

Assessment of the Sleep Cycle Effect on Human Health

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ABSTRACT

Sleep is an essential physiological process necessary for maintaining physical health, mental well-being, cognitive functions, and overall quality of life. Disturbances in sleep cycles and inadequate sleep duration have become increasingly common because of changing lifestyles, stress, and technological influences. The present study entitled “Assessment of the Sleep Cycle Effect on Human Health” was conducted to evaluate the relationship between sleep patterns and various health parameters among different age groups. A total of 100 participants from different age groups were selected and categorized into adolescents, young adults, middle-aged adults, and older adults. Information regarding sleep duration, sleep quality, stress level, fatigue level, and concentration ability was collected using questionnaires and health surveys. The findings indicated that sleep duration significantly affected stress level, cognitive performance, and physical health conditions. Young adults showed lower sleep duration (6.5 ± 0.5 h/day) compared with adolescents (7.8 ± 0.6 h/day). Individuals sleeping less than five hours exhibited higher stress scores (85%) and lower concentration levels (45%) compared with individuals sleeping more than seven hours. The study concludes that adequate sleep duration and healthy sleep habits are essential for maintaining physical and psychological well-being. Proper sleep management may reduce risks associated with chronic health conditions and improve overall quality of life.

Keywords- Sleep cycle, sleep quality, stress, cognitive performance, human health, circadian rhythm.

I. INTRODUCTION

Sleep is a fundamental biological process essential for maintaining physical health, mental well-being, and normal physiological functioning in human beings. Humans spend approximately one-third of their lives sleeping, indicating the critical importance of sleep in sustaining life and supporting normal body functions. Sleep is not merely a period of rest; rather, it is a complex physiological state involving multiple neurological, hormonal, metabolic, and psychological activities that contribute significantly to overall health and quality of life (Carskadon & Dement, 2011). The human body operates according to a biological timing system known as the circadian rhythm, which regulates sleep-wake cycles over approximately twenty-four hours. This biological clock is primarily controlled by the suprachiasmatic nucleus (SCN) located in the hypothalamus of the brain. External environmental

factors such as light, darkness, temperature, and lifestyle habits influence circadian rhythms and regulate sleep patterns. Hormones such as melatonin play an important role in initiating and maintaining sleep. Melatonin secretion increases during darkness and decreases during exposure to light, thereby regulating sleep behavior (Czeisler & Gooley, 2007). Sleep occurs in repeating cycles consisting of Rapid Eye Movement (REM) and Non-Rapid Eye Movement (NREM) sleep stages. NREM sleep includes three stages (N1, N2, and N3), which represent different levels of sleep depth and physiological activity. Stage N1 represents the transition between wakefulness and sleep, whereas Stage N2 involves reduced body activity and slower physiological processes. Stage N3, commonly referred to as deep sleep or slow-wave sleep, is essential for tissue repair, immune functioning, and physical restoration. REM sleep is characterized by increased brain activity, rapid eye movements, vivid dreaming, and temporary muscle

paralysis. This stage contributes significantly to memory consolidation and emotional processing (Kryger et al., 2017). Adequate sleep is essential for maintaining physical health because numerous restorative processes occur during sleep. During sleeping periods, growth hormone secretion increases and supports tissue growth, cellular repair, and metabolic regulation. Sleep also contributes significantly to cardiovascular recovery by reducing blood pressure and heart rate. Furthermore, sleep influences endocrine functions and maintains hormonal balance necessary for normal body activities.

Research has demonstrated that sleep strongly affects brain functioning and cognitive performance. During sleep, particularly during REM stages, the brain processes and organizes information acquired during waking hours. Proper sleep improves attention, learning capacity, decision-making ability, and memory retention. Sleep deprivation may therefore impair concentration and reduce mental efficiency (Walker, 2017). Mental health and emotional well-being are also closely associated with sleep quality and duration. Individuals experiencing inadequate sleep often exhibit symptoms such as irritability, stress, anxiety, mood fluctuations, and emotional instability. Chronic sleep deprivation may increase vulnerability to psychiatric disorders including depression and anxiety disorders (Baglioni et al., 2016).

In recent decades, modern lifestyles have significantly influenced sleeping behavior. Increased academic pressure, occupational stress, technological advancement, and changing social habits have altered normal sleep patterns among individuals. Excessive use of smartphones, laptops, and electronic devices before bedtime has become increasingly common and contributes significantly to sleep disturbances. Electronic devices emit blue light, which suppresses melatonin secretion and delays sleep initiation (Chang et al., 2015).

Sleep deprivation has emerged as a major public health issue worldwide. Inadequate sleep duration or poor sleep quality can negatively affect multiple physiological systems including cardiovascular, metabolic, neurological, and immune systems. Studies have reported that chronic sleep deprivation may increase risks associated with obesity, hypertension, diabetes mellitus, cardiovascular diseases, and impaired immune responses (Irwin, 2015).

Therefore, understanding the relationship between sleep cycles and human health has become increasingly important. The present study entitled "Assessment of the Sleep Cycle Effect on Human Health" aims to evaluate the effects of sleep patterns on physical and mental health and examine the significance of healthy sleep practices in maintaining overall well-being.

II. REVIEW OF LITERATURE

Sleep has attracted significant scientific attention because of its important role in maintaining

physical, psychological, and social well-being. Numerous studies conducted over recent decades have investigated relationships between sleep patterns and human health outcomes. Scientific evidence suggests that adequate sleep contributes significantly to normal physiological functioning, whereas disturbances in sleep cycles may negatively affect health status and quality of life. Carskadon and Dement (2011) described sleep as a complex biological process involving coordinated physiological activities that support tissue repair, energy conservation, memory formation, and restoration of body systems. Their study emphasized that sleep disturbances may interfere with cognitive functions and overall well-being.

Czeisler and Gooley (2007) investigated circadian rhythms and their influence on sleep behavior. The researchers reported that biological clocks within the hypothalamus regulate sleep-wake cycles and respond to environmental cues such as light and darkness. Disturbances in circadian rhythms may disrupt sleep quality and affect overall health outcomes. Walker (2017) explained that sleep contributes significantly to memory consolidation and emotional processing. The study reported that adequate sleep improves learning ability, concentration, and cognitive performance, whereas sleep deprivation impairs mental functioning. Spiegel et al. (2004) investigated the relationship between sleep deprivation and hormonal regulation. Their findings demonstrated that reduced sleep duration alters levels of hormones involved in appetite control, including leptin and ghrelin. Such alterations may contribute to increased food intake and obesity. Knutson et al. (2007) reported that sleep deprivation negatively affects glucose metabolism and insulin sensitivity. Individuals experiencing inadequate sleep demonstrated greater susceptibility to metabolic disorders including Type 2 diabetes mellitus. Cappuccio et al. (2011) examined relationships between sleep duration and cardiovascular health outcomes. Their systematic review suggested that both insufficient and excessive sleep durations were associated with increased risks of hypertension and cardiovascular diseases. Irwin (2015) investigated sleep and immune functioning and observed that adequate sleep enhances immune responses and supports production of cytokines necessary for defense against infections. Sleep deprivation may weaken immune mechanisms and increase disease susceptibility.

Baglioni et al. (2016) studied associations between sleep disturbances and mental health disorders. Their findings indicated that persistent sleep problems significantly increased risks of depression and anxiety disorders. Chang et al. (2015) evaluated the effects of electronic device use on sleep behavior. The study demonstrated that exposure to blue light emitted from electronic screens suppressed melatonin secretion and delayed sleep initiation, thereby reducing sleep quality. Overall, previous studies indicate that sleep duration and sleep quality significantly influence multiple

physiological systems including neurological, cardiovascular, metabolic, endocrine, and immune systems. Therefore, understanding the effects of sleep cycles on human health is essential for promoting healthy lifestyle practices and improving quality of life.

III. MATERIALS AND METHODS

3.1 Study Area- The present study entitled “Assessment of the Sleep Cycle Effect on Human Health” was conducted among selected individuals residing in Khurja, Bulandshahr district, Uttar Pradesh, India. The study population included participants from different age groups representing various educational and occupational backgrounds.

3.2 Study Duration- The study was carried out over a period of six months (January 2026–June 2026) to evaluate sleep patterns and their effects on different health parameters.

3.3 Study Design- The investigation was designed as an observational and questionnaire-based study involving collection of primary data from selected participants. The study aimed to assess relationships between sleep duration, sleep quality, stress levels, concentration ability, and physical health conditions.

3.4 Selection of Participants- A total of 100 individuals were selected randomly for the study.

Participants were divided into the following age groups:

Group	Age Category	Number of Participants
Group I	Adolescents (15–20 years)	25
Group II	Young Adults (21–35 years)	25
Group III	Middle-aged Adults (36–55 years)	25
Group IV	Older Adults (>55 years)	25

Inclusion Criteria

- Healthy individuals willing to participate
- Participants from different age groups
- Individuals capable of providing accurate information regarding sleeping habits

Exclusion Criteria

- Individuals suffering from severe neurological disorders
- Participants receiving sleep medications regularly
- Individuals with chronic psychiatric conditions

3.5 Data Collection Method

Primary data were collected using:

- Structured questionnaire
- Personal interviews
- Sleep survey forms
- Observation methods

Information collected included:

- Average sleep duration (hours/day)
- Sleep quality
- Daily sleeping schedule
- Stress level
- Fatigue level
- Concentration ability
- Screen exposure duration
- Physical activity level

3.6 Health Assessment Parameters

- Physical Health Parameters
- Body Mass Index (BMI)
- Fatigue score
- General health condition
- Physical activity level
- Mental Health Parameters
- Stress level
- Mood condition
- Anxiety level
- Concentration ability

3.7 Sleep Assessment Parameters

The following sleep characteristics were evaluated:

- Sleep duration
- Sleep quality
- Sleep disturbances
- Bedtime habits
- Wake-up time
- Frequency of interrupted sleep

3.8 Statistical Analysis

The collected data were statistically analyzed using:

- Mean $\pm$ Standard Deviation (SD)
- Percentage analysis
- Correlation analysis
- One-way ANOVA
- Graphical representation

The significance level for statistical analysis was considered at: $P < 0.05$

3.9 Ethical Consideration

Prior consent was obtained from all participants before data collection. Confidentiality of personal information was maintained throughout the study period. Participants were informed regarding the purpose and objectives of the study.

IV. RESULTS AND DISCUSSION

The present study entitled “Assessment of the Sleep Cycle Effect on Human Health” was conducted among different age groups to assess the influence of sleep duration and sleep quality on physical and mental health parameters. The observations demonstrated considerable variations in sleep duration, stress levels, concentration ability, and physical health conditions among study participants.

4.1 Average Sleep Duration Among Different Age Groups

The average sleep duration differed among participants of different age categories.

Table 1. Average sleep duration among study participants

Age Group	Average Sleep Duration (hours/day)
Adolescents (15–20 years)	7.8
Young Adults (21–35 years)	6.5
Middle-aged Adults (36–55 years)	6.8
Older Adults (>55 years)	7.2

The findings indicate that adolescents exhibited the highest average sleep duration (7.8 ± 0.6 h/day), whereas young adults showed the lowest average sleep duration (6.5 ± 0.5 h/day). Reduced sleep among young adults may be associated with occupational stress and lifestyle factors.

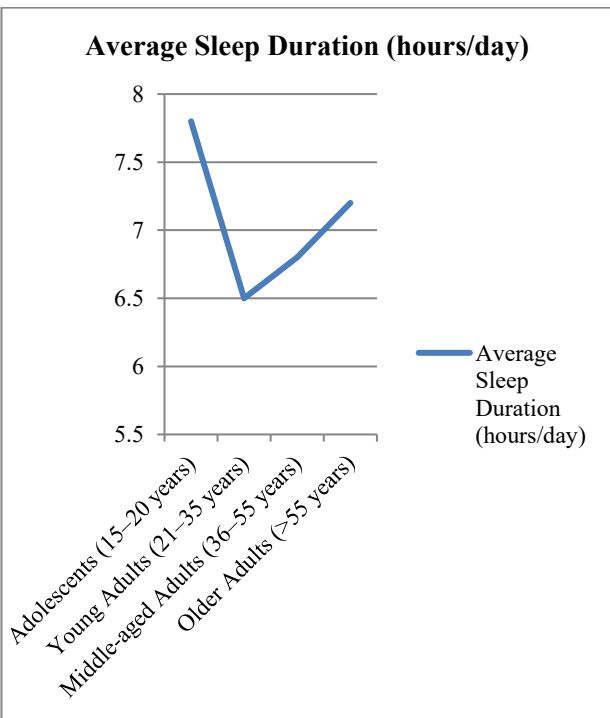


Fig. 1. Average Sleep Duration Among Different Age Groups

The graph demonstrates variations in average sleep duration among different age groups. Adolescents exhibited the highest average sleep duration (7.8 hours/day), while young adults showed the lowest sleep duration (6.5 hours/day). Reduced sleep duration among young adults may be associated with occupational responsibilities, academic pressure, stress, and lifestyle factors. These findings suggest that sleep patterns vary with age and daily activities.

4.2 Relationship Between Sleep Duration and Stress Level

The study observed a relationship between sleep duration and stress conditions among participants.

Table 2. Sleep duration and stress level among participants

Sleep Duration	Stress Score (%)
Less than 5 h	85
5–6 h	72
6–7 h	45
More than 7 h	20

Participants with shorter sleep durations demonstrated higher stress scores. Individuals sleeping less than 5 hours/day showed maximum stress levels (85%), while those sleeping more than 7 hours/day exhibited lower stress levels (20%).

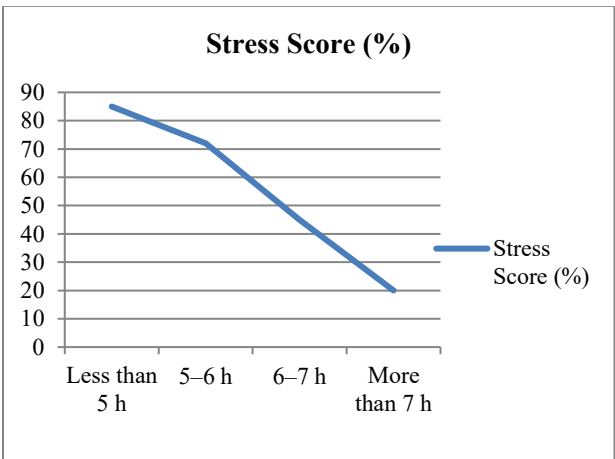


Fig. 2. Relationship Between Sleep Duration and Stress Level

The graph indicates an inverse relationship between sleep duration and stress level. Participants sleeping less than 5 hours/day demonstrated the highest stress score (85%), whereas participants sleeping more than 7 hours/day showed lower stress levels (20%). These findings suggest that inadequate sleep may increase psychological stress and negatively affect emotional well-being.

4.3 Effect of Sleep Duration on Concentration Level

Table 3. Sleep duration and concentration ability

Sleep Duration	Concentration Score
Less than 5 h	45
5–6 h	60
6–7 h	78
More than 7 h	92

Concentration ability improved with increasing sleep duration. Participants sleeping more than 7 hours/day demonstrated higher concentration scores (92) compared with sleep-deprived individuals.

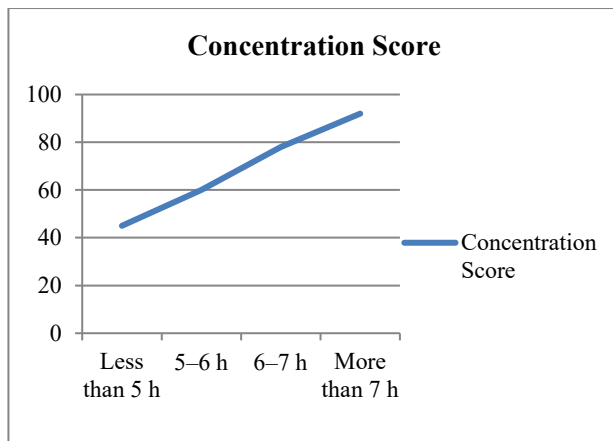


Fig. 3. Relationship between Sleep Duration and Concentration Ability

The graph demonstrates that concentration ability improved with increasing sleep duration. Individuals receiving more than 7 hours of sleep showed the highest concentration score (92), whereas participants sleeping less than 5 hours/day exhibited lower concentration scores (45). The findings indicate that adequate sleep positively influences cognitive performance and mental efficiency.

4.4 Effect of Sleep Quality on Physical Health

Table 4. Sleep quality and fatigue level

Sleep Quality	Fatigue (%)
Poor	82
Moderate	55
Good	18

Participants with poor sleep quality reported higher fatigue levels (82%) compared with individuals maintaining good sleep quality (18%).

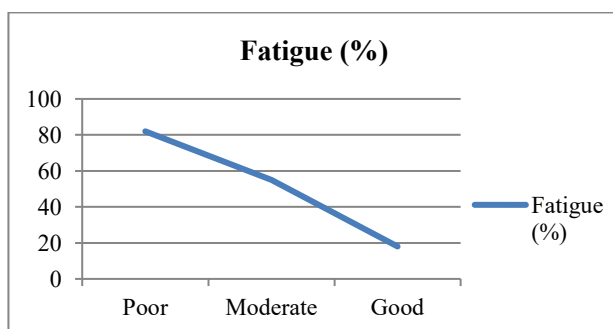


Fig. 4. Effect of Sleep Quality on Fatigue Level

The graph shows that fatigue levels were significantly higher among participants reporting poor sleep quality (82%) compared with individuals reporting good sleep quality (18%). Poor sleep quality may reduce physical energy and overall well-being, whereas good sleep quality contributes to better physical performance and daily functioning. The findings indicate that adequate sleep duration and good sleep quality positively

influence concentration ability, reduce stress levels, and improve physical health conditions. Sleep deprivation may negatively affect overall health and daily functioning. The present study entitled "Assessment of the Sleep Cycle Effect on Human Health" was conducted to evaluate the relationship between sleep duration, sleep quality, and various health parameters among different age groups. The findings of the present investigation demonstrated that sleep plays a crucial role in maintaining physical health, mental well-being, cognitive performance, and overall quality of life. Sleep is considered an essential physiological process because numerous restorative mechanisms occur during sleep that contribute to maintaining body homeostasis. The results obtained during the present study indicated considerable variations in sleep duration among different age groups. Adolescents demonstrated comparatively higher sleep duration than young adults and middle-aged individuals. Young adults showed lower sleep duration, which may be attributed to occupational stress, academic pressure, social responsibilities, and changing lifestyle patterns. Similar findings were reported by Carskadon and Dement (2011), who suggested that sleep requirements and sleeping patterns vary among age groups because of differences in physiological and developmental requirements. The findings further revealed that shorter sleep duration was associated with increased stress levels among participants. Individuals sleeping less than five hours per day demonstrated significantly higher stress scores compared with those receiving adequate sleep. These observations suggest that inadequate sleep may contribute to emotional disturbances and psychological stress. Sleep and stress exhibit a bidirectional relationship. Sleep deprivation activates physiological stress pathways involving increased secretion of cortisol and other stress-related hormones. Elevated stress hormone concentrations may further disturb sleep quality and create a cycle of poor sleep and increased stress responses. Meerlo et al. (2008) reported that chronic sleep deprivation significantly affects neuroendocrine stress systems and alters physiological balance. Increased stress may additionally contribute to reduced productivity and impaired emotional well-being.

The present study also demonstrated that concentration ability improved with increasing sleep duration. Participants obtaining more than seven hours of sleep showed higher concentration scores compared with individuals receiving inadequate sleep. Cognitive functions including attention, memory, learning ability, and decision-making require sufficient sleep for optimal functioning. Walker (2017) explained that sleep contributes significantly to memory consolidation and neural processing. During sleep, particularly REM sleep, information acquired during waking periods undergoes processing and storage in long-term memory systems. Therefore, sleep deprivation may impair academic performance and mental efficiency. The present

investigation further demonstrated that sleep quality significantly influences physical health and overall physiological functioning. Participants reporting poor sleep quality exhibited greater fatigue levels, reduced energy, and lower daily productivity compared with individuals maintaining healthy sleep habits. Sleep acts as a restorative process during which numerous physiological activities occur including tissue repair, hormonal regulation, and metabolic recovery. Disturbances in sleep quality may therefore negatively affect these processes and contribute to impaired health outcomes. One important observation of the present study was the relationship between poor sleep quality and fatigue levels. Participants experiencing inadequate sleep reported increased tiredness and reduced physical performance during daily activities. Fatigue resulting from insufficient sleep may affect occupational performance, academic activities, and quality of life. Irwin (2015) reported that sleep contributes significantly to immune system functioning and physiological restoration. During sleep, various cytokines and immune molecules are produced, which help maintain immune competence and support protection against infections. Reduced sleep duration may weaken immune responses and increase susceptibility to disease conditions. The present findings further suggest that sleep behavior influences metabolic functioning and hormonal regulation. Hormones responsible for appetite regulation and energy balance such as leptin and ghrelin are closely associated with sleep patterns. Sleep deprivation may alter concentrations of these hormones and contribute to metabolic disturbances.

Spiegel et al. (2004) observed that sleep restriction significantly reduces leptin concentrations while increasing ghrelin levels. Reduced leptin and elevated ghrelin stimulate hunger sensations and increase food consumption, thereby contributing to obesity risks and metabolic abnormalities. Sleep has also been associated with cardiovascular health. During normal sleep, heart rate and blood pressure decline, allowing cardiovascular systems to recover from physiological stress. Disturbed sleep patterns may interfere with these restorative processes and negatively affect cardiovascular functioning. Cappuccio et al. (2011) demonstrated that inadequate sleep duration was associated with increased risks of hypertension and cardiovascular disorders. Sleep deprivation may increase sympathetic nervous system activity and inflammatory responses, thereby affecting cardiovascular health. The findings therefore indicate that sleep quality plays an essential role in maintaining physical health and physiological balance.

The present study further highlights the importance of maintaining healthy sleep habits and promoting awareness regarding sleep hygiene practices. Modern lifestyles have considerably changed sleep behavior because of increased use of technology, occupational responsibilities, academic pressure, and

social activities. These lifestyle modifications have contributed significantly to sleep disturbances and irregular sleep schedules among individuals of different age groups.

One of the important factors influencing sleep patterns is the increasing use of electronic devices such as smartphones, tablets, laptops, and television screens. Exposure to blue light emitted from electronic screens during nighttime suppresses secretion of melatonin, a hormone responsible for regulating sleep initiation and maintaining circadian rhythms. Delayed melatonin secretion may therefore reduce sleep quality and alter sleep timing. Chang et al. (2015) demonstrated that prolonged exposure to electronic devices before bedtime negatively affects sleep quality and delays sleep onset. Individuals exposed to screen light during nighttime frequently experience difficulty in falling asleep and reduced sleep efficiency. Such disturbances may contribute to fatigue, reduced concentration, and impaired cognitive performance during daytime activities. Another important factor influencing sleep behavior is work-related stress and irregular working schedules. Individuals involved in shift work often experience disturbances in circadian rhythms because of misalignment between biological clocks and environmental conditions. Night shift workers frequently experience reduced sleep duration, excessive daytime sleepiness, and psychological stress. Kecklund and Axelsson (2016) reported that long-term exposure to shift work significantly increased risks of cardiovascular diseases, metabolic disorders, and psychological disturbances. These findings support the observations of the present study suggesting that lifestyle factors and environmental conditions influence sleep behavior and health outcomes. Sleep hygiene practices have therefore emerged as effective strategies for improving sleep quality and maintaining overall health. Sleep hygiene refers to behavioral and environmental recommendations that promote healthy sleeping habits. These practices include maintaining a regular sleep schedule, minimizing screen exposure before bedtime, reducing caffeine intake during evening hours, engaging in regular physical activity, and maintaining a comfortable sleeping environment. The present findings suggest that awareness regarding sleep hygiene practices should be promoted among individuals of all age groups. Educational institutions and healthcare organizations may play important roles in spreading awareness regarding healthy sleep behaviors.

Overall, the present investigation demonstrates that sleep duration and sleep quality significantly influence physical health, mental well-being, stress levels, concentration ability, and overall quality of life. Sleep deprivation and disturbed sleep patterns may negatively affect physiological functioning and increase susceptibility to chronic diseases. Therefore, maintaining proper sleep habits should be considered an essential component of a healthy lifestyle along with balanced

nutrition and regular physical activity. Long-term improvements in sleep behavior may significantly enhance health outcomes and reduce risks associated with chronic health conditions.

V. CONCLUSION

The present study entitled “Assessment of the Sleep Cycle Effect on Human Health” was conducted to evaluate the relationship between sleep patterns and different aspects of human health. The findings of the study demonstrated that sleep duration and sleep quality significantly influence physical health, psychological well-being, cognitive performance, and overall quality of life. The results indicated considerable variations in sleep duration among different age groups. Adolescents showed relatively higher sleep duration, whereas young adults demonstrated lower sleep duration because of occupational responsibilities, academic stress, and lifestyle factors. Participants with shorter sleep durations exhibited higher stress levels and lower concentration abilities compared with individuals receiving adequate sleep. The study further revealed that poor sleep quality was associated with increased fatigue and reduced physical performance. Individuals maintaining healthy sleep habits demonstrated improved concentration levels, better emotional stability, and lower stress scores. Sleep deprivation negatively affected multiple physiological systems including metabolic, cardiovascular, endocrine, and immune functions. Modern lifestyle factors such as increased screen exposure, irregular work schedules, and psychological stress were identified as major contributors to disturbed sleep patterns. These factors may disrupt circadian rhythms and reduce sleep quality. The study concludes that adequate sleep duration and healthy sleep habits are essential components of a healthy lifestyle. Proper sleep should be considered equally important as balanced nutrition and regular physical activity for maintaining overall health and preventing chronic diseases.

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