A REVIEW TO ADDRESS BINGE EATING AND SLEEP DEPRIVATION

Deepak Kumar Gupta[1], Neelam Balekar[2,] *, Yashashwi Shrivastav[3]

[1] *M. Pharmacy Final year IPS Academy College of Pharmacy, Indore (M.P.), India 452012*

Email: guptadeepak65039@gmail.com

[2*] *Professor, IPS Academy College of Pharmacy, Indore (M.P.), India 452012*

Email: neelambalekar@ipsacademy.org

[3] *Assistant Professor, IPS Academy College of Pharmacy, Indore (M.P.), India 452012*

Email: yashaswishrivastav@ipsacademy.org

Address of Correspondence - Dr. Neelam Balekar

Email: neelambalekar@ipsacademy.org

Mobile No:- +919039890627

Address- IPS Academy College of Pharmacy

Rajendra Nagar A.B. Road Indore 452012 (M.P.)

ABSTRACT

Sleep deprivation, affecting 20% of adults, is associated with diminished performance and health decline. Environmental and non-environmental factors contribute to sleep deprivation, with societal, mediational, pain-related, and psychological factors playing key roles. Ghrelin and leptin hormones, regulating hunger and fullness. Binge eating, affecting 5% of U.S. adults, poses a major public health issue linked to obesity and mental health conditions. BED is a disorder which is under DSM-V criteria which outline the key features. Sleep deprivation and binge eating have substantial impacts on mental health, contributing to increased stress levels and heightened risks of mental health disorders. Understanding the link between sleep and mental well-being highlights the need for collective action. Sleep deprivation and binge eating connect to health issues like diabetes and cardiovascular problems. By adopting healthy sleep practices, maintaining routines, Proper sleep, mindfulness will Address binge eating & sleep deprivation.

Keywords *- Sleep deprivation; Binge eating; DSM-V criteria; Sleep-wake cycle; health consequences.*

1. INTRODUCTION

Insufficient sleep, affecting 20% of adults, results in poor performance and health decline. Chronic sleep debt, from inadequate quantity or quality, can't be fully compensated [1]. Recommended daily sleep: preschoolers 10-12 hours, school-age kids/teens 9 hours, adults 7-8 hours [2]. In Saudi Arabia, 50% of teens experience weekday sleep deprivation, with 75% feeling unrefreshed. Adequate sleep crucial for well-being [3]. About 5% of U.S. adults engage in binge eating, linked to obesity and depression. Binge eating involves consuming large amounts of food quickly, unrelated to hunger [4]. Treatment includes therapy and lifestyle changes for healthier eating habits, addressing a significant public health concern [5].

2. UNDERSTANDING SLEEP DEPRIVATION

Sleep deprivation is a condition in which a person did not get proper amount of sleep. Sleep is a natural state where your body and mind take a break to rest and rejuvenate. It's like a daily reset button for your well-being. It is a vital and complex physiological process that is good for health [6]. Modern challenges like lifestyle shifts, technology, and societal demands contribute to widespread irregular sleep patterns [7].

2.1 Sleep-Wake Cycle

The sleep-wake cycle is the pattern of alternating wakefulness and sleep cycles, regulated by the circadian rhythm, the body's internal clock 24 h. The circadian rhythm is influenced by light exposure, which signals the brain to produce hormones and neurotransmitters that affect alertness and sleepiness. During a night of sleep,

people typically go through four stages of sleep, each with different impacts on the body. On average, adults experience 4 to 6 of these sleep cycles, and each cycle lasts around 90 minutes. This means that throughout the night, individuals go through these cycle's multiple times, with each cycle comprising various sleep stages [8] as shown in Table 1.

Table 1 - Length of sleep duration according to sleep stage.

Sleep Stage	Sleep Types	Sleep Time (min)
1st Stage	NREM (N_1)	1-7
2nd Stage	NREM (N_2)	10-25
3rd Stage	NREM (N_3)	20-40
4th Stage	REM	10-60

2.1.1 N1

It is also known as light sleep or drowsiness, which goes from wakefulness to sleep. It is lasting a few minutes during which individuals may experience muscle relaxation, slowed eye movements, and hypnic jerks. This stage is relatively easy to awaken from, and people may not be fully aware that they are asleep [8].

2.1.2 N2

During the second stage of non-rapid eye movement sleep, genuine sleep begins. This stage is marked by a continued reduction in muscle activity and the emergence of specific patterns on an (EEG), a device that measures brain activity. Two key features during this stage are sleep spindles and K-complexes. Sleep spindles are like quick bursts of brain activity, on the other hand K-complexes are large, slow waves. These patterns are believed to contribute to memory consolidation, helping the brain organize and store information. Additionally, they play a role in maintaining the stability of sleep. In simpler terms, the second stage of NREM sleep is when our brain starts to truly rest, with specific brain patterns helping us remember things better and ensuring our sleep stays steady [8].

2.1.3 N3

It is Commonly referred to as deep sleep or (SWS), the third stage of NREM. This phase is identified by the appearance of slow delta waves on the (EEG). Essentially, during deep sleep, your body goes into a repair mode. Your heart rate, blood pressure, and overall metabolic rate all decrease, allowing the body to focus on essential recovery processes. It's a crucial part of a good night's sleep, ensuring that your body gets the rest it needs for optimal functioning. Growth hormone is released, contributing to tissue repair and growth. N3 is the stage where it's most challenging to awaken someone, and disruptions during this phase can lead to feelings of grogginess and impaired cognitive function [8].

2.1.4 REM

The REM cycle is the second phase of the sleep cycle, occurring after the non-REM stages. It is initiated when signals reach the cerebral cortex of the brain. During REM sleep, which typically starts about 90 minutes into your sleep, most dreaming occurs. The cerebral cortex, responsible for thinking, learning, and memory, is highly active during this phase. Missing out on REM sleep can impact memory. As you age, the time spent in REM sleep decreases. Each REM cycle consists of a brief initial phase and a longer final phase, with four to six cycles occurring throughout the night. During REM, Body function increases such as eye, breathing becomes faster and irregular, muscles enter a temporary paralyzes-like state, and brain waves intensify [8]. All the stages of sleep cycle are enlisted in figure 1.

Figure 1 - Cycle of Sleep stages

2.2 Factors Responsible for Sleep Deprivation

There is various factor responsible for sleep deprivation such as environmental and non-environmental factors contributed to sleep deprivation. Environmental sounds were identified as the cause of waking up patients 17% of the time. This means that various types of sounds in the environment contribute to patients waking up, and researchers have classified them into different groups to better understand their impact on sleep [9].

2.2.1 Environmental Factors

The social environment, characterized by family dynamics and social cohesion, plays a pivotal role in sleep regulation. Strong family support and a cohesive social network have been associated with improved sleep quality and duration. Conversely, factors such as neighbourhood disorder and safety concerns can contribute to stress and anxiety, negatively impacting sleep. Moreover, the physical environment, including exposure to light, noise, traffic, and pollution, has a direct influence on sleep patterns. High noise levels and increased traffic in residential areas have been linked to difficulty falling asleep and more frequent awakenings during the night. Additionally, exposure to environmental pollutants may exacerbate respiratory issues, leading to sleep-related problems. During childhood and adolescence, many young people experience various sleep issues and disorders. In the early years (birth to age 3), around 20% to 30% of children face sleep problems, mostly behavioural ones. As children grow older, sleep disturbances tend to decrease, but OSA affects up to 6% of youths. Research indicates that being overweight, male, or African American increases the risk of experiencing sleep-disordered breathing. Insufficient sleep is widespread among adolescents, with an estimated 70%-90% not meeting the recommended sleep hours [10].

2.2.2 Non-Environmental Factor

Mediational Factor

In simple terms, the relationship between the medications taken before reaching the hospital and the quality of sleep, as well as the impact of stopping certain drugs during intensive care unit (ICU) stays, is significant. If someone has been taking benzodiazepines, stopping them can cause sleep problems and insomnia, affecting a specific stage of sleep called stage 2. Benzodiazepines and corticosteroids, while helping with some aspects of sleep, might decrease alertness and a different stage of sleep called REM during withdrawal. These drugs work on certain pathways in the brain. They can make people feel calm and improve a specific stage of sleep but reduce another. Other medications, like pain relievers and drugs that support the heart, also play a role in how well patients sleep. Drugs such as β-blockers, opioids, and glucocorticoids can change the overall structure of sleep-in individuals [9].

Pain Related

Research clearly suggest that pain is linked with sleep. In simpler terms, research suggests that not getting enough sleep, especially when it's interrupted or partial, can make people more sensitive to pain. For instance,

when individuals are restricted to only 4 hours of sleep for a couple of nights, they may experience increased bodily pain, as seen in studies with healthy subjects. This effect seems to be more pronounced in conditions like rheumatoid arthritis, where even a single night of limited sleep can lead to higher levels of pain, fatigue, and emotional distress. Another approach involved disrupting sleep continuity by regularly waking people during their 8-hour sleep opportunity, leading to reports of increased pain in otherwise healthy individuals. This disruption also affected the body's natural pain-inhibiting mechanisms, especially in individuals with chronic pain conditions [11].

Psychological Factor

Psychological stress was significant contributor to sleep deprivation, with limited studies exploring both psychological and physical factors. One study revealed that 30% of patients experienced pain and anxiety while using a respirator, and 60% reported disturbances in their sleep due to respirator use. In a South African investigation employing structured interviews, 70.6% of participants conveyed concerns about their inability to sleep, 64.7% experienced anxiety related to pain, and 58.8% were preoccupied with thoughts concerning their families. Furthermore, 29.4% expressed worries about work, 11.8% were apprehensive about death, and additional individuals had anxieties about diverse issues. Another investigation focused on the psychological effects and sleep patterns of patients Which demonstrated that, at the 26th week post-discharge, patients exhibited poor sleep quality, which was correlated with unfavourable psychological outcomes. These findings underscore the intricate relationship between psychological stress, sleep disruption, and overall well-being [9].

2.3 Impacts on Mental Health

Inadequate sleep has been associated with increased stress levels and a reduced experience of positive emotions. Insufficient and low-quality sleep has been identified as a contributing factor to a heightened risk of mental health issues. Although difficulties in sleeping may indicate underlying conditions such as anxiety or depression, it is now understood that sleep disturbances can exacerbate existing mental health challenges. Research on sleep deprivation reveals that even people who are generally healthy may feel more anxious and distressed after not sleeping well. For those with mental health disorders, having ongoing sleep issues is common and can make their symptoms worse, increasing the risk of suicidal thoughts. The good news is that there are ways to make sleep better, so it's important to recognize and fix sleep problems to help ease the impact of mental health issues. Even though we still need more research to fully understand how sleep and mental health are connected. It helps with things like paying attention, learning, and remembering information. So, when we don't sleep well, it becomes harder to handle stress, even the smaller challenges, and it can affect how we see and understand things around us. Essentially, good sleep is important for our overall well-being and how we deal with daily life [12].

3. UNDERSTANDING BINGE EATING

Binge eating is when someone consuming a large quantity of food in small time, even when they're not hungry. It happens uncontrollably, making the person feel like they've lost control. This can cause emotional distress and is often linked to being overweight. Binge eating can lead to both physical and mental health problems because of the excessive food intake in a short time. In simpler terms, it's eating too much, feeling out of control, and it can harm your health. One of the conditions that happen through binge eating is (BED) Binge eating disorder. Binge-eating disorder (BED) is officially recognized as an eating disorder, and it's listed in both the Diagnostic and Statistical Manual of Mental Disorders (DSM) since 2013 and the International Classification of Diseases (ICD) since 2019. To be diagnosed with BED based on DSM-5 criteria, a person needs to have episodes of binge-eating at least once a week for three consecutive months. The person is said to be binge eater when it shows 3-effect out of 5 of DSM-5 criteria. BED and BN are both eating conditions, But the difference is when someone often eats a lot of food in one sitting and feels like they can't control it is binge eating and Bulimia nervosa (BN) is, after eating a lot, the person tries to get rid of the calories by vomiting, using laxatives, or exercising a lot [13,14].

Table 2- DSM-IV and DSM-V diagnostic criteria for binge-eating disorder [14].

Criteria List	Specific Definitions
Criteria-I	Eating a noticeably large amount of food in a short period, like within two hours, more than what most people would eat in similar situations.

	Feeling powerless during overeating, unable to stop or manage what and how much one eats-losing control in the eating episode.
Criteria-II	Eating very fast.
	Eating until uncomfortably full.
	Eating a lot when not hungry.
	Eating alone due to embarrassment.
	Feeling disgusted, depressed, or guilty after overeating.
Criteria-III	Significant distress over binge eating.
Criteria-IV	Binge eating happens at least twice a week consistently for six months (based on DSM-IV criteria for frequency and duration).
	Binge eating occurs at least once a week consistently for three months (based on DSM-V criteria for frequency and duration).
Criteria-V	Binge eating doesn't involve regularly trying to "make up for it" through behaviours like purging or excessive exercise. It also doesn't only happen during anorexia or bulimia.

3.1 Hormone Responsible for Eating

Sleep regulation is a complex process influenced by various neurotransmitters and hormones. Two key neurotransmitters involved in sleep regulation are serotonin and Gamma-Aminobutyric Acid (GABA), while several hormones also play crucial roles, including Ghrelin, Leptin, melatonin, and cortisol [15]. Ghrelin, which makes us feel hungry, and leptin, which signals when we're full. These hormones help regulate our appetite and maintain a balance in our energy level [16].

3.1.1 Ghrelin

Ghrelin was first identified as a natural substance binding to the Growth Hormone Secretagogue Receptor (GHS-R). While initially linked to growth hormone release, later research revealed its significant role in regulating food intake and body weight. Ghrelin stands out for its ability to strongly increase short-term food consumption, ranking close to neuropeptide Y in effectiveness. Unlike other molecules, it can induce hunger whether injected in the body or brain. In humans, ghrelin is unique as the only substance known to boost appetite and food intake. When administered over an extended period, ghrelin consistently raises body weight in various species, including humans. This occurs due to its impact on increasing food intake, energy expenditure, and fuel utilization. Interestingly, ghrelin appears to stimulate appetite even more in obese individuals, suggesting that blocking its action could be explored as a potential weight loss strategy. As a result, there are active efforts in the pharmaceutical industry to develop drugs that either block (antagonists) or mimic (agonists) ghrelin's effects to address obesity and wasting conditions. The GHS-R, where ghrelin acts, is found widely in the brain and various body tissues. This allows ghrelin to influence a range of biological functions, such as hormone secretion, glucose regulation, pancreatic function, and more. While many of these effects are still not fully understood, ghrelin's impact on energy balance is considered its most crucial role. Despite its known ability to influence growth hormone secretion, some question whether this effect is physiologically significant, proposing that ghrelin may instead enhance the impact of other signals related to growth hormone release. Ghrelin doesn't just control hunger; it also plays a part in other things like regulating our sleep-wake cycle, influencing our sense of taste, and managing how our body handles (glucose metabolism) [16].

3.1.2 Leptin

Leptin is like the body's fullness signal, working opposite to ghrelin, which signals hunger. Together, they help regulate our energy balance. Leptin comes from fat cells and talks to the brain, specifically the ventromedial hypothalamus, telling it when we've had enough to eat. It also puts a brake on ghrelin's hunger signals from the lateral hypothalamus. Apart from managing hunger and fullness, leptin does more jobs in the body, like influencing reproduction, blood pressure. Scientists are also looking into how low levels of leptin might be

connected to obesity. So, think of leptin as a messenger that tells our brain about our energy stores and does a bunch of other important tasks in our body [17].

3.2 Risk Factors

3.2.1 Society

It is understood that eating disorders are influenced by various social and cultural factors. The pressure to conform to societal ideals of beauty, perpetuated by diet culture and relentless advertisements promoting unrealistic body expectations, significantly impacts our attitudes toward food and our bodies. According to experts like Koenig, one major societal force contributing to binge eating is the practice of weight loss dieting and food restriction. When we fall below certain nutritional intake levels, our bodies instinctively crave food [18].

3.2.2 Psychological

A 2006 national survey found that almost 80% of individuals diagnosed with binge eating disorder also fulfilled criteria for other mental health disorders. A subsequent 2009 study reported that 73.8% of those with this disorder had encountered another psychiatric condition at some stage, with 43.1% currently dealing with an additional mental health issue. In essence, individuals with binge eating disorder commonly face various mental health challenges, as demonstrated by high rates of comorbidity with much psychiatric conditions [18].

3.2.3 Biological

Binge eating disorder can be influenced by family history, with research suggesting a higher likelihood of developing the condition if a family member has it. Additionally, the disorder may be linked to our brain. Some studies indicate that individuals with BED may have heightened sensitivity to dopamine, a brain chemical associated with pleasure and reward. Another line of research suggests that specific brain structures could contribute to an increased response to food, making it challenging to control food intake. Scientists are exploring changes in brain chemicals to better understand these variations, aiming to improve our understanding of the differences in how our brains regulate eating habits [18].

4. HEALTH CONSEQUENCES OF SLEEP DEPRIVATION ON PHYSICAL HEALTH

4.1 Diabetes

various studies have found a connection between the amount of sleep people get and their risk of developing diabetes. One study followed men for several years, categorizing them based on their daily sleep duration. The results showed that both too little sleep (less than 5 hours) and too much sleep (more than 8 hours) were linked to a higher risk of diabetes compared to those who slept around 7 hours. The consistent risk of diabetes persists even when happening due to smoking, age, education, waist circumference, and hypertension. Studies in different populations, including Taiwan and a diverse U.S. cohort, confirm that both short and long sleep durations independently correlate with a higher diabetes prevalence. In Sweden, men who slept less or had sleep difficulties faced a significantly greater diabetes risk, but the link between sleep and diabetes in women appears weaker. One study suggested that shorter sleep duration and a later sleep midpoint increased the risk of gestational diabetes. During sleep, the body's parasympathetic nervous system takes control, slowing down functions like heart rate, blood pressure, and metabolism. This restful state is crucial for overall health. However, frequent disruptions in sleep patterns can upset this balance, leading to an increased influence of the sympathetic nervous system. This shift puts a higher load on the circulatory system, raises stress hormone levels, and contributes to a greater risk of insulin resistance and diabetes [19].

4.2 Cardiovascular

Lack of proper sleep can seriously affect both adults and teenagers by making the sympathetic nervous system more active. In adults, not getting enough sleep is linked to higher blood pressure and an increased chance of developing hypertension (high blood pressure). Studies show that adults with sleep issues have a 20% higher risk of hypertension. In teenagers, poor sleep is associated with negative health outcomes like higher cholesterol, increased body weight, higher blood pressure, and a greater risk of hypertension. Large studies found that people with sleep problems are 1.5 times more likely to develop cardiovascular disease. In simple terms, not getting adequate sleep can lead to serious health issues for both adults and teens. Another study observed that difficulty maintaining sleep can increased risk of myocardial infarction (heart attack) in 40-60 aged women. These findings collectively suggest that sleep disruption can lead to increased sympathetic nervous

system activity, disruptions in glucose metabolism, and potentially inflammation, all of which may contribute to adverse cardiovascular effects over time. In simpler terms, not getting enough quality sleep can negatively impact your heart health and increase the risk of cardiovascular problems [20].

5. HEALTH CONSEQUENCES OF BINGE EATING ON PHYSICAL HEALTH

5.1 Diabetes

Many people with Type 2 Diabetes (T2DM) also suffer from Binge Eating Disorder (BED), with rates possibly as high as 20%. However, BED often goes undiagnosed in this population, despite simple screening tools being available for healthcare providers. Studies suggest that binge-eating behaviors can negatively impact metabolic markers, affecting glycemic control. Certain diabetes medications have been linked to the onset of BED, and addressing this may involve discontinuing or replacing these drugs. Some medications have shown promise in reducing binge eating and aiding weight management. Psychotherapy, especially cognitive behavioral therapy, is beneficial for individuals with BED. Recognizing and addressing BED in T2DM patients is crucial for improving overall well-being and metabolic health [21].

5.2 Cardiovascular Issue

Binge Eating Disorder (BED) often leads to obesity, which can bring about various health problems, especially concerning the heart, such as high blood pressure and heart disease. While research on the specific cardiovascular risks of BED is limited due to its recent recognition, there are indications that BED might increase the risk of metabolic syndrome independently of obesity. Some studies have looked at heart rate variability and autonomic function in BED as potential indicators of cardiac events, but a meta-analysis found no significant differences in resting state HRV between individuals with BED and those without. In eating disorders like AN and BN, imbalances in electrolytes due to methods like purging and medication side effects can cause additional heart-related problems, more research is necessary to fully comprehend the nature and seriousness of these problems [22].

6. STRATEGIES FOR IMPROVEMENTS

6.1 Sleep Deprivation

Sleep hygiene refers to a set of suggestions aimed at promoting good sleep habits and creating a sleep-friendly environment. Originally designed to help with mild to moderate insomnia, it involves educating individuals on healthy sleep practices. People are encouraged to adopt habits like avoiding caffeine, exercising regularly, minimizing noise in their sleeping area, and sticking to a consistent sleep schedule. Despite finding connections between specific sleep hygiene practices and improved sleep, there's still less knowledge [23].

6.1.1 Sleep Routine

Our bodies naturally follow a 24-hour cycle that impacts various physiological processes, including temperature regulation and mood. Maintaining a regular sleep routine is crucial to synchronize with this internal clock. To establish a consistent sleep pattern, it is recommended to wake up at the same time interval, even on weekends. Sleep allows to maintain 7 hours of sleep every night. It is recommended that do not go to sleep if you are not feeling asleep [24].

6.1.2 Proper Environment

Creating a cool environment in your bedroom is beneficial for better sleep. The National Sleep Foundation recommends maintaining a temperature between 60–67°F for optimal sleep conditions. If you struggle with light or noise, consider using blackout blinds, wearing an eye mask, or using earplugs. Some people distract on low noise like fan [24].

6.1.3 Avoid Stimulants

The statement emphasizes the impact of two common stimulants, caffeine, and nicotine, on sleep quality and recommends avoiding their consumption at least 4–6 hours before bedtime for improved sleep. Caffeine, found in coffee, tea, and various energy drinks, is a central nervous system stimulant that can increase alertness and reduce the perception of fatigue. Similarly, nicotine, primarily found in tobacco products, acts as a stimulant, and can disrupt sleep patterns [25].

6.2 Binge Eating

The main goals of treating (BED) are to reduce or stop binge eating patterns and address related mental health issues, leading to an overall improvement in mood and psychological symptoms [13].

6.2.1 Meal Timing

Creating a consistent eating routine can be a powerful strategy to overcome binge eating. Skipping meals might make you more likely to crave unhealthy snacks and overeat later. In a small two-month study, it was discovered that having a single large meal leads to higher blood sugar and increased feelings of hunger compared to spreading the same amount of food across three regular meals [26].

6.2.2 Proper Sleep

Insufficient sleep can impact your appetite by messing with your hunger hormones. Research indicates that people who don't get enough sleep may be more likely to overeat. When you lack sleep, the hormone that makes you hungry (ghrelin) increases, while the hormone that signals fullness (leptin) decreases, leading to increased feelings of hunger. Those who sleep less than 8 hours a night also tends to weight more. To control your appetite and reduce the risk of overeating, it's recommended to aim for at least 8 hours of sleep each night [27].

6.2.3 Mindfulness

It is a way of paying close attention to how your body feels in the present moment. It's a useful tool to prevent overeating by helping you recognize when you're no longer hungry. Research shows that practicing mindfulness meditation can reduce binge eating and emotional eating. Combining mindfulness with cognitive behavioral therapy also seems to improve eating habits and self-awareness. To use mindfulness for healthier eating, listen to your body to know when you're full. Eat slowly and savor your food to encourage good eating habits [28].

6.2.4 Psychological

Binge Eating Disorder (BED) is commonly treated with psychotherapy as the first-line approach due to its proven effectiveness in reducing binge eating episodes. Various psychotherapeutic methods have demonstrated positive outcomes, with overall abstinence rates from binge eating around 50%. Among the successful approaches are Cognitive-Behavioral Therapy (CBT), Interpersonal Therapy, and Dialectical Behavioral Therapy (DBT) [29].

7. CONCLUSION

This review underscores the importance of recognizing and addressing binge eating and sleep deprivation. Sleep deprivation, influenced by various environmental and non-environmental factors, disrupts the intricate sleep-wake cycle, leading to adverse effects on overall well-being. Factors such as societal pressure, psychological stress, and medication contribute to sleep disturbances. Inadequate sleep is linked to increased stress levels and a heightened risk of mental health issues.

In the future, further research is needed to fully understand the intricate connections between sleep, binge eating, and overall health. Implementing effective strategies, such as improving sleep hygiene and promoting mindful eating habits, can contribute to better physical and mental health outcomes for individuals facing these challenges.

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