

Review Article

Sleep quality and diabetes associated factors, effect and interventions

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ABSTRACT

Getting sleep is incredibly important for maintaining health and well-being, especially for individuals who have diabetes. Poor sleep quality can have an effect on how our bodies process glucose and utilize insulin potentially resulting in diabetes related issues and complications. Additionally, we explore interventions that have the potential to improve both sleep quality and overall diabetes outcomes. Through this review it is indicated that inadequate sleep quality can influence glucose control, increase the risk of complications associated with diabetes and reduce quality of life. Furthermore, we've identified interventions that show promise in improving both sleep quality and overall outcomes for individuals with diabetes. These interventions include implementing lifestyle changes, making modifications utilizing behavioral therapies and incorporating device-based strategies. We suggest that future studies use experimental designs and objective measures of sleep quality and glucose metabolism and include diverse samples of different types of diabetes.

Keyword: Diabetes, Glucose metabolism, Insulin sensitivity, Sleep disorders, Sleep quality

INTRODUCTION

Getting sufficient and good quality sleep plays a role in maintaining the health and well-being of individuals managing diabetes. The basic relationship between sleep and diabetes is actually a complex phenomenon, as poor sleep quality can have an impact on aspects of managing the condition.^{1,2} Scientists tried to explore the nature of sleep quality in individuals navigating the challenges of

diabetes. To improve diabetes care it is crucial to understand the relationship between sleep, its impact on diabetes management and the various factors that influence it. By examining these aspects and exploring interventions we can enhance our approach to caring for individuals with diabetes. Several factors include demographics (such as age), behaviors, psychology, environment, and physiology.^{3,4} Usually, the duration and quality of sleep are influenced by age; individuals tending

to experience less efficient sleep may tend to wake up at night. Gender differences also come into play as women with diabetes tend to have better sleep quality compared to men.^{5,6} Ethnicity should not be overlooked either since individuals from minorities may face challenges related to cultural differences, discrimination, stressors, and limited access, to healthcare services. Both status and educational levels influence the quality of sleep. People who have resources may face difficulties when it comes to maintaining sleep habits creating optimal sleep environments, and dealing with disturbances in their surroundings.^{7,8} In terms of getting quality sleep, important factors, including behavior factors, play an essential role. Physical activity can hinder sleep quality. Moderate exercise has benefits like reducing stress, enhancing mood, and regulating the body's clock. However, excessive or late-night exertion can disrupt sleep by making you more alert and increasing body temperature.⁹ A person's dietary habits may also have an impact on sleep quality. Specific meal compositions, those in carbohydrates, can cause high blood sugar after eating and low blood sugar during the night in people with diabetes, which can affect the continuity of their sleep. Habits such as smoking, alcohol consumption, and caffeine intake can sabotage sleep quality by interfering with a hormone named melatonin secretion (which helps regulate sleep), increasing activity (part of our system that controls stress response), and disrupting different stages of sleep.^{10,11} Conditions like depression, anxiety, stress, and diabetes-related distress often have an impact on sleep quality. Depression is frequently associated with sleep quality among this population. Anxiety can lead to difficulties initiating or maintaining sleep due to worry or fear. However, stress triggers the axis, which in turn causes a rise, in cortisol levels. These elevated cortisol levels can impede the ability to both fall asleep and maintain sleep.¹² The emotional challenges associated with managing diabetes, known as diabetes distress, can introduce a range of feelings into one's sleep routine, such as frustration, anger, guilt, or a sense of helplessness. The environment also plays a role in how people with diabetes experience their nights. In a better sleeping environment can also create an impact on the sleep quality of an individual. Factors like temperature, lighting, noise levels, bedding quality, and air purity can all have an impact. Uncomfortable temperatures or humidity can cause discomfort and night sweats. Bright or blue light from devices can disrupt the production of melatonin. Make it harder to fall asleep. Noisy interruptions during the night can disturb sleep. Poor quality bedding and pillows can lead to pain or pressure points, while air that is filled with allergens may cause issues and allergies. The way our bodies regulate sleep quality is connected to processes in individuals with diabetes. Our internal timekeepers, called rhythms, help coordinate functions based on the 24-hour light-dark cycle. They play a role in determining when and how long we sleep—our alertness during the day. At the time, they also influence glucose metabolism by controlling insulin secretion, glucose uptake, and hepatic glucose production. Disruptions in

rhythms caused by factors like shift work or travel across time zones can have ranging effects on both sleep quality and glucose regulation. This review study aims to explore factors associated with sleep quality and diabetes as their effects and possible interventions.

LITERATURE REVIEW

On October 1, 2023, we conducted a literature review on the topic of sleep quality and diabetes-associated factors, effects, and interventions. For this, we searched the Medline and PubMed databases, using medical subject headings and various related terms in each database. We used keywords such as sleep quality, diabetes, glucose metabolism, insulin sensitivity, sleep disorders, etc. We also searched Google Scholar manually. We also checked the references of the retrieved papers for additional sources. To ensure the quality of our review, we applied inclusion criteria, such as excluding papers published before 2008 or after 2023 and preferring English language publications. We did not apply any restrictions based on age or publication type.

DISCUSSION

The number of people suffering from diabetes mellitus are increasing rapidly globally and several factor are related to this. Some key factors like getting older, urbanization, obesity, and lack of activity.¹³ Estimates suggest that around 463 million individuals, accounting for 9.3% of the world's population, were impacted by diabetes in 2019. There is also a projection that indicates the uptrend of the figure that is 578 million people or 10.2% of the population by the year 2030 and further increase to around 700 million individuals or about 10.9% of the population by the year 2045. Diabetes presents a challenge for both developing countries. In Ethiopia, studies have indicated that DM has impacted 3.8% of the population. Sleep plays a role in maintaining health and facilitating proper bodily functions.¹⁴ During sleeping time, our bodies release hormones that regulate metabolism and endocrine functions. The main things of sleep are to restore balance throughout the body, including the nervous system making it an essential daily requirement.

Clinical manifestation

For keeping the body well, it is mandatory to have a good quality sleep. Better sleep remains a person fit and it heals all the body and makes bodies muscle and organ to regenerate. But when comes to patients who are diabetic may face some issue in getting a sound and quality sleep. This can have effects on their glucose metabolism and insulin sensitivity. Increase the likelihood of experiencing sleep disorders and complications related to diabetes. To address this matter thoroughly, a comprehensive review has been done to understanding regarding factors that impact the quality of sleep in people with diabetes. It also explores the consequences of sleep quality on diabetes

management. Highlights potential interventions that can improve both sleep quality and diabetes outcomes. Many different things can impact the quality of sleep in people who have diabetes, such as environmental and physiological factors. Some of these factors are shared among the population, while others are specific to individuals with diabetes. For example, factors like age, being female or belonging to an ethnic minority group having socioeconomic status or education level have been associated with poorer sleep quality among people with diabetes. Additionally, lifestyle habits such as activity levels, dietary choices, smoking habits, alcohol consumption patterns, caffeine intake, and medication usage can also have an impact on sleep quality for individuals living with diabetes by affecting glucose levels, hormone regulation, for appetite neurotransmitter functioning, melatonin secretion, sympathetic nervous system activity and different stages of sleep.^{15,16} Moreover, individuals with diabetes may experience difficulties in maintaining sleep quality due to the presence of several health related issues such as depression, anxiety, stress, and diabetes-related distress. These conditions can lead to emotions, excessive worrying, and fear of sleep.^{17,18} Additionally, the physical environment in which one sleeps plays a role in sleep quality for people with diabetes. Factors like comfort, relaxation, and safety can influence how well they sleep. Furthermore, biological processes involved in regulating both sleep and glucose metabolism can impact sleep quality for individuals with diabetes. This includes changes in rhythms, sleep stages, sleep patterns, hormones, and glucose levels. It's worth mentioning that having a lack of quality sleep can actually impact how well you manage diabetes. It can affect your glucose control. Even raise the chances of experiencing complications related to the condition. Moreover, it may diminish the quality of life for individuals living with diabetes by affecting mood stability, cognitive function, and daily activities.

Management

There are ways to enhance both sleep quality and diabetes outcomes for individuals struggling with these issues. These approaches include types of interventions; interventions, behavioral interventions, cognitive behavioral interventions, and device-based interventions. Some other types of intervention which include pharmacological interventions that refer to the utilization of medications to address sleep disorders or enhance the quality of sleep. For instance, melatonin regulates sleep patterns and facilitates falling asleep, while hypnotics assist in initiating or sustaining sleep.¹⁹ When doctors prescribe antidepressants to treat depression or anxiety, they use medications to reduce high blood pressure.²⁰ On the other hand, behavioral interventions concentrate on modifying lifestyle habits or behaviors that impact the quality of sleep. They encompass educating individuals about sleep hygiene practices and some other factors like environmental factors that can either promote or hinder

sleep. Additionally, promoting activity through exercise, making dietary adjustments to improve food choices and patterns, quitting tobacco use for smoking cessation purposes limiting alcohol consumption for alcohol reduction goals as well as enhancing medication compliance all fall under this category. On the other hand, device-based interventions utilize devices to monitor or treat sleep disorders while working towards improving sleep quality.^{21,22} These diverse intervention options provide an approach to addressing both sleep quality and diabetes outcomes in individuals affected by these conditions. There are approaches to help with psychological conditions. One example is Cognitive Behavioral Therapy for Insomnia (CBT I) which is a program that combines techniques like controlling stimuli limiting sleep relaxation training, and educating about sleep hygiene. It also includes strategies such as restructuring thoughts providing education, and problem-solving to treat insomnia effectively. Similarly, cognitive behavioral therapy for depression (CBT D) is another program that integrates strategies like activity scheduling, behavioral activation, and pleasant event planning with cognitive approaches such as cognitive restructuring, psychoeducation, and problem-solving to address depression effectively.²³ In addition, Cognitive Behavioral Therapy for Anxiety (CBT A) is a program that integrates approaches to address anxiety effectively. It combines techniques like exposure therapy, relaxation training, and breathing exercises with strategies such as restructuring thoughts educating individuals about their condition, and problem-solving to manage anxiety successfully. Lastly, cognitive behavioral therapy for diabetes distress (CBT DD) is a program that combines strategies such as self-monitoring, goal setting, and action planning with cognitive techniques such as cognitive restructuring, psychoeducation, and problem-solving to cope with distress associated with diabetes effectively. Interventions using devices encompass the utilization of airway pressure (CPAP).²⁴ This device administers pressurized air through a mask to maintain an airway during sleep. Another device known as mandibular advancement devices (MADs) can be employed well. These devices cover the teeth. Shift the jaw forward, preventing the tongue from obstructing the airway while sleeping. There are some ways to address sleep-related issues. One option is to use advancement devices (MADs) which are devices that fit over your teeth and move your lower jaw forward. This helps prevent the tongue from blocking your airway while you sleep. Another option is therapy (BLT), where a device emits bright light during the day to reset your circadian clock and enhance alertness. Additionally, transcutaneous electrical nerve stimulation includes the utilization of a device that administers currents via electrodes connected to your skin. This stimulates the nerves. It can help reduce pain.

CONCLUSION

Having good sleep quality is crucial, for maintaining health and well-being for individuals with diabetes. When

the quality of sleep is affected, it can have an impact on aspects of managing diabetes. These factors consist of the way our body processes glucose, how sensitive we are to insulin, how our appetite is regulated, the presence of inflammation levels of stress, and the functioning of our system. These effects can lead to worsened outcomes and complications related to diabetes. Therefore, it is important to comprehend the factors that influence sleep quality in individuals with diabetes, understand the consequences of sleep quality on their condition management, and explore interventions that can improve both sleep quality and diabetes outcomes. This review paper provides a summary of evidence on these subjects along with recommendations for future research. There are factors that encompass characteristics as well as behavioral patterns, such as lifestyle choices and psychological aspects. Additionally, environmental conditions and physiological factors specific to diabetes play a role in determining sleep quality. Furthermore, we discovered that poor sleep quality has effects on managing diabetes by disrupting glucose control mechanisms elevating the risk of complications associated with the condition and lowering life satisfaction. In exploring interventions aimed at enhancing sleep quality and diabetes outcomes in people dealing with this condition, we encountered proposed approaches. These include interventions involving medications or supplements targeted at improving sleep patterns; behavioral interventions focusing on modifying habits or routines; behavioral techniques aimed at addressing underlying thought patterns affecting sleep; as well as device-based interventions utilizing technological tools designed to optimize restful slumber. Nevertheless, it is important to acknowledge limitations within existing literature while also recognizing areas where further research is warranted. For instance, a majority of the research conducted was in the form of sectional or observational studies. This does pose limitations on our ability to draw inferences and apply the findings broadly. Furthermore, most of the studies relied on measures to evaluate sleep quality, which may not accurately reflect sleep parameters or identify specific sleep disorders. Additionally, most of these studies primarily focused on type 2 diabetes. This might not be applicable to patients who have type 1 diabetes or other forms of diabetes. Therefore, for research, we propose the utilization of experimental designs along with objective measures to assess both sleep quality and glucose metabolism. It is also crucial to ensure that samples representing individuals with types of diabetes are included in these studies. In summary, there exists an association between sleep quality and diabetes evident among individuals with type 2 diabetes who often experience suboptimal sleep or insomnia. On a note, adopting an approach towards diet exercise routines and blood sugar management can substantially enhance sleep quality, thereby positively impacting overall health. Additionally, interventions can effectively enhance both sleep quality and diabetes-related outcomes in individuals. Henceforth, we recommend that healthcare professionals thoroughly

evaluate and address sleep quality as a part of care for individuals with diabetes.

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