

Effect of Disrupted Sleep-Wake Cycle on Mental Intelligence due to Screen Time at Night

¹Jagruti P. Patel, ²Misba J. Shaikh, ³Dr. Swati A. Bande

^{1,2}Student, ³Assistant Professor

Department of Zoology

M. M. College Of Arts, N. M. Institute Of Science, H. R. J. College Of Commerce, Bhavan's College
Munshi Nagar, Andheri (W), Mumbai-58, India.

Abstract- Circadian rhythm is a 24-hour internal body clock that influences various behavioral, mental and physical state. Any disruption in this cycle is known to have impact on overall physiology and psychology of the body. Disruption in circadian cycle alters the functioning of the brain and affects mental intelligence especially in the youth. Using a pre-prepared questionnaire based on 5 parameters - Thinking capacity, Reasoning, Retention, Processing speed and Problem-solving, the responses were collected for further analysis. The students were categorized into 2 groups- Group A (Students with disrupted circadian cycle i.e. those who use phone in the night) and Group B (Students with undisrupted circadian cycle i.e. those who have no screen time in night). The group difference was statistically significant. The mean intelligence score of group B students was comparatively more than group A student. Group B students were more active than group A student. We can thus say that those with disturbed circadian cycle have a low mental intelligence. One of the factors could be that of stress due to lack of sleep. Due to excessive screen time, the sleeping hours are reduced due to which the brain processing speed may be reduced. We can thus conclude that those with a disturbed circadian cycle have low mental intelligence. This disruption results in low quality of brain functioning and affects cognitive abilities, behaviour and judgements. A good and maintained sleep-wake cycle helps the brain to function to its optimum level and thus IQ level is maintained. Their busy lifestyle and excessive screen time are cons to their body. A balanced sleep-wake cycle will help the student to maintain a distressed life.

Keywords: circadian rhythm/cycle, Internal body clock, sleep cycle, cognition, youth.

1.INTRODUCTION

Circadian rhythm is a 24-hour internal body clock, which influences our behavioral, mental and physical state. It not only plays a role in the body's metabolism but also controls the hormonal cycles and organ's functions including that of the brain. The circadian rhythm that was discovered in 1935 is the body clock of every organism that enables it to sleep and wake in a 24-hour period (William, et al., 2021). It was successfully discovered in *Drosophila* after which the Bunker experiment (1966) confirmed the phenomenon (Rong-Chi Huang et al., 2018). This cycle has known to be influenced and detected by light (whether natural or artificial). The light provides signals to the clock genes. Various changes take place at the molecular level. The cells of the body work accordingly. (Annaelle, et al., 2017) The sleep-wake cycle has effects overall on mental as well as physical state of a human being (William, et al., 2021). Disruptions in which have been known to cause several metabolic and psychological disorders (Ippai, et al., 2016). The circadian cycle gets disrupted by any artificial light due to thenocturnal activities of our body, specifically the use of Mobile phone due to social or work schedules. Disturbed cycle is also known to show effects in mental health in a negative way including mood regulation and sleeping disorders and syndromes. Thus, a body which follows the sleep-wake cycle is considered to be healthier mentally as well as physically as compared to the body that faces disruption in its cycle. (RM Voigt, et al., 2016, Tuğçe, et al., 2022) Moreover the lifestyle we follow, today allows us to disrupt the cycle by exposure to artificial light (mobile) and gives way to reduced physical and mental abilities and activeness. To highlight the effects of such disruption among young students, a survey experiment was conducted wherein the mental intelligence was tested on the basis of the following parameters- Thinking capacity, problem solving, reasoning, processing speed and retention. The focus of the survey was to bring attention to the importance of circadian rhythm in the life of a student and the effects of its disruption on their health. The results showed two groups of students namely A and B which shows exposure to light after 12.00am and no exposure to light after 12.00am respectively. Mental intelligence can overall be assumed as the summation of parameters like thinking capacity, problem solving, processing speed reasoning and retention. These parameters differ from student to student and the difference may be due to external or internal factor. External factors involve environment, surrounding, company, low concentration due to disturbance, etc. (Archita, et al., 2016). While internal factors include brain disorder, psychological disorder, etc. The normal functioning of brain can be disturbed by the disruption of sleep-wake cycle or the circadian rhythm in all since

the Master clock (SCN) is situated in the brain (Erik,et.al.,2017). Various aspects like nocturnal activities, lifestyle, screen time at night, sleep disorders, stress contribute to a disrupted circadian rhythm. Lack of sleep due to screen time at night is the most widespread reason for disrupted circadian cycle among the youth.

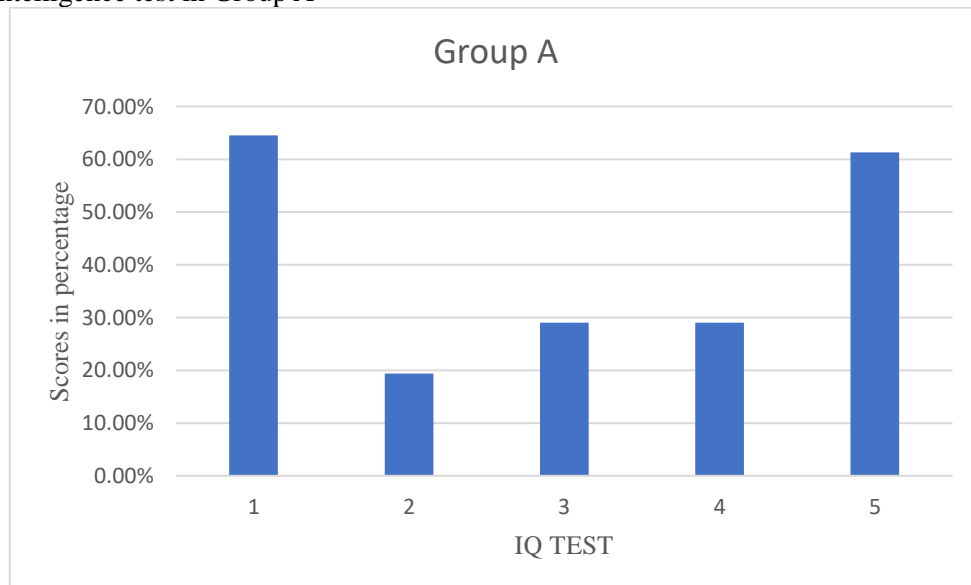
2.METHODOLOGY

A survey was conducted among the students of Bhavan's College, Andheri to check their mental intelligence in relation to their disrupted or undisrupted circadian cycle. The age criteria were specified as 17- 25 years. Students of this age group had reportedly exposure to artificial light mainly due to mobile phone use which resulted into a disrupted or disturbed circadian cycle. The questionnaire included - Thinking capacity, Reasoning, Retention, Processing speed and Problem-solving based questions. These questions were in accordance with Wechsler's Intelligence test. Responses were recorded using Google Forms and further analyzed. The students which had an exposure to mobile phone light after 12.00 a.m. showed deviation in marks obtained as compared to the students who didn't have any such exposure after 12.00 a.m. The collected data was segregated into two groups 'A' and 'B' in order to make the comparison between the students using mobile phone and students not using mobile phones after 12.00a.m. respectively.

3.OBSERVATION TABLE AND RESULT

	GROUP A		GROUP B		T test	SD
	Mean Score	Percentage	Mean score	Percentage		
Question no 1	20	64.51	23	58.97	0.136351	6.854844
Question no 2	6	19.35	14	35.89		
Question no 3	9	29.03	13	33.33		
Question no 4	9	29.03	11	28.20		
Question no 5	19	61.29	27	69.23		
Total	12.6	203.21	17.6	225.62		

Fig.1- Showing intelligence test in Group A



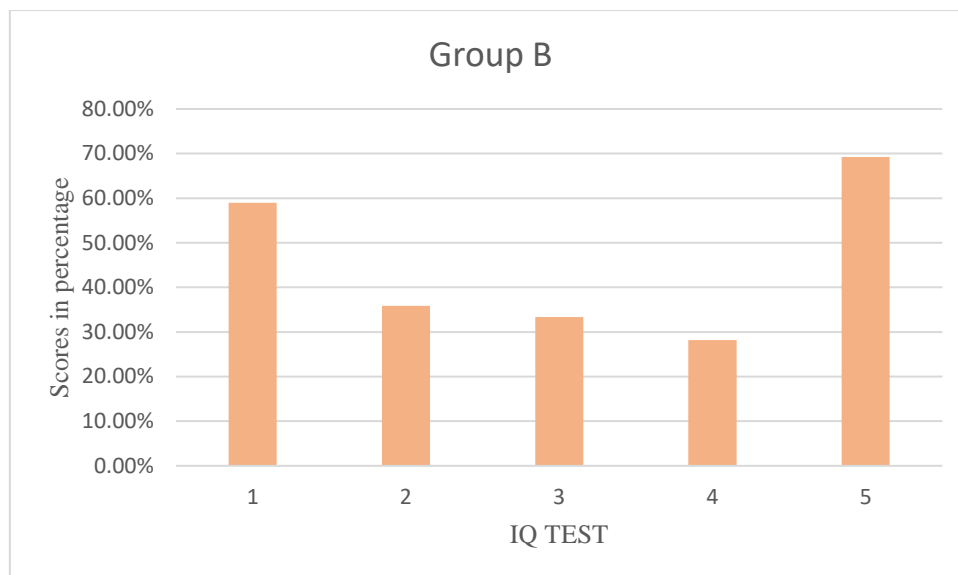


Fig. 2- Showing intelligence test in Group B

The above graph categorizes the participants into two groups namely, Group A and Group B. Group A includes all those who have screen time after 12 am representing those who have a disrupted circadian cycle. On the other hand, Group B includes all those who have no screen time after 12 am representing those who have an undisturbed circadian cycle. The graph was plotted based on the marks received in a pre-prepared questionnaire of IQ test.

We compared the self-reported sleep-wake timing of young students between age group 17-25. Total 100 students were classified. The IQ of subjects was differentially affected by the varying degree of circadian cycle. The difference in intelligence score in Group A (students with disrupted circadian cycle) and Group B (students with undisturbed circadian cycle) analyzed by a two-way ANOVA was found to be statistically significant. The most interesting part of the finding was that group B (students with undisturbed circadian cycle) was more active than group A.

This group difference was found to be statistically significant. The mean of intelligence score of subjects between A and B imitated the ecological or anthropogenic standpoint of circadian cycle.

Students of group B have a higher mental intelligence score than students of group A. The undisturbed circadian cycle of Group B students may play a role in providing faster brain processing. On the other hand, students of group A have a comparatively lower mental intelligence score. Among the various other reasons for low score, one might be the disruption of circadian cycle due to staying awake at night.

4. CONCLUSION

We can thus conclude that those with a disturbed circadian cycle have low mental intelligence. The cause of the disrupted circadian cycle is the lack of sleep and over exposure to light. The normal physiological process may be affected due to the disrupted circadian cycle. There may be a factor of stress involved in the reduced mental intelligence. Stress among the young generation may be the cause of misbalanced circadian cycle prevalent in today's time. Be it social media or studies or work or any other reason, screen time among students after 12 am has become common nowadays. Sleep-wake cycle among various other factors play a crucial role in determining a person's mental intelligence. Sleep is an effortlessly important process that allows our body and brain to rest. While asleep our body works on the toxins produced while the brain reorganises the stored data. On completion of sleep-wake cycle one wakes up fresh with an active mind for the day. Assuming 6-7 hours of sleep is necessary for students, cell phone takes the most of this time. This disruption results in low quality of brain functioning and affects cognitive abilities, behaviour and judgements. A good and maintained sleep-wake cycle helps the brain to function to its optimum level and thus IQ level is maintained. Lack of sleep is an emerging problem faced by many students. Their busy lifestyle and excessive screen time are cons to their body. A balanced sleep-wake cycle will help the student to maintain a distressed life.

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