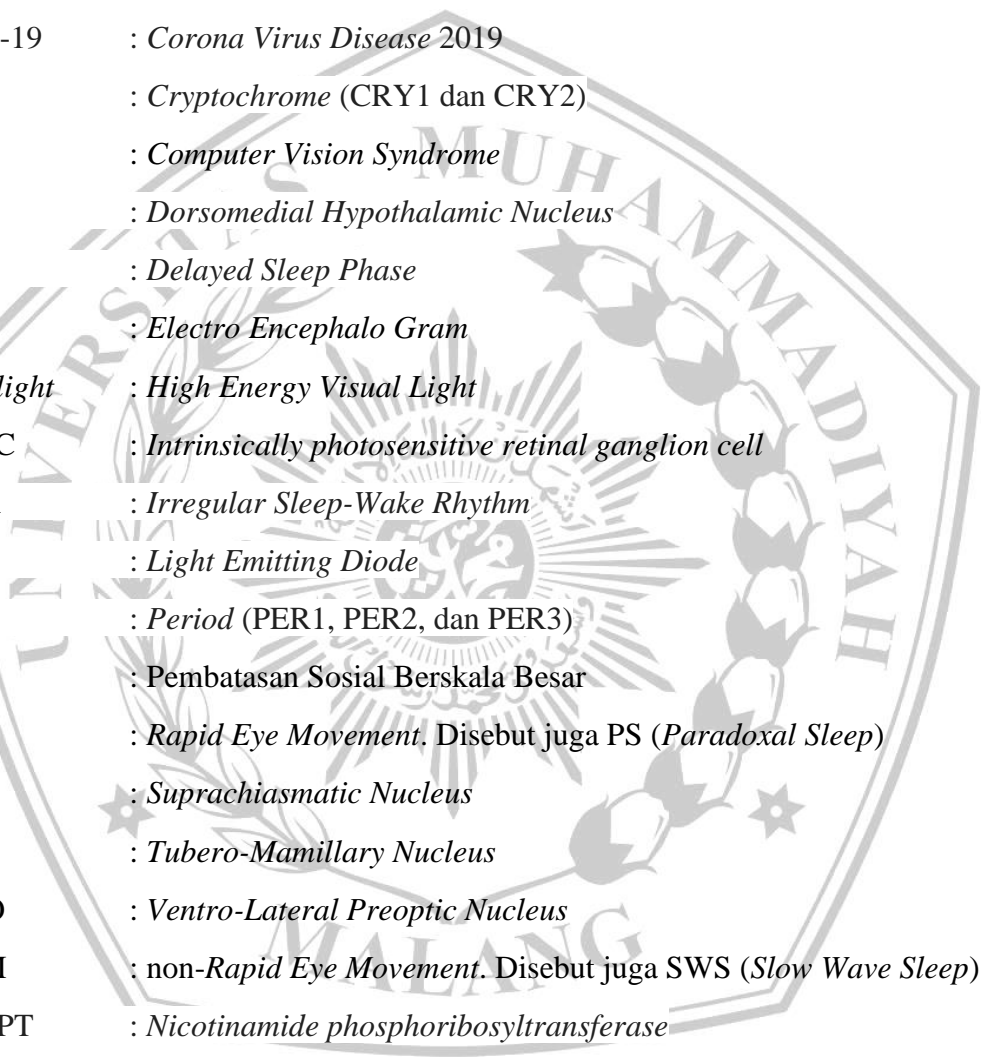
Nomor	Judul Tabel	Halaman
Tabel 2.1	Tahap Tidur Manusia	17
Tabel 4.1	Rincian Literatur yang Digunakan	33



DAFTAR GAMBAR

Nomor	Judul Gambar	Halaman
Gambar 2.1	Spektrum Gelombang Elektromagnetik dan Cahaya Tampak	6
Gambar 2.2	Panjang Gelombang (λ) dan Hubungannya dengan Frekuensi (F)	7
Gambar 2.3	Perbandingan penggunaan BLI dan Sinar Putih pada endoskopi	9
Gambar 2.4	Perbandingan tempat jatuh sinar biru, hijau, dan merah pada bola mata emetropik, hiperopik, dan miopik	11
Gambar 2.5	Alur perjalanan neuromediator dalam siklus tidur-bangun manusia	15
Gambar 2.6	Siklus sederhana neuromediator homeostasis tidur manusia	16
Gambar 2.7	Perbandingan frekuensi dan amplitudo gelombang alfa (<i>awake</i>), beta, teta (REM), dan delta (nREM)	17
Gambar 2.8	Grafik Pengulangan Tahap nREM 1, nREM 2, nREM 3, dan REM dalam siklus tidur manusia sepanjang malam	20
Gambar 2.9	Siklus Sirkadian dalam Sel Mamalia	23
Gambar 2.10	Siklus Metabolisme Sel yang Berhubungan dengan Siklus Sirkadian Mamalia	24
Gambar 2.11	Neuroanatomi <i>Suprachiasmatic Nucleus</i>	26

DAFTAR SINGKATAN



ASP	: <i>Advanced Sleep Phase</i>
BBL	: <i>Blue-Blocking Lens</i>
BMAL1	: <i>Brain and muscle Arnt-like protein-1</i>
CLOCK	: <i>Circadian Locomotor Output Cycles Kaput</i>
Covid-19	: <i>Corona Virus Disease 2019</i>
CRY	: <i>Cryptochrome (CRY1 dan CRY2)</i>
CVS	: <i>Computer Vision Syndrome</i>
DMH	: <i>Dorsomedial Hypothalamic Nucleus</i>
DSP	: <i>Delayed Sleep Phase</i>
EEG	: <i>Electro Encephalo Gram</i>
HEV light	: <i>High Energy Visual Light</i>
IPRGC	: <i>Intrinsically photosensitive retinal ganglion cell</i>
ISWR	: <i>Irregular Sleep-Wake Rhythm</i>
LED	: <i>Light Emitting Diode</i>
PER	: <i>Period (PER1, PER2, dan PER3)</i>
PSBB	: <i>Pembatasan Sosial Berskala Besar</i>
REM	: <i>Rapid Eye Movement. Disebut juga PS (Paradoxal Sleep)</i>
SCN	: <i>Suprachiasmatic Nucleus</i>
TMN	: <i>Tubero-Mamillary Nucleus</i>
VLPO	: <i>Ventro-Lateral Preoptic Nucleus</i>
nREM	: <i>non-Rapid Eye Movement. Disebut juga SWS (Slow Wave Sleep)</i>
NAMPT	: <i>Nicotinamide phosphoribosyltransferase</i>
PVN	: <i>Paraventricular Nucleus</i>
IML	: <i>Intermediolateral Nucleus</i>
SCG	: <i>Superior Cervical Ganglion</i>
WFH	: <i>Work From Home</i>
WHO	: <i>World Health Organization</i>

DAFTAR LAMPIRAN

Nomor	Judul Lampiran	Halaman
Lampiran 1	Rangkuman Jurnal	50
Lampiran 2	Hasil Deteksi Plagiasi	66
Lampiran 3	Kartu Konsultasi Tugas Akhir	67



DAFTAR PUSTAKA

- Baptista, E., André Arriel, R., de Castro Carvalho, A. L., Bispo, M. M. C., Rodrigues, A. B., Souza, H., Mota, G. R., & Marocolo, M. (2022). Influence of Wearing Blue Lenses on Melatonin Production and Performance in Volleyball Players. *Sports medicine international open*, 6(1), E1–E8. <https://doi.org/10.1055/a-1720-6083>
- Bigalke, J. A., Greenlund, I. M., Nicevski, J. R., & Carter, J. R. (2021). Effect of evening blue light blocking glasses on subjective and objective sleep in healthy adults: A randomized control trial. *Sleep health*, 7(4), 485–490. <https://doi.org/10.1016/j.sleh.2021.02.004>
- Bowler, J., & Bourke, P. (2019). Facebook use and sleep quality: Light interacts with socially induced alertness. *British journal of psychology* (London, England : 1953), 110(3), 519–529. <https://doi.org/10.1111/bjop.12351>
- Brinkman, J. E., Reddy, V., & Sharma, S. (2023). *Physiology of Sleep*. In StatPearls. StatPearls Publishing.
- Cahill, E. M., Chua, K., Doppalapudi, S. K., & Ghodoussipour, S. (2022). The use of blue-light cystoscopy in the detection and surveillance of nonmuscle invasive bladder cancer. *Current urology*, 16(3), 121–126. <https://doi.org/10.1097/CU9.0000000000000142>
- Calvo-Sanz, J. A., & Tapia-Ayuga, C. E. (2020). Blue light emission spectra of popular mobile devices: The extent of user protection against melatonin suppression by built-in screen technology and light filtering software systems. *Chronobiology international*, 37(7), 1016–1022. <https://doi.org/10.1080/07420528.2020.1781149>
- Campiche, R., Curpen, S. J., Lutchmanen-Kolanthan, V., Gougeon, S., Cherel, M., Laurent, G., Gempeler, M., & Schuetz, R. (2020). Pigmentation effects of blue light irradiation on skin and how to protect against them. *International journal of cosmetic science*, 42(4), 399–406. <https://doi.org/10.1111/ics.12637>
- Canazei, M., Weninger, J., Pohl, W., Marksteiner, J., & Weiss, E. M. (2022). Effects of dynamic bedroom lighting on measures of sleep and circadian rest-activity rhythm in inpatients with major depressive disorder. *Scientific reports*, 12(1), 6137. <https://doi.org/10.1038/s41598-022-10161-8>
- Comtet, H., Geoffroy, P. A., Kobayashi Frisk, M., Hubbard, J., Robin-Choteau, L., Calvel, L., Hugueny, L., Viola, A. U., & Bourgin, P. (2019). Light therapy with boxes or glasses to counteract effects of acute sleep deprivation. *Scientific reports*, 9(1), 18073. <https://doi.org/10.1038/s41598-019-54311-x>

- Connolly, L. J., Ponsford, J. L., Rajaratnam, S. M. W., & Lockley, S. W. (2021). Development of a Home-Based Light Therapy for Fatigue Following Traumatic Brain Injury: Two Case Studies. *Frontiers in neurology*, 12, 651498. <https://doi.org/10.3389/fneur.2021.651498>
- Dabrowiecki, A., Villalobos, A., & Krupinski, E. A. (2020). Impact of blue light filtering glasses on computer vision syndrome in radiology residents: a pilot study. *Journal of medical imaging (Bellingham, Wash.)*, 7(2), 022402. <https://doi.org/10.1117/1.JMI.7.2.022402>
- Dierayani, A P (2019) Perancangan Kampanye Sosial Mengenai Dampak Bahaya Blue Light Terhadap Kesehatan Mata Anak. Skripsi Desain Komunikasi Visual Universitas Pasundan
- Diogo, M. L. G., Campos, T. M., Fonseca, E. S. R., Pavani, C., Horliana, A. C. R. T., Fernandes, K. P. S., Bussadori, S. K., Fantin, F. G. M. M., Leite, D. P. V., Yamamoto, A. T. A., Navarro, R. S., & Motta, L. J. (2021). Effect of Blue Light on Acne Vulgaris: A Systematic Review. *Sensors (Basel, Switzerland)*, 21(20), 6943. <https://doi.org/10.3390/s21206943>
- Domagalik, A., Oginska, H., Beldzik, E., Fafrowicz, M., Pokrywka, M., Chaniecki, P., Rekas, M., & Marek, T. (2020). Long-Term Reduction of Short-Wavelength Light Affects Sustained Attention and Visuospatial Working Memory With No Evidence for a Change in Circadian Rhythmicity. *Frontiers in neuroscience*, 14, 654. <https://doi.org/10.3389/fnins.2020.00654>
- Ebbesen, F., Vreman, H. J., & Hansen, T. W. R. (2022). Blue-Green (~480 nm) versus Blue (~460 nm) Light for Newborn Phototherapy-Safety Considerations. *International journal of molecular sciences*, 24(1), 461. <https://doi.org/10.3390/ijms24010461>
- Eckel-Mahan, K., & Sassone-Corsi, P. (2013). Metabolism and the circadian clock converge. *Physiological reviews*, 93(1), 107–135. <https://doi.org/10.1152/physrev.00016.2012>
- Emet, M., Ozcan, H., Ozel, L., Yayla, M., Halici, Z., & Hacimuftuoglu, A. (2016). A Review of Melatonin, Its Receptors and Drugs. *The Eurasian journal of medicine*, 48(2), 135–141. <https://doi.org/10.5152/eurasianjmed.2015.0267>
- Esaki, Y., Takeuchi, I., Tsuboi, S., Fujita, K., Iwata, N., & Kitajima, T. (2020). A double-blind, randomized, placebo-controlled trial of adjunctive blue-blocking glasses for the treatment of sleep and circadian rhythm in patients with bipolar disorder. *Bipolar disorders*, 22(7), 739–748. <https://doi.org/10.1111/bdi.12912>
- Falup-Pecurariu, C., Diaconu, Ş., Țiņț, D., & Falup-Pecurariu, O. (2021). Neurobiology of sleep (Review). *Experimental and therapeutic medicine*, 21(3), 272. <https://doi.org/10.3892/etm.2021.9703>

- Gao, J., Provencio, I., & Liu, X. (2022). Intrinsically photosensitive retinal ganglion cells in glaucoma. *Frontiers in cellular neuroscience*, 16, 992747. <https://doi.org/10.3389/fncel.2022.992747>
- Grissinger M. (2019). Understanding Human Over-Reliance On Technology. *P & T : a peer-reviewed journal for formulary management*, 44(6), 320–375. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6534180/>
- Guyton, Arthur C; Hall, John E. (2019). *Guyton Dan Hall: Buku Ajar Fisiologi Kedokteran* (13). Singapore: ELSEVIER.
- Hastings, M. H., Maywood, E. S., & Reddy, A. B. (2008). Two decades of circadian time. *Journal of neuroendocrinology*, 20(6), 812–819. <https://doi.org/10.1111/j.1365-2826.2008.01715.x>
- Henriksen, T. E. G., Grønli, J., Assmus, J., Fasmer, O. B., Schoeyen, H., Leskauskaitė, I., Bjorke-Bertheussen, J., Ytrehus, K., & Lund, A. (2020). Blue-blocking glasses as additive treatment for mania: Effects on actigraphy-derived sleep parameters. *Journal of sleep research*, 29(5), e12984. <https://doi.org/10.1111/jsr.12984>
- Herryawan, C., Wahyuni, I., Lestari, P., & Nurwasis, N. (2021). The The Effect of Blue Light Radiation Exposure Habits On Refractive Error in Airlangga University Faculty of Medicine class 2018. *JIMKI: Jurnal Ilmiah Mahasiswa Kedokteran Indonesia*, 8(3), 8-18. <https://doi.org/10.53366/jimki.v8i3.257>
- Hussey K. D. (2023). Timeless spaces: Field experiments in the physiological study of circadian rhythms, 1938-1963. *History and philosophy of the life sciences*, 45(2), 17. <https://doi.org/10.1007/s40656-023-00571-w>
- Janků, K., Šmotek, M., Fárková, E., & Kopřivová, J. (2020). Block the light and sleep well: Evening blue light filtration as a part of cognitive behavioral therapy for insomnia. *Chronobiology international*, 37(2), 248–259. <https://doi.org/10.1080/07420528.2019.1692859>
- Jniene, A., Errguig, L., El Hangouche, A. J., Rkain, H., Abouddrar, S., El Ftouh, M., & Dakka, T. (2019). Perception of Sleep Disturbances due to Bedtime Use of Blue Light-Emitting Devices and Its Impact on Habits and Sleep Quality among Young Medical Students. *BioMed research international*, 2019, 7012350. <https://doi.org/10.1155/2019/7012350>
- Jo, H., Park, H. R., Choi, S. J., Lee, S. Y., Kim, S. J., & Joo, E. Y. (2021). Effects of Organic Light-Emitting Diodes on Circadian Rhythm and Sleep. *Psychiatry investigation*, 18(5), 471–477. <https://doi.org/10.30773/pi.2020.0348>
- Jones B. E. (2020). Arousal and sleep circuits. *Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology*, 45(1), 6–20. <https://doi.org/10.1038/s41386-019-0444-2>

- Kjørstad, K., Faaland, P. M., Sivertsen, B., Kallestad, H., Langsrud, K., Vethe, D., Vestergaard, C. L., Harris, A., Pallesen, S., Scott, J., & Vedaa, Ø. (2022). Sleep and work functioning in nurses undertaking inpatient shifts in a blue-depleted light environment. *BMC nursing*, 21(1), 187. <https://doi.org/10.1186/s12912-022-00973-4>
- Klarsfeld, A., Birman, S., & Rouyer, F. (2018). L'horloge circadienne à l'heure Nobel - Prix Nobel de Médecine 2017 : Jeffrey C. Hall, Michael Rosbash et Michael W. Young [Nobel time for the circadian clock - Nobel Prize in Medicine 2017: Jeffrey C. Hall, Michael Rosbash and Michael W. Young]. *Medecine sciences : M/S*, 34(5), 480–484. <https://doi.org/10.1051/medsci/20183405023>
- Knoop, M. S., de Groot, E. R., & Dudink, J. (2021). Current ideas about the roles of rapid eye movement and non-rapid eye movement sleep in brain development. *Acta paediatrica (Oslo, Norway : 1992)*, 110(1), 36–44. <https://doi.org/10.1111/apa.15485>
- Knufinke, M., Fittkau-Koch, L., Møst, E. I. S., Kompier, M. A. J., & Nieuwenhuys, A. (2019). Restricting short-wavelength light in the evening to improve sleep in recreational athletes - A pilot study. *European journal of sport science*, 19(6), 728–735. <https://doi.org/10.1080/17461391.2018.1544278>
- Knufinke, M., Nieuwenhuys, A., Geurts, S. A. E., Møst, E. I. S., Moen, M. H., Maase, K., Coenen, A. M. L., Gordijn, M. C. M., & Kompier, M. A. J. (2021). Dim light, sleep tight, and wake up bright - Sleep optimization in athletes by means of light regulation. *European journal of sport science*, 21(1), 7–15. <https://doi.org/10.1080/17461391.2020.1722255>
- Le Bon O. (2020). Relationships between REM and NREM in the NREM-REM sleep cycle: a review on competing concepts. *Sleep medicine*, 70, 6–16. <https://doi.org/10.1016/j.sleep.2020.02.004>
- Leanse, L. G., Dos Anjos, C., Mushtaq, S., & Dai, T. (2022). Antimicrobial blue light: A 'Magic Bullet' for the 21st century and beyond?. *Advanced drug delivery reviews*, 180, 114057. <https://doi.org/10.1016/j.addr.2021.114057>
- Lee, S., Buxton, O. M., Andel, R., & Almeida, D. M. (2019). Bidirectional associations of sleep with cognitive interference in employees' work days. *Sleep health*, 5(3), 298–308. <https://doi.org/10.1016/j.sleh.2019.01.007>
- Lee, T. M., Loh, E. W., Kuo, T. C., Tam, K. W., Lee, H. C., & Wu, D. (2021). Effects of ultraviolet and blue-light filtering on sleep: a meta-analysis of controlled trials and studies on cataract patients. *Eye (London, England)*, 35(6), 1629–1636. <https://doi.org/10.1038/s41433-020-01132-2>
- Levani, Y., Prastya, A. D., & Mawaddatunnadila, S. (2021). Coronavirus disease 2019 (COVID-19): patogenesis, manifestasi klinis dan pilihan terapi. *Jurnal Kedokteran dan kesehatan*, 17(1), 44-57.

- Luppi, P. H., & Fort, P. (2019). Sleep-wake physiology. *Handbook of clinical neurology*, 160, 359–370. <https://doi.org/10.1016/B978-0-444-64032-1.00023-0>
- Ma, M. A., & Morrison, E. H. (2023). Neuroanatomy, Nucleus Suprachiasmatic. In StatPearls. StatPearls Publishing. PMID: 31536270
- Mason, B. J., Tubbs, A. S., Fernandez, F. X., & Grandner, M. A. (2022). Spectrophotometric properties of commercially available blue blockers across multiple lighting conditions. *Chronobiology international*, 39(5), 653–664. <https://doi.org/10.1080/07420528.2021.2021229>
- Montaruli, A., Castelli, L., Mulè, A., Scurati, R., Esposito, F., Galasso, L., & Roveda, E. (2021). Biological Rhythm and Chronotype: New Perspectives in Health. *Biomolecules*, 11(4), 487. <https://doi.org/10.3390/biom11040487>
- Mungkasa, Oswar. (2020). Bekerja dari Rumah (Working From Home/WFH): Menuju Tatanan Baru Era Pandemi COVID 19. *Jurnal Perencanaan Pembangunan: The Indonesian Journal of Development Planning*, 4. 126-150. <https://doi.org/10.36574/jpp.v4i2.119>
- Naufal Wildan Askandar, N. W. (2022). Hubungan Penggunaan Gadget dan Ritme Sirkadian dengan Kualitas Tidur pada Mahasiswa Kedokteran Universitas Sebelas Maret. Skripsi Fakultas Kedokteran Universitas Sebelas Maret
- Ouyang, X., Yang, J., Hong, Z., Wu, Y., Xie, Y., & Wang, G. (2020). Mechanisms of blue light-induced eye hazard and protective measures: a review. *Biomedicine & pharmacotherapy = Biomedecine & pharmacotherapie*, 130, 110577. <https://doi.org/10.1016/j.biopha.2020.110577>
- Petrowski, K., Buehrer, S., Niedling, M., & Schmalbach, B. (2021). The effects of light exposure on the cortisol stress response in human males. *Stress (Amsterdam, Netherlands)*, 24(1), 29–35. <https://doi.org/10.1080/10253890.2020.1741543>
- Rashid, S. M. M., Mawah, J., Banik, E., Akter, Y., Deen, J. I., Jahan, A., Khan, N. M., Rahman, M. M., Lipi, N., Akter, F., Paul, A., & Mannan, A. (2021). Prevalence and impact of the use of electronic gadgets on the health of children in secondary schools in Bangladesh: A cross-sectional study. *Health science reports*, 4(4), e388. <https://doi.org/10.1002/hsr2.388>
- Rucker F. (2019). Monochromatic and white light and the regulation of eye growth. *Experimental eye research*, 184, 172–182. <https://doi.org/10.1016/j.exer.2019.04.020>
- Santoso, J., Suhardjono, H., & Wattimury, A. (2020). The Study of Color Spectrum Curs Value Against Sunlight Color and Artificial Light for Plant Growth. *Nusantara Science and Technology Proceedings*, 11-22. <https://doi.org/10.11594/nstp.2020.0602>

- Saputra, R. D., Sudarti, S., & Yushardi, Y. (2022). RESIKO RADIASI BLUE LIGHT TERHADAP SIKLUS TIDUR DAN PENGARUHNYA PADA MATA MANUSIA. *OPTIKA: Jurnal Pendidikan Fisika*, 6(2), 190-197. <https://doi.org/10.37478/optika.v6i2.2215>
- Sliney D. H. (2016). What is light? The visible spectrum and beyond. *Eye* (London, England), 30(2), 222–229. <https://doi.org/10.1038/eye.2015.252>
- Spitschan, M., Lazar, R., & Cajochen, C. (2019). Visual and non-visual properties of filters manipulating short-wavelength light. *Ophthalmic & physiological optics : the journal of the British College of Ophthalmic Opticians (Optometrists)*, 39(6), 459–468. <https://doi.org/10.1111/opo.12648>
- Studer, P., Brucker, J. M., Haag, C., Van Doren, J., Moll, G. H., Heinrich, H., & Kratz, O. (2019). Effects of blue- and red-enriched light on attention and sleep in typically developing adolescents. *Physiology & behavior*, 199, 11–19. <https://doi.org/10.1016/j.physbeh.2018.10.015>
- Tähkämö, L., Partonen, T., & Pesonen, A. K. (2019). Systematic review of light exposure impact on human circadian rhythm. *Chronobiology international*, 36(2), 151–170. <https://doi.org/10.1080/07420528.2018.1527773>
- Teran, E., Yee-Rendon, C. M., Ortega-Salazar, J., De Gracia, P., Garcia-Romo, E., & Woods, R. L. (2020). Evaluation of Two Strategies for Alleviating the Impact on the Circadian Cycle of Smartphone Screens. *Optometry and vision science : official publication of the American Academy of Optometry*, 97(3), 207–217. <https://doi.org/10.1097/OPX.0000000000001485>
- Vasey, C., McBride, J., & Penta, K. (2021). Circadian Rhythm Dysregulation and Restoration: The Role of Melatonin. *Nutrients*, 13(10), 3480. <https://doi.org/10.3390/nu13103480>
- Wong, N. A., & Bahmani, H. (2022). A review of the current state of research on artificial blue light safety as it applies to digital devices. *Heliyon*, 8(8), e10282. <https://doi.org/10.1016/j.heliyon.2022.e10282>
- Zerbini, G., Kantermann, T., & Mellow, M. (2020). Strategies to decrease social jetlag: Reducing evening blue light advances sleep and melatonin. *The European journal of neuroscience*, 51(12), 2355–2366. <https://doi.org/10.1111/ejn.14293>
- Zhu, Y., Hu, W., Wang, F., Zhou, Y., Xia, G., Xu, J., & Gong, W. (2021). Evaluation of blue laser endoscopy for detecting colorectal non-pedunculated adenoma. *Arab journal of gastroenterology : the official publication of the Pan-Arab Association of Gastroenterology*, 22(2), 127–132. <https://doi.org/10.1016/j.ajg.2020.12.002>
- Zwinkels, J. (2015). *Light, Electromagnetic Spectrum*. Springer Science+Business Media New York. https://doi.org/10.1007/978-3-642-27851-8_204-1



UNIVERSITAS MUHAMMADIYAH MALANG

FAKULTAS KEDOKTERAN

Kampus II : Jl. Bendungan Sutami 188 A Tlp. 0341-552443 Hunting 0341-551149
Fax. 0341-582060 E-mail : webmaster@univ.um.ac.id Website : www.um.ac.id

HASIL DETEKSI PLAGIASI

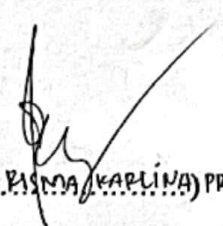
Berikut ini adalah hasil deteksi plagiasi karya ilmiah (naskah proposal / naskah hasil penelitian / naskah publikasi)*

Nama : FIRDA SYAVIERA MAHARANI
Nim : 201810330311123
Judul : EFEK PENGURANGAN BLUE LIGHTS TERHADAP RITME
SIRKADIAN MANUSIA

NO	Bagian	Maksimum Kesamaan	Hasil Deteksi		
			Tgl	Tgl	Tgl
			27/6/24		
1	Bab 1 (Pendahuluan)	10%	2%		
2	Bab 2 (Tinjauan Pustaka)	25%	5%		
4	Bab 3 (Kerangka Teori)	-	-		
5	Bab 4 (Metode Penelitian)	5%	4%		
6	Bab 5 (Pembahasan)	15%	0%		
7	Bab 6 (Penutup dan Kesimpulan)	5%	3%		
8	Naskah Publikasi	25%	2%		

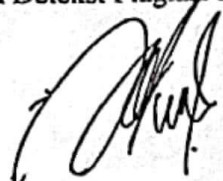
Kesimpulan Deteksi Plagiasi : ~~LOLOS~~ / ~~TIDAK~~ LOLOS PLAGIASI

Mengetahui
Pembimbing I


(dr. PISMA KARLINA) PRABALATI, Sp.S., I.A.B. IUMED.



Malang, 27 JUNI 2024
Tim Deteksi Plagiasi FKUMM,


(Joko Febriantoro, S.Ikom., M.Si)

Kontak Tim Plagiasi FKUMM
Email : plagiasifkumm@gmail.com
telp : 0341-551149