



## **INFLUENCE OF BLUE LIGHT ON SLEEP & WELLBEING AMONG ADULTS IN UAE**

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### **Abstract**

### **Introduction**

In the last decade, electronic devices have become an important part of life, it does not only entertain, but it becomes a part of their social lives.<sup>1</sup>The general consensus is that blue light from electronic media negatively affects sleep quality.<sup>2</sup> The other aspects of blue light exposure which are often overlooked, for example, it may influence performance and wellbeing.<sup>3</sup>

### **Objectives of the study**

1. To assess sleep & wellbeing among adults
2. To determine the association of blue light on sleep & wellbeing
3. To determine association of sleep & wellbeing with selected demographic variables

### **Methods**

A quantitative research approach with a cross-sectional study design was used. The Study population was among the General public in UAE, 100 adults were selected by convenience sampling based on inclusion criteria. Survey was collected using Pittsburg Sleep Quality Index and a Wellbeing scale were used to collect data.

### **Results**

Majority (54%) of the subjects were of the age between 29-39 years, 58% were females, 62% were Asians, 69% used mobile phones and 47% had exposure to Blue light for 5-8 hours. Among the 100 subjects, 62% had poor sleep. There was a statistical significance in relation to sleep quality and hours of exposure to blue light in a day at  $p < 0.001$  level of significance. Those who had greater duration (5-8 & >9) hours of exposure to blue light had poor sleep quality. There was a significant association between sleep and wellbeing parameters – autonomy, positive relation with others and self – acceptance at 0.05 level of significance. There was a statistical significance between type of blue light and environmental mastery and purpose with life at 0.05 level of significance and hours of exposure of blue light and positive relations with others and self - acceptance at 0.05 level of significance.

### **Conclusion**

The present study findings have revealed that blue light causes poor sleep. In relation to wellbeing parameters. Blue light use has improved wellbeing on certain wellbeing parameters such as positive relation with others.

Key words – Blue light, sleep quality, wellbeing, adults



## **Introduction**

In the last decade, we have seen a rapid rise in the utilization of electronic devices and how readily available these are. Smartphones, video game consoles, televisions, audio players, computers, and tablets were obtainable everywhere. These electronic devices have become an important part of a teenagers' life, it does not only entertain, but it becomes a part of their social lives. Social media has become an integral part of their life and the more active and stimulating the use of these devices are, the more that it negatively affects their sleep.<sup>1</sup> Electronic devices, such as television, computers and smartphones have become permanent features of our everyday life. <sup>1</sup> The general consensus is that blue light from electronic media negatively affects sleep quality. It has a wavelength which may influence our circadian rhythm and cause bad sleep. <sup>2</sup> The other aspects of blue light exposure which are often overlooked, for example, it may influence performance and wellbeing. However, numerous studies report that blue light exposure did not only have negative, but also positive effects <sup>1</sup> Blue light exposure can positively affect cognitive performance, alertness, and reaction time. It is an effective treatment against major depression symptoms. <sup>3</sup> It has a stimulating effect on cognitive brain activity and increases physical performance <sup>1</sup>

The consequences of blue light exposure on sleep and well-being are not limited to the UAE; this issue has garnered global attention due to the pervasive use of electronic devices in the modern era. Electronic devices emitting blue light are omnipresent, and their usage extends beyond the UAE, affecting individuals worldwide.<sup>1</sup> The rapid technological advancements and urbanization experienced by the UAE mirror trends in many developed and developing countries. This shift towards a more digitized and urban lifestyle has far-reaching implications for the sleep patterns and overall health of individuals. Understanding the effects of blue light on sleep and well-being in the UAE can serve as a microcosm for the broader global challenge of adapting to the digital age while maintaining healthy sleep habits. <sup>2</sup> Moreover, the implications of blue light exposure on sleep and health transcend cultural and geographical boundaries, making it a pertinent topic for research and public health awareness internationally. As the UAE serves as a case study for the impact of modernization and technological development on sleep quality and well-being, the insights gained from this research can contribute to a more comprehensive understanding of the issue's global relevance.<sup>3</sup> The research conducted in the UAE could potentially inform policies and interventions aimed at mitigating the adverse effects of blue light exposure on sleep and well-being not only in the UAE but also in other nations facing similar challenges. In this context, the study's findings may offer valuable insights into the development of strategies and guidelines for improving sleep and overall health in the digital age. The findings of this research will provide valuable insights into the potential consequences of blue light exposure on the sleep and well-being of adults in the UAE.

It is the norm to measure restful and good sleep based on sleep quality. The use of electronic devices causes a decrease in sleep quality. People go to bed later, and the process of falling asleep is delayed. In addition, sleep time is reduced, which translates into sleep deprivation. <sup>1</sup> It was found that blue light emitted by electronic devices suppresses the



secretion of the hormone melatonin. One of the main functions of melatonin is the regulation of the circadian rhythm, which consequently influences sleep.<sup>2</sup> The term wellbeing includes the elements mood, irritability, arousal, tension, anxiety, and motivation. Literature has shown that blue light shows both positive as well as negative effects on wellbeing. A study done on effect of blue light on wellbeing of athletes, wellbeing was strained because they were under a lot of pressure to perform well which led to over training & mental stress. The review showed that Athletes used their smartphones immediately before competitions to distract them from stress and use the blue light from the smartphone as an additional effect to improving wellbeing.<sup>3</sup>

A study conducted in Switzerland. The databases that were searched were Cochrane, Embase, Pubmed, Scopus, and Virtual Health Library. The studies included investigated the influence of blue light exposure on either sleep, performance, wellbeing or a combination of those parameters on healthy humans. Quality assessment was done based on the quantitative assessment tool "QualSyst." The results revealed Fifty percent of studies found tiredness to be decreased. One fifth of studies found sleep quality to be decreased and one third found sleep duration to be decreased. Half of the studies found sleep efficacy to be decreased and slightly less than half found sleep latency to be increased. Blue light exposure can positively affect cognitive performance, alertness, and reaction time. Further research should explore if blue light can improve sleep, performance and wellbeing to significantly benefit athletic performance.<sup>1</sup>

A large cross-sectional population-based survey was conducted in Norway among 9846 adolescents from three age cohorts aged 16-19. The main independent variables were type and frequency of electronic devices at bedtime and hours of screen-time during leisure time. Sleep variables calculated based on self-report including bedtime, rise time, time in bed, sleep duration, sleep onset latency and wake after sleep onset. Results revealed that adolescents spent a large amount of time during the day and at bedtime using electronic devices. Daytime and bedtime use of electronic devices were both related to sleep measures, with an increased risk of short sleep duration, long sleep onset latency and increased sleep deficiency. A doseresponse relationship emerged between sleep duration and use of electronic devices, exemplified by the association between PC use and risk of less than 5 h of sleep (OR=2.70, 95% CI 2.14 to 3.39), and comparable lower odds for 7-8 h of sleep (OR=1.64, 95% CI 1.38 to 1.96). The study concluded that use of electronic devices is frequent in adolescence, during the day as well as at bedtime. The results demonstrate a negative relation between use of technology and sleep, suggesting that recommendations on healthy media use could include restrictions on electronic devices.<sup>2</sup>

Hence this study is done to evaluate the influence of Blue light on sleep & wellbeing among adults in UAE

### **Objectives of the study**

1. To assess sleep & wellbeing among adults
2. To determine the association of blue light on sleep & wellbeing
3. To determine association of sleep & wellbeing with selected demographic variables



**Methods**

A quantitative approach using a descriptive cross-sectional design was used for this study among 100 adults who satisfied the inclusion criteria. The tools used were the Pittsburg Sleep Quality Index to assess quality of sleep and a Wellbeing scale to assess wellbeing. Through a google survey after ethical clearance form the concerned Institutions.

**Results**

The study shows that majority (54%) were of the age between 29-39 years, 58% were females, 50% had a Bachelor’s degree, 62% were Asians, 47% belonged to other professions, 69% used mobile phones and 47% had exposure to Blue light for 5-8 hours.

**Table 1: Frequency and percentage distribution selected demographic variables**

Demographic variables		Frequency (N=100)
Age	18- 28 Years	11
	29-39 Years	54
	40-50 Years	27
	>50 Years	8
Gender	Male	42
	Female	58
Educational	Bachelor degree	50
	Diploma	9
	High school	7
	Higher degree or more	34
Nationality	Asia	62
	Other GCC	7
	Others	19
	UAE	12
Occupation	IT professional	12
	Medical professional	30
	Other profession	47
	Not working	11
Type of Blue Light	Laptop or desktops	26
	Mobile phone	69
	Others	5
Blue Light in a Day	0-4 hours	31
	5- 8 hours	47
	>=9 hours	22



**Quality of Sleep and Wellbeing**

**Table 2a: Mean & Standard Deviation of Sleep & Wellbeing**

<b>PSQI<sup>‡</sup></b>		7.0 ± 3.6
<b>Sleep Quality</b>	<b>Good</b>	38
	<b>Poor</b>	62
<b>Wellbeing Domains</b>		
<b>Autonomy<sup>‡</sup></b>		14.7 ± 2.4
<b>Environmental mastery<sup>‡</sup></b>		15.3 ± 2.9
<b>Personal growth<sup>‡</sup></b>		15.9 ± 2.8
<b>Positive relations with other<sup>‡</sup></b>		14.2 ± 4.0
<b>Purpose in life<sup>‡</sup></b>		13.0 ± 3.3
<b>Self-acceptance<sup>‡</sup></b>		16.7 ± 3.0

<sup>‡</sup>Mean±SD

The study shows that 62% had poor sleep with a mean PSQI of 7.0 ± 3.6. Among the wellbeing domains self - acceptance had the highest score with a Mean ± SD of 16.7 ± 3.0. The study also shows that there is a significant association between sleep and wellbeing parameters – autonomy, positive relation with others and self – acceptance at 0.05 level of significance.

**Table 2b: Association between Sleep & Wellbeing**

<b>Parameter</b>	<b>Sleep Quality</b>		<b>P-value<sup>‡</sup></b>
	<b>Good</b>	<b>Poor</b>	
<b>N</b>	38	62	
<b>Autonomy</b>	15.3 ± 2.1	14.3 ± 2.6	0.058*
<b>Environmental mastery</b>	15.4 ± 3.4	15.1 ± 2.6	0.646
<b>Personal growth</b>	16.2 ± 3.1	15.7 ± 2.6	0.482
<b>Positive relations with other</b>	15.3 ± 4.3	13.6 ± 3.7	0.043*
<b>Purpose in life</b>	13.6 ± 3.7	12.6 ± 3.1	0.147
<b>Self-acceptance</b>	17.8 ± 2.5	16.0 ± 3.1	0.004*

<sup>‡</sup>Independent Sample T test \* significant

Table 2b shows that there is a significant association between sleep and wellbeing parameters –autonomy, positive relation with others and self – acceptance at 0.05 level of significance.



There study revealed that there was a statistical significance in relation to sleep quality and hours of exposure to blue light in a day at  $p < 0.001$  level of significance. Those who had greater duration (5-8 & >9) hours of exposure to blue light had poor sleep quality.

**Association of Wellbeing and selected demographic Variables**

The study shows increase in certain parameters of wellbeing on use of blue light. There is a significant association between wellbeing parameters –autonomy, positive relation with others and self - acceptance.

**Table 3: Association of sleep quality with selected demographic variables**

**N=100**

Parameter		Sleep quality		P-value
		Good (n=38)	Poor (n=62)	
Age	18- 28	6 (15.8%)	5 (8.1%)	0.60
	29-39	20 (52.6%)	34 (54.8%)	
	40-50	10 (26.3%)	17 (27.4%)	
	>50	2 (5.3%)	6 (9.7%)	
Gender	Male	20 (52.6%)	22 (35.5%)	0.092
	Female	18 (47.4%)	40 (64.5%)	
Educational	High school	2 (5.3%)	5 (8.1%)	0.30
	Diploma	1 (2.6%)	8 (12.9%)	
	Bachelor degree	20 (52.6%)	30 (48.4%)	
	Higher degree or more	15 (39.5%)	19 (30.6%)	
Nationality	Asia	28 (73.7%)	34 (54.8%)	0.26
	UAE	4 (10.5%)	8 (12.9%)	
	Other GCC	2 (5.3%)	5 (8.1%)	
	Others	4 (10.5%)	15 (24.2%)	
Occupation	Not working	5 (13.2%)	6 (9.7%)	0.61
	Medical professional	10 (26.3%)	20 (32.3%)	



	It professional	3 (7.9%)	9 (14.5%)	
	Other profession	20 (52.6%)	27 (43.5%)	
<b>Type of blue light</b>	Laptop desktops or	10 (26.3%)	16 (25.8%)	0.57
	Mobile phone	25 (65.8%)	44 (71.0%)	
	<b>Others</b>	3 (7.9%)	2 (3.2%)	
<b>Blue light in a day</b>	<b>0-4 hours</b>	19 (50.0%)	12 (19.4%)	<0.001*
	<b>5- 8 hours</b>	17 (44.7%)	30 (48.4%)	
	<b>&gt;=9 hours</b>	2 (5.3%)	20 (32.3%)	

There is no statistical significance between age, gender, occupation and parameters of wellbeing. There is a statistical significance between education and positive relations with others, those with bachelors and higher degrees had positive relations with others, which is one of the parameters of wellbeing. There is statistical significance between nationality and parameters positive relation with others and purpose with life. Asians had better positive relations with others and better purpose in life compared to UAE and other GCC.

**Table 4. Association of parameters of Wellbeing with type of blue light**  
N=100

Parameter	Type of Blue Light			P-value <sup>¥</sup>
	Laptop desktops	or	Mobile phone	
<b>N</b>	<b>26</b>		<b>69</b>	<b>5</b>
<b>Autonomy</b>	14.8 ± 2.6		14.8 ± 2.1	12.6 ± 5.1
<b>Environmental mastery</b>	15.2 ± 2.6		15.5 ± 2.9	11.8 ± 4.1
<b>Personal growth</b>	15.7 ± 2.6		16.1 ± 3.0	14.8 ± 1.9
<b>Positive relations with other</b>	15.2 ± 4.0		14.0 ± 4.0	12.4 ± 2.7
<b>Purpose in life</b>	14.4 ± 3.0		12.5 ± 3.4	11.8 ± 2.4
<b>Self-acceptance</b>	16.4 ± 3.3		16.8 ± 3.0	16.4 ± 1.5

<sup>¥</sup>One-way ANOVA



There is statistical significance between type of blue light and environmental mastery and purpose with life at 0.05 level of significance and hours of exposure of blue light and positive relations with others and self - acceptance at 0.05 level of significance.

**Table 5. Association of parameters of Wellbeing with number of hours of exposure of blue light**

**N=100**

Parameter	Blue light in a day			P-value <sup>‡</sup>
	0-4 hours	5- 8 hours	>=9 hours	
<b>N</b>	<b>31</b>	<b>47</b>	<b>22</b>	
<b>Autonomy</b>	14.6 ± 2.6	15.0 ± 1.7	14.1 ± 3.4	0.341
<b>Environmental mastery</b>	15.5 ± 3.8	15.4 ± 2.4	14.5 ± 2.6	0.442
<b>Personal growth</b>	15.7 ± 3.2	16.0 ± 2.8	16.0 ± 2.6	0.867
<b>Positive relations with other</b>	14.9 ± 3.9	14.8 ± 4.3	12.0 ± 2.8	0.014*
<b>Purpose in life</b>	12.9 ± 3.6	13.0 ± 3.3	13.0 ± 3.2	0.999
<b>Self-acceptance</b>	17.7 ± 2.7	16.7 ± 2.9	15.2 ± 3.1	0.012*

<sup>‡</sup>One-way ANOVA \*Significant

The table 4g shows that there is statistical significance between hours of exposure of blue light and positive relations with others and self - acceptance at 0.05 level of significance

### Discussion

Present study shows that 62% had poor sleep with a mean PSQI of 7.0 ± 3.6. Among the wellbeing domains self - acceptance had the highest score with a Mean ± SD of 16.7 ± 3.0. The study also shows that there is a significant association between sleep and wellbeing parameters – autonomy, positive relation with others and self – acceptance at 0.05 level of significance.

A systemic review in Switzerland showed one fifth of studies found sleep quality to be decreased and one third found sleep duration to be decreased. Half of the studies found sleep efficacy to be decreased and slightly less than half found sleep latency to be increased. Fifty percent of studies found tiredness to be decreased. Half of the studies found sleep efficacy to be decreased and slightly less than half found sleep latency to be increased. Blue light





exposure can positively affect cognitive performance, alertness, and reaction time. Further research should explore if blue light can improve sleep, performance and wellbeing to significantly benefit athletic performance.<sup>1</sup>

The present study revealed that there was a statistical significance in relation to sleep quality and hours of exposure to blue light in a day at  $p < 0.001$  level of significance. Those who had greater duration (5-8 &  $> 9$ ) hours of exposure to blue light had poor sleep quality. A similar study in Norway found a dose response relationship emerged between sleep duration and use of electronic devices, exemplified by the association between PC use and risk of less than 5 h of sleep (OR=2.70, 95% CI 2.14 to 3.39), and comparable lower odds for 7-8 h of sleep (OR=1.64, 95% CI 1.38 to 1.96). The study concluded that use of electronic devices is frequent in adolescence, during the day as well as at bedtime. The results demonstrate a negative relation between use of technology and sleep, suggesting that recommendations on healthy media use could include restrictions on electronic devices.<sup>2</sup>

The present study shows increase in certain parameters of wellbeing on use of blue light. There is a significant association between wellbeing parameters –autonomy, positive relation with others and self - acceptance. There is no statistical significance between age, gender, occupation and parameters of wellbeing. There is a statistical significance between education and positive relations with others, those with bachelors and higher degrees had positive relations with others, which is one of the parameters of wellbeing. There is statistical significance between nationality and parameters positive relation with others and purpose with life. Asians had better positive relations with others and better purpose in life compared to UAE and other GCC. There is statistical significance between type of blue light and environmental mastery and purpose with life at 0.05 level of significance and hours of exposure of blue light and positive relations with others and self - acceptance at 0.05 level of significance.

A similar study revealed that exposure to blue light can affect sleep, performance and wellbeing. An important negative effect of exposure to blue light is a reduction in the quality and length of sleep, which can negatively affect performance. It is believed that in order to maintain a healthy circadian rhythm, it is necessary not only to increase the proportion of blue light in artificial light during the day, but also to reduce the amount of that light in the evening and night hours.<sup>4</sup>

## **Conclusion**

The present study findings have revealed that blue light causes poor sleep. In relation to wellbeing parameters. Blue light use has improved wellbeing on certain wellbeing parameters such as positive relation with others. There is a significant association between sleep and wellbeing parameters such as autonomy, positive relation with others and self - acceptance.



## **Ethical Considerations**

The study proceeded after permission from Institution Review Board, consent was obtained and confidentiality maintained

## **Conflict of Interest**

There is no conflict of interest

## **Contribution of Authors**

All authors have contributed to this research

## **References**

1. Silvani MI, Werder R, Perret C. The influence of blue light on sleep, performance and wellbeing in young adults: A systematic review. *Front Physiol.* 2022 Aug 16;13:943108. doi: 10.3389/fphys.2022.943108. PMID: 36051910; PMCID: PMC9424753
2. Hysing M, Pallesen S, Stormark KM, Jakobsen R, Lundervold AJ, Sivertsen B. Sleep and use of electronic devices in adolescence: results from a large population-based study. *BMJ Open.* 2015 Feb 2;5(1):e006748. doi: 10.1136/bmjopen-2014-006748. PMID: 25643702; PMCID: PMC4316480
3. Alkozei A, Smith R, Pisner DA, Vanuk JR, Berryhill SM, Fridman A, Shane BR, Knight SA, Killgore WD. Exposure to Blue Light Increases Subsequent Functional Activation of the Prefrontal Cortex During Performance of a Working Memory Task. *Sleep.* 2016 Sep 1;39(9):1671-80. doi: 10.5665/sleep.6090. PMID: 27253770; PMCID: PMC4989256.
4. Gruzewska-Piotrowska K, Gruzewska A, Pająk M. Does blue light affect sleep quality or performance? – empirical research based on anonymous surveys among medical students and physicians. *Qual Sport [Internet].* 2023 Jun. 30 [cited 2023 Sep. 27];14(1):80-91. Available from: <https://apcz.umk.pl/QS/article/view/44411>
5. Mazurek MO, Engelhardt CR, Hilgard J, Sohl K. Bedtime Electronic Media Use and Sleep in Children with Autism Spectrum Disorder. *J Dev Behav Pediatr.* 2016 Sep;37(7):525- 31. doi: 10.1097/DBP.0000000000000314. PMID: 27355885.
6. Buysse, DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ: The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice. *Psychiatry Research* 28:193-213, 1989 <https://www.goodmedicine.org.uk/files/assessment,%20pittsburgh%20psqi.pdf>
7. Ryff, C. D., Almeida, D. M., Ayanian, J. S., Carr, D. S., Cleary, P. D., Coe, C., ... Williams, D. (2010). National Survey of Midlife Development in the United States (MIDUS II), 2004- 2006: Documentation of psychosocial constructs and composite



variables in MIDUS II Project 1. Ann Arbor, MI: Inter-university Consortium for Political and Social Research. <https://osf.io/d39yg/download>

8. <https://www.dictionary.com/browse/bluelight#:~:text=%5B%20bloo%2Dlahyt%20%5D%20show%20ipa,devices%20that%20use%20LED%20technology>.
9. Dijk DJ, Archer SN. Light, sleep, and circadian rhythms: together again. *PLoS Biol.* 2009 Jun 16;7(6):e1000145. doi: 10.1371/journal.pbio.1000145. Epub 2009 Jun 23. PMID: 19547745; PMCID: PMC2691600.
10. Cain N, Gradisar M. Electronic media use and sleep in school-aged children and adolescents: A review. *Sleep Med.* 2010 Sep;11(8):735-42. doi: 10.1016/j.sleep.2010.02.006. Epub 2010 Jul 29. PMID: 20673649