



# SLEEP QUALITY, GENERAL HEALTH, AND COGNITION AMONG MALE AND FEMALE UNIVERSITY STUDENTS: A CORRELATIONAL STUDY

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## ABSTRACT

The aim of this study was to measure the sleep quality, general health and cognition among male and female university students. A sample of 124 young adults between the age group of 18 – 25 were taken from various universities of Delhi and Delhi – NCR region. The data was collected using Pittsburgh Sleep Quality Index (PSQI), General Health Questionnaire – 28 (GHQ – 28) and PGI Memory Scale. The scores were analysed using Statistical Analysis using SPSS. The results of this study show significant positive correlation between Sleep Quality and Cognition, and between General Health and Cognition.

*Keywords: Cognition, General Health, Sleep Quality, Young Adults*

## INTRODUCTION

Sleep strengthens the neural connections between the neurons. So, if one is sleep deprived, it can overload the neural connections causing disturbances in cognitive functions such as attention and concentration which are prerequisites for most of the learning. In addition to cognitive functions, sleep also serves as the bases of improved physical as well as mental health. To improve our cognitive abilities, physical health and mental health, one needs adequate amount of 7 – 8 hours of sleep. A goodnight's sleep can help you to cope up with stress and other related regular discomforts such as recover from illness.

Sleep cycle is divided into two states that are, non – rapid eye movement (non – REM) and rapid eye movement (REM) sleep. The brain and body works differently during these phases. Although modern science has advanced in knowledge about sleep there are still a lot of facts that seem unknown.

Neurotransmitters are involved in our sleep cycle. They control our wake and sleep routines depending on which neurons they're acting on. Neurons in the brainstem (which is the converging point of the brain and the spinal cord) produce neurotransmitters called serotonin and norepinephrine. These chemicals keep our brain active when we are awake. The neurons that are located at the base of the brain are responsible for us falling asleep Many parts of the brain are under stimulation during the sleep hours.

Sleep helps us in many ways such as hormonal and physical growth in children and young adults. The body releases growth hormone during this type of sleep. The body also increases production of proteins, which we need for cell growth and to repair damage. A lack of sleep affects our memory, performance and ability to think clearly. If a person is severely sleep deprived, they may even experience neurological problems such as mood swings and hallucinations. Sleep also helps our nerve cells. They can repair themselves, so they function at their best. And certain nerve connections get a chance to turn on, strengthening our brain and thinking ability.

Researchers don't fully understand why sleep is so essential. But studies in animals have shown that getting deprived of REM sleep can shorten lifespans. Lack of sleep may harm the immune system, which protects us from infections. People who don't get enough sleep are at higher risk for developing various health conditions including obesity, diabetes and heart problems.

### *Sleep and Cognition*

Sleep serves multiple functions. It is very critical for waking cognition, the ability to think clearly and to be vigilant, alert and sustained attention. Sleep also serves as a key role in emotional regulation. The results of a recent study suggests that younger adults are more vulnerable to the adverse effects of chronic sleep loss and recurring circadian disruption than older adults. However, the neurobiological basis for these age – related differences are not yet comprehended well but such finding can help to form new approaches to prevent drowsy driving and related motor – vehicle accidents among young drivers.

According to Dr. Dinges, sleep is not an optional activity, rather it is highly mandate. Previous researches also reveal that sleep deprivation can cause significant and adverse changes in mood, cognitive abilities, immune function and work performances (Choo et al., 2005). Lack of sleep can disturb body circulation which can result in decline of cognitive and emotional abilities of an individual (Raymond, 1988). Other researchers have also found that inadequate sleep can impair response inhibition (Harrison and Horne, 1998; Muzur et al., 2002; Jennings et al., 2003). In addition to such consequences, sleep deprivation can damage the hippocampus and could affect memory by destroying synaptic plasticity (Cote et al., 2014). It was identified by Thomas (2003) that partial sleep can reduce cerebral blood flow and metabolic rate in the thalamus, prefrontal cortex and parietal cortex (Geraldine et al., 2005).

Due to life style changes, one is unable to get complete sound sleep at a stretch. The population which is at severe risk are the adolescents and young adults. Increase usage of social media and academic competition, adolescents and young adults face increase disturbance in their sleep quality. Researches suggest that adolescents and young adults need at least 9 – 10 hours sleep since their body goes through tremendous stress and hormonal changes. Heavy sleep debts can result in consequences as the individual grows (Carskadon and Dement, 1981; Wolfson and Carskadon, 1998).

### *Sleep and General Health*

Another well-known factor effected by sleep is General Health. Poor sleep quality is usually associated with poor general health. Glucose impairment, hypertension, metabolic syndrome, cardiovascular diseases and many more are a cause of sleep deprivation in many cases. (Kaur, et al., 2015). Poor sleep quality is common among young adults which in turn effects the general health of the population (Farhad Ghalebani, 2009). Health maintenance is vital throughout one's lifetime. Incorporating exercise, diet, preventative health checks and sleep management can help regulate general health of an individual (Meer, 2022).

The word health means a state of complete emotional and physical well – being. Good health is central to handling stress and living a longer, more active life. In 1948, the World Health Organization defined health as “A state of complete physical, mental and social well – being and not merely the absences of disease or infirmity.” Researches published in The Lancet (2009) defined health as the ability of a body to adapt to new threats and infirmities. They base this definition on the idea that the past few decades have seen modern science take significant strides in the awareness of diseases by understanding how they work, discovering new ways to slow or stop them, and acknowledging that an absence of pathology may not be possible.

### *Literature Review*

About Sleep's Role in Memory. This paper was authored by Bjorn Rasch and Jan Born (2013). It is a literature review on sleep and memory” research by providing a historical perspective on concepts and a discussion of more recent key findings.

Effect of Sleep Deprivation on the Working Memory – Related N2 – P3 Components of the Event – Related Potential Waveform. This paper was authored by Ziyi Peng, Cimin Dai and Yi Ba (2019). This study found that Total Sleep Deprivation can impair working memory capacity, which is characterized by lower amplitude and prolonged latency.

Sleep improves memory: The effect of sleep on long term memory in early adolescence. This paper was authored by Katya Trudeau Potkin and William E. Bunney Jr (2012). This study found out that Declarative memory is significantly improved by sleep in a sample of normal adolescents.

Sleep Deprivation; Impact on cognitive performance. This paper was authored by Paula Alhola and Paivi Polo – Kantola (2007). The result of this study was that Cognitive recovery processes, although insufficiently studied, seem to be more demanding in partial sleep restriction than in total SD.

Effects of total sleep deprivation on divided attention performance. This paper was authored by Eric Fang and Joshua J (2007). The result of this study was that the ability to divide attention between multiple tasks is impaired during exposure to sleep deprivation. These findings have potential implications for occupations that require multi-tasking combined with long work hours and exposure to sleep loss.

Sleep Quality and Its Correlation with General Health in Pre-university Students of Karaj, Iran. This paper was authored by Amir-Abbas Keshavarz-Akhlaghi and Mir Farhad Ghalebani (2009). The result of this study was that the prevalence of poor sleep quality in Iranian pre- university students is higher than that of many other countries. Further researches are required for finding the etiology.

Sleep quality, duration, and consistency are associated with better academic performance in college students. This paper was authored by Okano (et al., 2019). These findings provide quantitative, objective evidence that better quality, longer duration, and greater consistency of sleep are strongly associated with better academic performance in college. Gender differences are discussed.

Impact of sleep quality and general health on academic performance. This paper was authored by Omar Modayfer, Meshail A Al Aamer, Abdullellah M Al Adel and Laura Al Olayan (2016). The result of this study was that the effect of sleep quality and general mental well-being on academic achievement is inconclusive.

Sleep quality, duration, and consistency are associated with better academic performance in college students. This paper was authored by Okano (et al., 2019). These findings provide quantitative, objective evidence that better quality, longer duration, and greater consistency of sleep are strongly associated with better academic performance in college. Gender differences are discussed.

Association of sleep quality with general health: an Indian college students study. This paper was authored by Kaur (et al., 2015). The findings determine that the quality of sleep significantly affects the quality of health in college students.

Sleep quality and its association with psychological distress and sleep hygiene: a cross sectional study among pre-clinical medical students. This paper was authored by Mojtaba Rezaei (et al., 2008). These findings suggest that poor sleep quality is a common problem among pre-clinical medical students and is associated with some psychological symptoms and sleep hygiene behaviors. This issue demonstrates necessity of interventions to improve the sleep quality in this population group.

Sleep, Well – Being and Academic Performance: A study in a Singapore Residential College. This paper was authored by Armand (et al., 2021). This study determines that individuals with the highest levels of psychological well-being are not the best sleepers (in terms of overall sleep quality), neither are the highest academic achievers necessarily the best sleepers.

Sleep Improves Memory: The Effect of Sleep on Long Term Memory in Early Adolescence. This paper was authored by Katya Trudeau (et al., 2012). This study determines that Declarative memory is significantly improved by sleep in a sample of normal adolescents.

Effect of Sleep Deprivation on the Working Memory-Related N2-P3 Components of the Event- Related Potential Waveform. This paper was authored by Ziyi Peng, Cimin Dai, Yi Ba (et al., 2020). This study determines that total sleep deprivation can impair working memory capacity, which is characterized by lower amplitude and prolonged latency.

The Impact of Sleep on Learning and Memory. This paper was authored by Kelly Cappello (2019). This study determines that the less students slept during the semester, the worse their scores.

The Role of Sleep in Cognition and Emotion. This paper was authored by Matthew P. Walker (2009). This study determines that as critical as waking brain function is to cognition, an extensive literature now indicates that sleep supports equally important, different yet complementary operations.

Comparison of general health status and sleep quality between nurses with fixed working shifts and nurses with rotating working shifts. This paper was authored by Fereshteh Ghaljarei, Mahin Naderifar, Mahnaz Ghaljeh (2018). This study determines that a statistically significant difference in sleep quality and general health of nurses based on two questionnaires ( $p=0.01$   $p=0.05$ ) respectively.

Self-reported sleep quality, strain and health in relation to perceived working conditions in females. This paper was authored by Ulla M. Edéll-Gustafsson (2002). This study determines that a persistently high rate of psycho-physiological long-term effects of stress related to working conditions.

Sleep quality versus sleep quantity: Relationships between sleep and measures of health, well-being and sleepiness in college students. This paper was authored by June J. Pilcher, Douglas R. Ginter (1997). This study determines that health care professionals should focus on sleep quality in addition to sleep quantity in their efforts to understand the role of sleep-in daily life.

Sleep quality and psychological distress among undergraduate students of a Nigerian university. This paper was authored by Kolawole Samuel Mosaku (2017). This study determines that Presence of psychological distress and symptoms of depression and anxiety were significantly associated with poor sleep quality.

Relationship between sleep quality and health risk behaviors in undergraduate college students. This paper was authored by K Vail-Smith, WM Felts (2009). This study determines that sleep quality was associated with several health risk behaviours including physical aggression, suicide ideation, smoking, alcohol and marijuana use and physical inactivity.

Relationship between Sleepiness and General Health Status. This paper was authored by Berta Briones, Nancy Adams, Milton Strauss, Carl Rosenberg (et al., 1996). This study determines that measures of general health status may be broadly influenced by sleepiness and sleep quality. These data suggest that 1) sleepiness has an important impact on general health and functional status, specifically influencing self-perceptions regarding energy/fatigue; 2) a more specific assessment of sleepiness in general health evaluations may help explain some of the observed variability in these measures across subjects; and 3) general health measures may be useful in the evaluations of patients with sleep disorders.

Sleep quality in times of Covid-19 pandemic. This paper was authored by Josue Pinto, Mafalda Van Zeller, Pedro Amorim (et., al. 2020). This study determines that Home confinement without working, female gender and SDB may predict a higher risk of reporting sleep difficulties. Medical support during major disasters should be strengthened and potentially delivered through telemedicine, as this comprehensive approach could reduce psychological distress and improve sleep quality.

### **OBJECTIVES AND HYPOTHESIS**

The aim of this research was to study the relationship of sleep quality and general health with various domains of memory.

The objectives of this research are as follows;

The first objective for this research was;

- To study the relationship between sleep quality and various domains of memory including Remote Memory, Recent Memory, Mental Balance, Attention, Delayed Recall, Immediate Recall, Retention for Similar Pairs, Retention for Dissimilar Pairs, Visual Retention and Recognition.

The second objective of this research was;

- To study the relationship between general health and various domains of memory including remote Memory, Recent Memory, Mental Balance, Attention, Delayed Recall, Immediate Recall, Retention for Similar Pairs, Retention for Dissimilar Pairs, Visual Retention and Recognition.



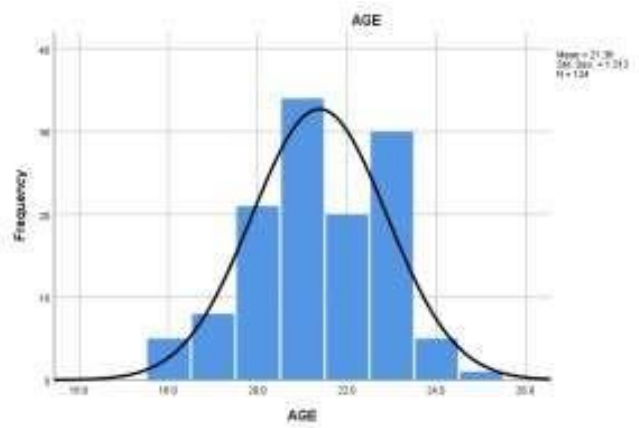
The hypothesis of this research are as follows;

The H1 hypothesis for this study is,

- There will be significant positive correlation between sleep quality and various domains of memory including remote Memory, Recent Memory, Mental Balance, Attention, Delayed Recall, Immediate Recall, Retention for Similar Pairs, Retention for Dissimilar Pairs, Visual Retention and Recognition.

And the H2 hypothesis for this study is,

- There will be significant positive correlation between general health and various domains of memory including Remote Memory, Recent Memory, Mental Balance, Attention, Delayed Recall, Immediate Recall, Retention for Similar Pairs, Retention for Dissimilar Pairs, Visual Retention and Recognition.



## METHODOLOGY

### Sample

A sample size of 124 young adults was collected from various higher educational institutions of Delhi and Delhi – NCR for the purpose of this study. The age range of the sample size for this study was from 18 – 25 years of age. This age category was chosen since people who fall under this age group have similar trends of sleep quality and general health that are compromised. Gender specified for this study were male and female since both are equally vulnerable to the effects of sleep quality and general health on attention and other major cognitive functions. A data of 55 females and 68 males were collected for the same. The sample collection was done one to one as it required equal participation of the subject as well as the experimenter. Volunteer Sampling method was used for in this study.

### Sample Characteristics

#### AGE

CLASS INTERVAL	FREQUENCY	PERCENTAGE
18 - 20	34	27.2
21 – 23	84	67.2
24 - 26	6	4.8

Table 1: A sample size of 124 young adults between the ages of 18 to 26 were collected. Majority of the sample size lied between the age group of 21 to 23 years of age with a frequency of 84 and a percentage of 67.2%.

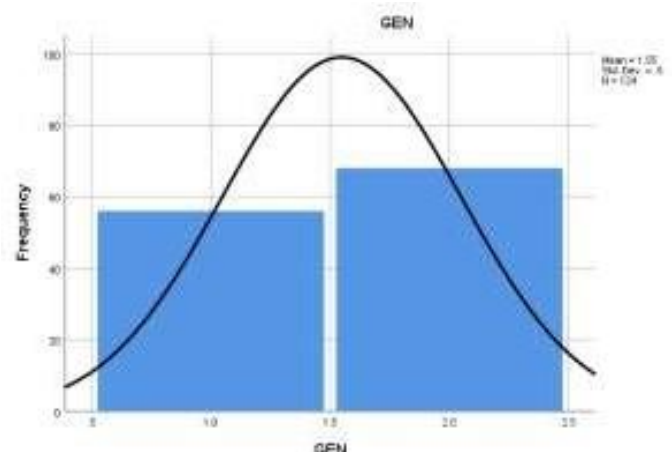
(N = 124)

#### GENDER

GENDER	FREQUENCY	PERCENTAGE
MALE	68	54.7
FEMALE	56	54.4

Table 2: A sample size of 124 young adults were collected among which 68 were male and 56 were female. Since there is not much difference in the sample of male and female, the results can be generalized for both.

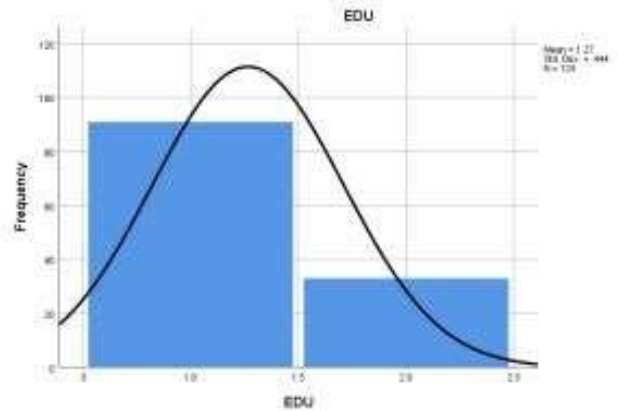
(N = 124)



**EDUCATION**

DEGREE	FREQUENCY	PERCENTAGE
UNDER GRADUATE	91	72.8
POST GRADUATE	33	26.4

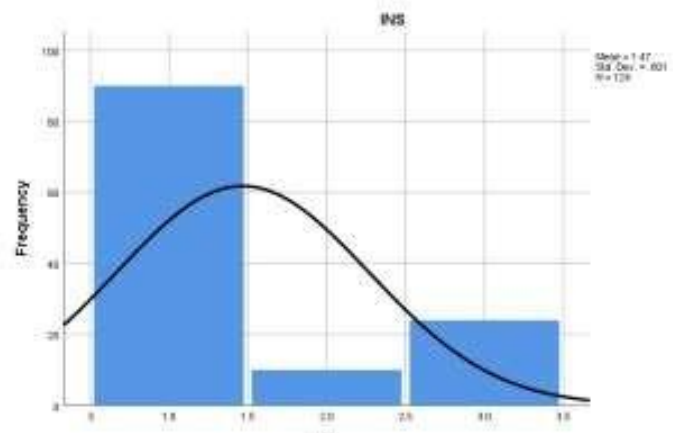
Table 3: A sample size of 124 young adults were collected from which 91 were undergraduates and 33 were postgraduates. (N = 124)



**INSTITUTION**

INSTITUTION	FREQUENCY	PERCENTAGE
SGT University	90	72.0
Amity University	10	8.0
Delhi University	24	19.2

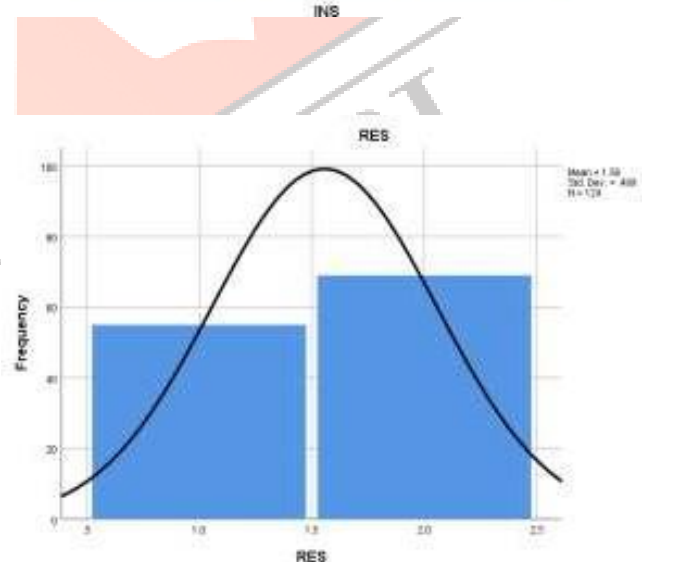
Table 4: A sample size of 124 young adults were collected among which 90 were from SGT University, 10 were from Amity University and 24 were from Delhi University. (N = 124)



**RESIDENCY**

RESIDENCY	FREQUENCY	PERCENTAGE
Delhi	55	44.0
Haryana	69	26.4

Table 5: A sample size of 124 young adults were collected from residential areas of Delhi and Haryana. The sample size collected from Delhi region were 55 and from Haryana region were 69. (N = 124)



*Tools and Measurements*

The scales, tests and measurements which were used in this research study are as follows;

1. Pittsburgh Sleep Quality Index (PSQI) is a standardized measure which is designed to gather consistent information about the subjective nature of people’s sleeping habits and provide a clear index that both, clinicians and patients can use. PSQI contains 19 self-rated questions and 5 questions rated by the bed partner or roommate (if one is available). Only self – rated questions are included in the scoring. The 19 self – rated items are combined to form seven “component” scores, each of which has a range of 0 – 3 points. In all cases, a score of “0” indicates no difficulty, while a score of “3” indicates severe difficulty. The seven component scores are then added to yield one “global” score, with a range of 0 – 21 points, “0” indicating no difficulty and “21” indicating severe difficulties in all areas. The coefficient for test – retest reliability of PSQI is .87. Cronbach’s alpha for the questionnaire was found to be 0.736. The criterion validity – correlations between the PSQI global score and polysomnography (PSG) measures were low, however they did show some significant relationship.

2. PGI Memory scale is a standardised test and is a part of PGI Battery of Brain Dysfunction (1977). P.G.I. Memory scale contains ten sub-tests — I. remote memory, II. recent memory, III. mental balance, IV. attention-concentration, V. delayed recall, VI. immediate recall, VII. retention for similar pairs, VIII. retention for dissimilar pairs, IX. visual retention and X. recognition. Raw scores are collected for each domain and are then converted into score which are correlated through a table presented to us in the manual. The test – retest reliability of P.G.I. Memory Scale was to be found .69 to .85.
3. General Health Questionnaire – 30 (GHQ-30) is a self-report screening measure used to detect possible psychological disorder. It is one of the widely used version of GHQ scale. It has a Pearson correlation of 0.493 with Pittsburgh Sleep Quality Index. This test was developed from GHQ – 60.

### Statistical Analysis

Correlational statistical analysis was used for this study to understand the relationship between sleep quality, general health and various memory domains. The characteristics of the sample data were described in terms of mean and standard deviation For the same, descriptive statistics was used.

## RESULT

V A R I A B L E S	VARIABLES										
		REM	RCM	MB	AT	DR	IR	RS	RD	VR	RE
GH	-	-	.199*	.211*			.31**	-		.19*	-
SQ	-	.21*	.34**	.55**	.39**	.50**	-	.33**	.44**	.28**	

Table 6: Shows significant correlation between General health, Sleep Quality and Various Domains of Memory, such as Remote Memory, Recent Memory, Mental Balance, Attention, Delayed Recall, Immediate Recall, Retention for Similar Pairs, Retention for Dissimilar Pairs, Visual Retention and Recognition. (N = 124)

\*\* Correlation is significant at the 0.01 level (2-tailed)

\* Correlation is significant at the 0.05 level (2-tailed).

(GH – General Health; SQ - Sleep Quality; REM – Remote Memory; RCM – Recent Memory; MB – Mental Balance; AT – Attention; DR – Delayed Recall; IR – Immediate Recall; RS – Retention for similar pairs; RD – Retention for Dissimilar pairs; VR – Visual Retention; RE – Recognition)

Results presented in the table: memory variable, mental balance has significant positive correlation with General Health ( $r = 0.20$ ;  $p < 0.05$ ). Attention and concentration shows significant positive correlation with General Health ( $r = 0.21$ ;  $p < 0.05$ ). Immediate Recall shows significant positive correlation with General health ( $r = 0.31$ ;  $p < 0.01$ ). Visual Retention has significant positive correlation with General Health ( $r = 1.90$ ;  $p < 0.05$ ).

Results presented in the table: memory variable, Recent memory shows positive correlation with Sleep Quality ( $r = 0.21$ ;  $p < 0.05$ ). Mental Balance shows positive correlation with Sleep Quality ( $r = 0.34$ ;  $p < 0.01$ ). Attention has positive correlation with Sleep Quality ( $r = 0.60$ ;  $p < 0.01$ ). Delayed Recall has a significant positive correlation with Sleep Quality ( $r = 0.40$ ;  $p < 0.01$ ). Immediate Recall has a significant positive correlation with Sleep Quality ( $r = 0.50$ ;  $p < 0.01$ ). Retention for Dissimilar Pairs shows significant positive correlation with Sleep Quality ( $r = 0.33$ ;  $p < 0.01$ ). Visual Retention shows significant positive correlation with Sleep Quality ( $r = -0.44$ ;  $p < 0.01$ ). Recognition has a significant negative correlation with Sleep Quality ( $r = -0.30$ ;  $p < 0.01$ ).

## DISCUSSION AND CONCLUSION

A research paper on sleep quality and cognition stated that long term sleep debts can result in poor sleep quality which would in turn greatly impact the cognition. There is a significant relationship between sleep and all the functions of the body. Sleep debt can impact not just our cognition but also our health quality. It plays an important role in our overall development and growth. The results of this study found that young adults with poor sleep quality were more prone to mental stress and physical illnesses.

The other dependent variable for this research was General Health. General Health can impact memory and other cognitive functions since poor health may lead to cognitive decline due to gradual wear and tear on the cerebrovascular system. Poor health quality might not leave direct impression on cognition, but within a span of several years poor health quality can result in decline of cognitive functions.

Several previous researches provide evidence for declined cognitive functions due to long term poor health quality. This is found mostly in adults of the age 50 – 74 who have had prolonged low health quality. Although the current research was on young adults, the results were still significant however, health quality did not meaningfully effect cognition. The relationship between general health and cognition did show a decrease in general health quality which impacted cognitive function of memory positively. Which means that decrease in health quality would result in decrease in cognitive functions of memory.

The results of this study show a significant positive correlation between General Health and various domains of memory such as Remote Memory, Recent Memory, Mental Balance, Attention, Delayed Recall, Immediate Recall, Retention for Similar Pairs, Retention for Dissimilar Pairs, Visual Retention and Recognition.

Recent researches have found that people who experience recurrent episodes of declined physical and mental health status throughout adulthood are at more risk of developing memory problems later in life. A study of 2016, published in the journal, Cognition and Emotion discovered that individuals with dysphoria — a persistent sense of unhappiness or dissatisfaction that is often a symptom of depression; had poorer working memory than people without any mental health problems. However, a research held in the University of Sussex in Brighton, U.K. found evidence that associates the occurrence of mental health problems throughout adulthood to memory problems at the age of 50 years.

The current study used GHQ – 30 scale which has more items of psychological health than physical health. Although, physical health was also considered for this research, its effect on cognition was not meaningfully explored. There are previously conducted researches that support the hypothesis of the impact of physical health on memory in the long run. By this, we can infer that there is still scope to explore the relationship between physical health and cognition.

Out of all the domains of memory, this study focused more on understanding the relationship between general health and attention concentration (a domain of memory). It was found that poor health resulted in lower attention – concentration comparatively to other domains of interest. Remote memory and recent memory did not have much effect of general health on them. However, according to previous researches, in the long run, there are chances for poor cognition due to poor health quality.

The sample of this study was of 124 with demographics of male and female, undergraduate and postgraduate, Delhi and Haryana, SGT University, Delhi University and Amity University. From which, male, undergraduate students, Haryana residence and SGT University samples had higher frequencies than other considered demographic details.

The  $H_1$  hypothesis for this study is,

- There will be significant positive correlation between sleep quality and various domains of memory including remote Memory, Recent Memory, Mental Balance, Attention, Delayed Recall, Immediate Recall, Retention for Similar Pairs, Retention for Dissimilar Pairs, Visual Retention and Recognition.

And the  $H_2$  hypothesis for this study is,

- There will be significant positive correlation between general health and various domains of memory including Remote Memory, Recent Memory, Mental Balance, Attention, Delayed Recall, Immediate Recall, Retention for Similar Pairs, Retention for Dissimilar Pairs, Visual Retention and Recognition.



Thus, according to the results, the above hypothesis are proven to be true. We can find significant positive correlation between sleep quality, general health and various domains of memory such as Remote Memory, Recent Memory, Mental Balance, Attention, Delayed Recall, Immediate Recall, Retention for Similar Pairs, Retention for Dissimilar Pairs, Visual Retention and Recognition.

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