RSSDI

Indian Diabetes

EDUCATOR JOURNAL

Theme of the Month

Rest and Regulate – The Sleep-Diabetes Link

To keep Members of Diabetes Care team abreast about
DSME/DSMS - (Diabetes Self management Education/Support) Concepts

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1st time in India
To keep the members of diabetes care team abreast with DSME and DSMS concepts

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*DSME: Diabetes Self-Management Education, DSMS: Diabetes Self-Management Support

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FOREWORD

Research Society for the Study of Diabetes in India (RSSDI) founded by Prof. MMS Ahuja in the year 1972 is the biggest scientific association of healthcare professionals involved in promoting diabetes education and research in India. RSSDI is happy to collaborate with USV to support their endeavour to make India the 'Diabetes care capital of the world'. Through this collaboration, RSSDI would like to strengthen the cadre of diabetes educators by empowering them with recent updates in diabetes management helping bridge the gap between the physician and the patient. Today, the rule of 50% is prevailing in terms of awareness, detection, treatment and control in T2DM. Our aspiration is to achieve 90-90-90-90 i.e.90% of people with diabetes should be made aware, 90% should be detected, 90% of those detected should be treated, and 90% of those treated should reach their goals.

Indian Diabetes Educator Journal (IDEJ) is the first of its kind in India, and the longest running monthly diabetes educator journal since April 2015 and continues its endeavour to spread awareness, knowledge and enable healthcare teams to manage individuals with diabetes and empower them for self-care. RSSDI IDEJ will continue to keep the members of diabetes care team abreast with concepts of Diabetes Self-Management Education/Support (DSME/S) with a reach of 44000 doctors and diabetes educators digitally.

This month's theme, "Rest and Regulate – The Sleep-Diabetes Link," highlights the crucial role of sleep in diabetes management. Beyond rest, sleep affects glucose metabolism, insulin sensitivity, and hormonal balance. Poor sleep can disrupt blood glucose control and raise the risk of complications. This edition of IDEJ explores the science of sleep, practical sleep strategies, and the educator's role in promoting healthier sleep habits. We hope it provides valuable insights to make sleep a key component of holistic diabetes care.

We sincerely thank our contributors for making this issue delightful reading for our readers. We dedicate this journal to all the healthcare professionals who are working relentlessly towards making "India–The Diabetes Care Capital of the World."

Sincere Regards,

Dr. Sanjay Agarwal
RSSDI Secretary

*DSME: Diabetes Self-Management Education, DSMS: Diabetes Self-Management Support

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Article: Understanding the Sleep-Diabetes Connection

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Article: The Bidirectional Relationship Between Sleep Apnea and Cardiovascular Disorders

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Article: Frequently Asked Questions on Rest and Regulate — The Sleep-Diabetes Link

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Cover Story: Understanding the Sleep-Diabetes Connection

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Sleep is essential for the healthy functioning of the mind and body. It is regulated by circadian rhythms and homeostatic pressure that build up during periods of wakefulness. The circadian rhythm is a biological clock that controls various physiological activities, including glucose metabolism. Irregular sleep schedules can disrupt circadian rhythms, which may in turn impair glucose metabolism.

Diabetes and sleep have a two-way relationship. Individuals with diabetes may experience symptoms such as frequent urination, which can disrupt their sleep. One study reported that one in four individuals with diabetes had poor sleep quality. On the other hand, individuals with insufficient sleep and poor sleep hygiene are reported to have elevated blood glucose levels and insulin resistance, increasing the risk for the development of diabetes.

How does sleep increase the risk of diabetes

Figure 1 shows various mechanisms through which sleep deprivation can increase blood glucose levels and diabetes risk. These mechanisms include activation of inflammatory cytokines such as C-reactive protein (CRP), and interleukin-6 (IL-6), increased caloric intake, body weight, etc.

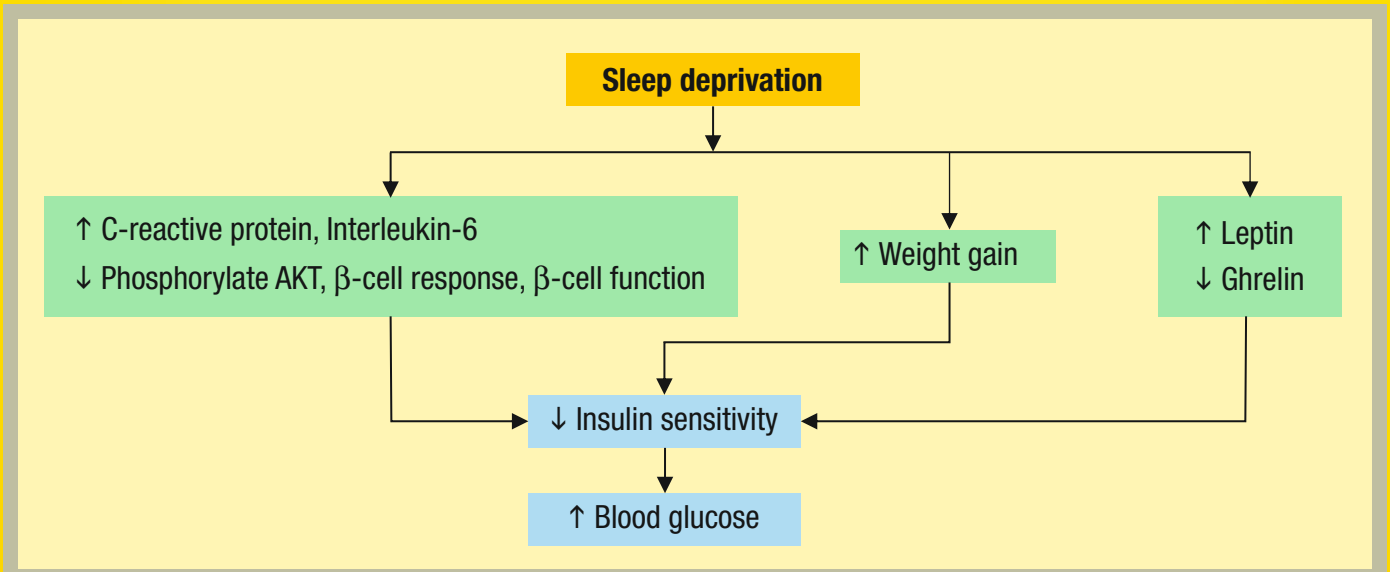

Figure 1: Sleep deprivation and associated mechanisms of impaired glucose metabolism

How does diabetes affect sleep

Elevated glucose levels in people with diabetes can lead to nocturia (frequent night-time urination), contributing to disturbed sleep quality. Other diabetes-related factors further disrupt sleep and include nocturnal hypoglycemia, neuropathy and pain, restless legs syndrome, obstructive sleep apnea (OSA), depression, etc. These may collectively impair sleep and affect overall health. Figure 2 illustrates diabetes and associated conditions that affect sleep quality.

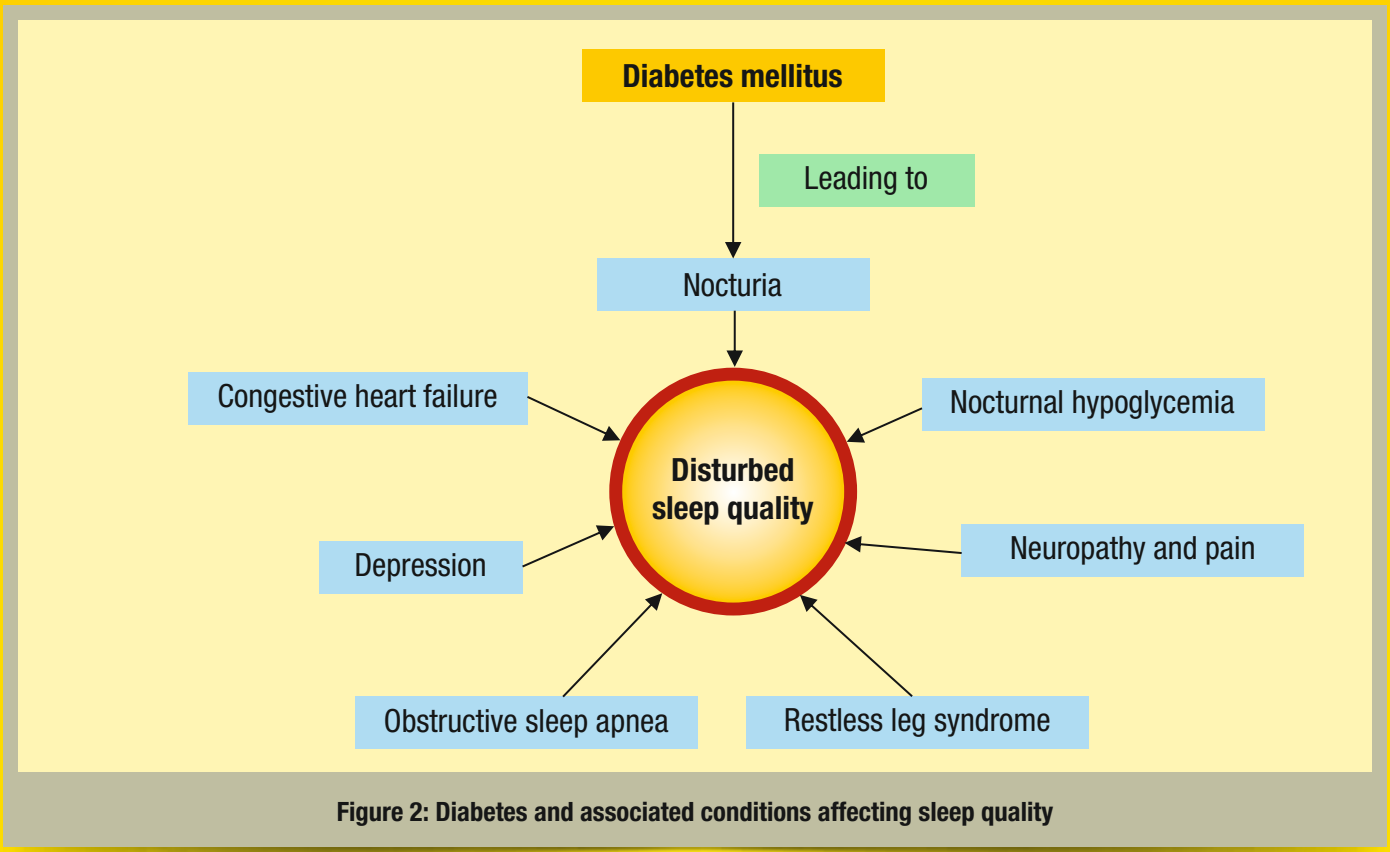

Figure 2: Diabetes and associated conditions affecting sleep quality

Individuals with diabetes often do not mention sleep issues during healthcare visits, as more acute concerns usually take priority. However, it is essential for healthcare providers managing diabetes to actively identify and address sleep disturbances, as these can significantly impact quality of life. Inadequate and fragmented sleep can significantly hinder diabetes control, recovery, and overall well-being. Therefore, incorporating sleep education into diabetes care should be considered an essential component of comprehensive management.

Key points

- Sleep disruption increases diabetes risk through inflammatory and metabolic pathways.
- Elevated blood glucose levels in diabetes can lead to nocturia, disturbing sleep continuity.
- Diabetes-related complications such as neuropathy, nocturnal hypoglycemia, and obstructive sleep apnea can significantly impair sleep quality.
- Healthcare providers should proactively address sleep health during diabetes management.

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2. Tiwari R, Tam DNH, Shah J, Moriyama M, Varney J, Huy NT. Effects of sleep intervention on glucose control: A narrative review of clinical evidence. *Prim Care Diabetes*. 2021;15(4):635–641. doi: 10.1016/j.pcd.2021.04.003
3. Surani S, Brito V, Surani A, Ghamande S. Effect of diabetes mellitus on sleep quality. *World J Diabetes* 2015; 6(6): 868–873. doi: 10.4239/wjd.v6.i6.868
4. Maheshwari V, Basu S. Sleep problems and their predictors in community-dwelling older adults with diabetes in India: Evidence from the Longitudinal Ageing Study in India. *Sleep Med X*. 2024;7:100108. Published 2024 Mar 6. doi: 10.1016/j.sleepx.2024.100108

The Bidirectional Relationship Between Sleep Apnea and Cardiovascular Disorders

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Obstructive sleep apnea (OSA) is a disorder characterized by recurrent episodes of collapse in the upper airway during sleep, leading to intermittent hypoxia and sleep fragmentation. OSA and diabetes mellitus (DM) and class II obesity onwards at times leading to insulin resistance are two prevalent conditions that often co-exist, each independently increasing the risk of cardiovascular diseases (CVD). Evidence indicates a bidirectional relationship between OSA and CVD in people with DM, necessitating a comprehensive understanding of their interplay.

OSA and DM act synergistically to heighten the risk of CVD and all-cause mortality through overlapping pathophysiological pathways. OSA, characterized by intermittent hypoxia and sleep fragmentation, and DM, driven by insulin resistance, both contribute to enhanced sympathetic nervous system activity, vagal dysfunction, oxidative stress, low-grade systemic inflammation, and activation of the hypothalamic-pituitary-adrenal (HPA) axis. These disruptions lead to arterial stiffness, endothelial dysfunction, hypertension, and chronic kidney disease. Such vascular impairments pave the way for atherosclerosis, arrhythmias, myocardial dysfunction, and ultimately, heart failure. The convergence of these mechanisms creates a self-perpetuating cycle, significantly amplifying the burden of CVD and increasing mortality in individuals with both conditions.

CVD can also contribute to the development of OSA, particularly in individuals with DM, through mechanisms such as fluid redistribution, increased upper airway resistance, and impaired respiratory control. Heart failure-related fluid shifts and autonomic dysfunction promote airway collapsibility and central apneas, while diabetes exacerbates these effects through inflammation, oxidative stress, and endothelial dysfunction. Though OSA is known to elevate CVD risk, emerging evidence shows that CVD itself can initiate or worsen OSA, forming a bidirectional and reinforcing relationship.

SLEEP APNEA HURTS

By increasing the risk of:

- **H** Heart failure
- **E** Elevated blood pressure
- **A** Atrial fibrillation
- **R** Resistant hypertension
- **T** Type 2 diabetes
- **S** Stroke

Prevention of cardiovascular complications and diabetes progression requires intensified risk factor control, including lifestyle modifications, weight loss strategies, and pharmacologic therapies. Improving adherence to continuous positive airway pressure (CPAP) therapy, especially by extending night-time usage, is also vital. Tools such as sleep questionnaires, nocturnal oxygen saturation monitoring, and polygraphy as a first-line diagnostic test can facilitate early diagnosis. Behavioral strategies and alternative therapies may be considered for those who are non-compliant or intolerant to CPAP. This comprehensive approach can significantly mitigate the cardiovascular burden in individuals with coexisting OSA and DM.

The bidirectional relationship between OSA and CVD in people with DM calls for an integrated approach to diagnosis and management. Early identification and treatment of OSA can help in mitigating the risk of CVD in people with DM and improve the quality of life. Future research should target developing precise interventions to address this complex interplay.

Key points

- Obstructive sleep apnea and diabetes together amplify cardiovascular disease risk through shared pathways like inflammation, oxidative stress, and autonomic dysfunction.
- CVD can worsen OSA, especially in people with diabetes, creating a reinforcing cycle of cardiometabolic damage.
- Early diagnosis and integrated management, including CPAP, lifestyle changes, and risk factor control, are key to reducing complications.

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What is Restless Leg Syndrome

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Restless leg syndrome (RLS), or Willis-Ekbom disease, is a neurological disorder characterized by the constant urge to move one's legs. It's often accompanied by uncomfortable sensations like aching, throbbing, pulling, itching, or crawling. These symptoms worsen during rest (especially evening or night), and are temporarily relieved by movement, leading to sleep disruption, which hampers daytime routines. People with diabetic neuropathy (DN) have a higher risk of developing RLS due to diabetes induced nerve damage.

Clinical features and diagnosis of RLS

Diagnosis of RLS is based on the criteria established by the International Restless Legs Syndrome Study Group (IRLSSG)

- Constant urge to move the legs, usually with unpleasant, painful sensations
- Symptom onset or worsening during rest
- Partial or complete relief with movement
- Symptoms worsening in the evening or night

Pathophysiology of RLS

The pathophysiology of RLS is complex, multifaceted, and not entirely understood. Dopaminergic dysfunction in brain pathways controlling movement is considered a primary factor. Iron deficiency (even without anemia), essential for dopamine synthesis, is also a key contributor. In some individuals, genetic factors are also said to play a significant role. Additionally, inflammation, oxidative stress, and imbalances in other neurotransmitters are contributors. DN, i.e., nerve damage from high blood glucose levels, further exacerbates RLS symptoms. It is also hypothesized that shared metabolic or inflammatory pathways associated with both diabetes and RLS could contribute to their frequent coexistence.

Management of RLS

RLS management aims to ease symptoms, improve sleep, and enhance life quality. Non-drug methods include lifestyle changes and physical therapies. Medications like dopamine agonists and alpha-2-delta ligands are used, along with iron supplementation if deficient. For those with DN and RLS, careful blood glucose control is key to managing neuropathy and potentially reducing overlapping discomfort.

RLS is a prevalent and often underdiagnosed condition, with a higher occurrence in individuals with diabetes. Recognizing its distinct yet coexisting nature with DN is crucial for accurate diagnosis and tailored management strategies to improve the quality of life for affected individuals. Ongoing research continues to explore the intricate mechanisms underlying RLS and to develop more effective therapeutic interventions.

Key points

- **RLS:** Irresistible leg movement urge with discomfort, worse at rest/night, disrupts sleep, higher risk with diabetic neuropathy.
- **Diagnosis:** Based on urge to move with unpleasant/painful sensations, worsening at rest/night, relief with movement.
- **Causes:** Likely dopamine issues, low iron, genetics, inflammation, and DN-associated nerve damage.
- **Management:** Includes lifestyle changes, physical therapies, medications, and blood glucose control, which helps those with DN.

Resources:

1. Mansur A, Castillo PR, Rocha Cabrero F, *et al*. Restless Legs Syndrome. [Updated 2023 Feb 27]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK430878/
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Effects of Sleep Deprivation on Glucose Homeostasis

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Sleep is essential for maintaining metabolic balance, especially in controlling glucose homeostasis. A growing body of research suggests that poor quality sleep or inadequate sleep can have an adverse effect on insulin sensitivity and glucose metabolism. Evidence suggests that loss of sleep can lead to impaired glucose metabolism, increased insulin levels, elevated cortisol levels, and altered leptin and ghrelin concentrations, resulting in increased hunger and appetite. These changes may lead to weight gain, increase insulin resistance, and eventually affect glucose metabolism. It has also been reported that, regardless of risk factors like obesity or physical inactivity, poor sleep quality and irregular sleep schedule contribute to hyperglycemia and reduced beta-cell function.

Individuals with diabetes are more vulnerable to glycemic variability due to sleep deprivation and poor sleep quality, which are linked to abnormalities in blood glucose regulation and impaired insulin sensitivity. Mechanisms involved are illustrated in the figure below.

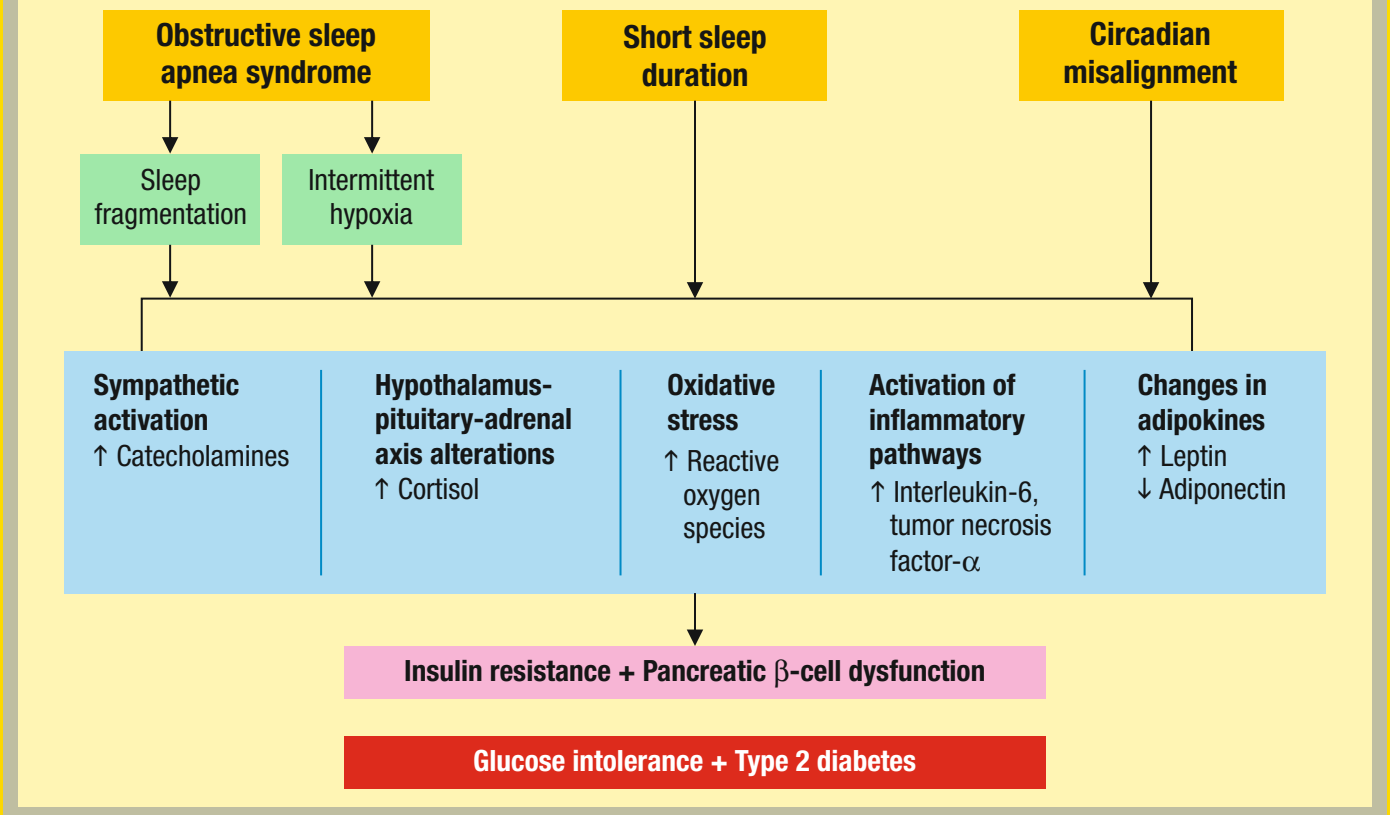

Figure 1: Effect of sleep on glucose homeostasis

Studies have shown improvement in insulin sensitivity and glucose management in individuals with diabetes with improved sleep duration. All of these results highlight how important sleep is for blood glucose regulation. Sleep hygiene should thus be emphasized as a component of all - comprising lifestyle changes for glycemic management.

Resources:

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Abridged Prescribing Information

UDAPA-TRIO Forte, UDAPA-TRIO, Dapagliflozin, Sitagliptin & Metformin Hydrochloride Extended Release Tablets

Composition: Dapagliflozin 10 mg, Sitagliptin 100 mg & Metformin Hydrochloride Extended Release 1000 mg tablets Dapagliflozin propanediol monohydrate eq. To Dapagliflozin 10 mg Sitagliptin Phosphate Monohydrate IP Eq. Sitagliptin 100 mg Metformin Hydrochloride IP (as Extended Release) 1000 mg Dapagliflozin10 mg, Sitagliptin 100 mg & Metformin Hydrochloride Extended Release 1000 mg tablets Dapagliflozin propanediol monohydrate eq. To Dapagliflozin 10 mg Sitagliptin Phosphate Monohydrate IP Eq. Sitagliptin 100 mg Metformin Hydrochloride IP (as Extended Release) 500 mg **Indication:** It is indicated as an adjunct to diet and exercise to improve Glycemic Control adults with type 2 diabetes mellitus **Recommended Dosage:** As directed by the physician. **Method of Administration:** Oral **Adverse Reactions:** Most common adverse reactions reported are: Dapagliflozin - Female genital mycotic infections, Nasopharyngitis, Urinary tract infections. Sitagliptin - Upper respiratory tract infection, nasopharyngitis and headache. Metformin - Diarrhea, nausea/vomiting, flatulence, asthenia, indigestion, abdominal discomfort, and headache. **Warnings and Precautions:** Dapagliflozin: Volume depletion; Ketoacidosis in patients with Diabetes Mellitus; Urosepsis and Pyelonephritis; Hypoglycemia; Genital mycotic infections Sitagliptin: General: Sitagliptin should not be used in patients with type 1 diabetes or for the treatment of Diabetic Ketoacidosis. Acute pancreatitis: Hypoglycemia is used in combinations when combined with other anti-hyperglycemic medicinal product; Renal impairment: Hypersensitivity reactions including anaphylaxis, angioedema, and exfoliative skin conditions - Steven johnson syndrome; Bullous pemphigoid Metformin Hydrochloride: Lactic acidosis; In case of dehydration (severe diarrhea or vomiting, fever or reduced fluid intake), metformin should be temporarily discontinued and contact with a healthcare professional is recommended. **Contraindications:** Hypersensitivity to the active substance of Dapagliflozin, Sitagliptin & Metformin or to any of the excipients listed. Any type of acute metabolic acidosis (such as lactic acidosis, diabetic ketoacidosis). Diabetic pre-coma; Severe renal failure (eGFR < 30ml/min); Acute conditions with the potential to alter renal function such as: Dehydration, Severe infection, Shock; Acute or chronic disease which may cause tissue hypoxia such as: Cardiac or respiratory failure, Recent myocardial infarction, Shock, Renal Impairment, Acute intoxication, Alcoholism. **Use in special population:** Pregnant women: Due to lack of human data, drugs should not be used during pregnancy. Lactating women: It should not be used during breastfeeding. Pediatric patients: The safety and efficacy of drugs has not yet been established. No data is available. Geriatric Patients: In patients >65 years, it should be used with caution as age increases. For Additional Information/full prescribing information, please write to us: USV Private Limited, Arvind Vithal Gandhi Chowk, B.S.D. Marg, Govandi, Mumbai - 400088 Last updated on 02/04/2024.

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Insulin and Integrated Care in T2DM Pregnancy
A Doctor's Experience on the MyCare Patient Support Program for PwD

Dr. Raghu M. S.

MBBS, MD, DM. Endocrinology

Consultant Endocrinologist and Diabetologist,
Dr. Raghu's Diabetes and Hormone Care,
Mysore

Here's what Dr. Raghu M. S. has to say:

A 37-year-old woman with type 2 diabetes mellitus (T2DM), who successfully conceived through in vitro fertilization, consulted me. Due to elevated blood glucose levels, she was started on insulin. She was referred to MyCare Diabetes Educator (MDE), Ms. Shaista Anjum, for personalized dietary guidance and education, and remained under my medical supervision throughout the pregnancy.

MDE Shaista took a detailed dietary recall and advised a healthy diet that addressed the increased nutrient requirements during pregnancy while also focusing on glucose control. This was followed by regular follow-ups. It was observed that she was regularly waking up at night due to hunger, indicative of hypoglycemia. She was educated on how to recognize the signs of hypoglycemia and manage them effectively. A bedtime snack containing low-to-moderate carbohydrates, along with nuts and seeds, was also recommended. This simple yet effective intervention helped her sleep through the night without hypoglycemia-related interruptions.

She was observed to have occasional blood glucose spikes up to 190 mg/dL. MDE Shaista explained the importance of maintaining glycemic control not just for the mother's health, but also for the baby's growth and well-being. She emphasized the importance of adequate protein intake and the need to distribute it evenly across all three main meals and snacks. This strategy supported better post-meal glucose control and also contributed to healthy fetal weight gain. In addition to dietary guidance, MDE Shaista encouraged light physical activity, such as short 10 to 15 minute strolls after each meal, along with 20 to 30 minute walks in the morning and evening, as comfortable. The combination of dietary counseling, insulin therapy, and physical activity helped maintain her blood glucose levels within the desired range. She went on to deliver a healthy baby boy weighing 3.2 kg.

Ms. Shaista Anjum

NDEP and T1DE Certified Diabetes Educator

Here's what MDE Shaista Anjum has to say:

This is a strong example of how personalized education, timely interventions, and teamwork between the doctor and the diabetes educator can make a significant difference in pregnancy outcomes for women with T2DM.

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*PWD: People with Diabetes

Contact for more information
Nikita Thawarkar | 7304930643 | nikita.thawarkar@usv.in

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Ref.: L Ravikumar et al.Cardiology and Cardiovascular Medicine. 2023; 7: 141-144. |

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Composition: Each Film Coated Tablet Contains: Dapagliflozin Propanediol Monohydrate eq. to Dapagliflozin (10 mg) + Sitagliptin Phosphate Monohydrate IP eq. to Sitagliptin (100 mg). **Indications:** For the treatment of type 2 diabetes mellitus inadequately controlled on Metformin monotherapy. Recommended Dosage: As directed by the physician. **Method of Administration:** Oral. **Adverse Reactions:** Female genital mycotic infections, nasopharyngitis, and urinary tract infections are most common adverse reactions associated with dapagliflozin. While, upper respiratory tract infection, nasopharyngitis, and headache are most common adverse reactions associated with sitagliptin. **Warnings and Precautions: Risk of Volume Depletion in Elderly** - Before initiating Dapagliflozin and Sitagliptin, assess volume status and renal function in the elderly, patients with renal impairment or low systolic blood pressure, and in patients on diuretics. Monitor for signs and symptoms during therapy. **Ketoacidosis in Patients with Diabetes Mellitus** - Assess patients who present with signs and symptoms of metabolic acidosis for ketoacidosis regardless of blood glucose level. If suspected, discontinue UDAPA™-S, evaluate and treat promptly. Before initiating UDAPA™-S, consider risk factors for ketoacidosis. Patients on UDAPA™-S may require monitoring and temporary discontinuation of therapy in clinical situations known to predispose to ketoacidosis. **Urosepsis and Pyelonephritis** - Evaluate for signs and symptoms of urinary tract infections and treat promptly, if indicated. Hypoglycemia - Consider a lower dose of insulin or the insulin secretagogue to reduce the risk of hypoglycemia when used in combination with Dapagliflozin and Sitagliptin. **Necrotizing Fasciitis of the Perineum** - Serious, life-threatening cases have occurred in patients with diabetes, both females and males. Assess patients presenting with pain or tenderness, erythema, or swelling in the genital or perianal area, along with fever or malaise. If suspected, institute prompt treatment. **Genital Mycotic Infections** - Monitor and treat if indicated. **Contraindications:** Patients with a history of hypersensitivity reaction to the active substance or to any of the excipients. In patients with varying degrees of renal impairment, adjusting the dosage is advised based on the severity of the condition. Prohibited medications include strong CYP2C8 inhibitors/ inducers, drugs increasing/decreasing hypoglycemic action, drugs known to cause QT prolongation, or other oral hypoglycemic agents other than study medications.

For Additional Information/full prescribing information, please write to us:
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Updated on 20th March 2024

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Expert Insights: Interview with Dr. Firdous Shaikh

Dr. Firdous Shaikh

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Consultant Diabetologist and Metabolic Physician, Jyoti Polyclinic, Mumbai

Dr. Firdous Shaikh is a highly accomplished diabetologist and metabolic physician based in Mumbai, with extensive national and international recognition. A fellow of the Indian Society of Chronomedicine and Diabetes India, she currently serves as chief clinical advisor for the Alignia Foundation. Her work has earned her multiple prestigious awards for excellence in diabetes care and education. Dr. Shaikh is the author of two books and has contributed to numerous national and international medical journals. She is also the co-founder of the "A Sweet Life" app, focused on patient-centered diabetes management. Her compassionate leadership continues to inspire advancements in the field of diabetes care.

Rest and Regulate — The Sleep-Diabetes Link

1. How does poor sleep affect blood glucose levels and insulin sensitivity?

Ans. Poor sleep—whether due to short duration, fragmentation, or disorders like sleep apnea—disrupts circadian rhythms and increases cortisol and sympathetic activity, leading to:

- **Elevated blood glucose:** Sleep deprivation reduces glucose uptake in muscles and promotes hepatic gluconeogenesis.
- **Insulin resistance:** Impaired sleep decreases insulin sensitivity by altering adipokine secretion (e.g., increased leptin, decreased adiponectin) and promoting low-grade inflammation (elevated Tumor Necrosis Factor-alpha [TNF-α], Interleukin-6 [IL-6]).
- **Increased appetite:** Ghrelin rises and leptin falls, driving cravings for high-carbohydrate foods, worsening glycemic control. Studies show even one night of poor sleep can induce transient insulin resistance akin to pre-diabetes.
- Inadequate sleep impairs the acute insulin response to glucose and reduces the disposition index, reflecting deterioration in pancreatic compensation mechanisms. These effects can manifest clinically as elevated morning fasting glucose, impaired postprandial glucose control, and progressive insulin resistance.

2. Do you often see sleep issues in people with uncontrolled diabetes?

Ans. Absolutely. In my practice, ~50% of patients with uncontrolled diabetes report sleep disturbances, including:

- **Insomnia** (difficulty falling/staying asleep due to stress, nocturia, or neuropathic pain).
- **Sleep apnea** (notably obstructive sleep apnea [OSA], prevalent in 30–50% of type 2 diabetes [T2DM] patients due to obesity and autonomic dysfunction).
- **Restless legs syndrome** (linked to iron deficiency or uremia in chronic kidney disease [CKD] patients).

Clinical implication: Addressing sleep issues often leads to better glycemic control and reduced insulin requirements.

- Nocturnal hyperglycemia frequently triggers nocturia, thirst, and headaches that fragment sleep. Conversely, hypoglycemic episodes during sleep can trigger counter-regulatory hormone release, causing nocturnal awakenings, night sweats, and morning headaches. Glycemic variability itself disrupts sleep architecture, with studies demonstrating reduced slow-wave sleep in patients with high glycemic excursions. Interestingly, patients often don't recognize these disruptions as "sleep problems" per se, but rather as intrinsic aspects of living with diabetes. Targeted questioning about sleep quality should be a standard component of diabetes assessment, especially in those with suboptimal control.

3. What's the link between sleep apnea and type 2 diabetes?

Ans. OSA and T2DM share a bidirectional relationship:

- **Pathophysiology:** Intermittent hypoxia from apneas activates the sympathetic system and hypoxia-inducible factor 1-alpha (HIF-1α), worsening insulin resistance.
- **Inflammation:** OSA increases oxidative stress and cytokines (e.g., IL-6), exacerbating pancreatic β-cell dysfunction.
- **Prevalence:** Up to 80% of obese T2DM patients have undiagnosed OSA (Indian data suggests 60%–70%).

- Clinically, OSA severity correlates with worse glycemic control, greater insulin resistance, and accelerated progression of diabetic complications. Importantly, effective continuous positive airway pressure (CPAP) therapy demonstrates measurable improvements in insulin sensitivity and modest improvements in glycemic control, highlighting the therapeutic potential of addressing this comorbidity.

Key takeaway: Screening for OSA (e.g., snoring, tiredness, observed apnea, high blood pressure, body mass index [BMI], age, neck circumference, and gender [STOP-BANG] questionnaire) in T2DM patients is essential — studies have shown CPAP therapy can improve insulin sensitivity by 15%–20%.

4. What tips do you give patients to improve sleep and blood glucose control?

Ans. I emphasize a structured approach targeting both glycemic management and sleep hygiene.

Lifestyle and behavioral modifications:

- **Sleep hygiene:** Fixed sleep-wake times, dark/cool room, and avoiding screens 1–2 hours before bedtime due to blue light's melatonin-suppressing effects.
- **Meal timing:** Dinner consumption at least 3 hours before bedtime.
- **Evening nutrition:** A protein-rich snack (e.g., nuts, Greek yogurt) to prevent nocturnal hypoglycemia (if on insulin/sulphonylureas).
- **Exercise:** Morning/afternoon workouts (avoid late evenings).
- **Caffeine/alcohol:** Limit after 4 pm; alcohol disrupts rapid eye movement (REM) sleep.
- **Stress management:** Mindfulness or deep breathing to lower cortisol.
- **For OSA:** Weight loss, positional therapy, and CPAP adherence. Those intolerant to CPAP consider oral appliances or nasal pillows.

5. How can diabetes educators help identify and address sleep issues?

Ans. Diabetes educators are uniquely positioned to integrate sleep assessment into comprehensive diabetes care through several practical approaches:

- **Screening:** Integrate simple tools (e.g., STOP-BANG, Epworth Sleepiness Scale) during routine visits.
- **Education:** Explain the sleep-diabetes link using patient-friendly analogies (e.g., "sleep is like charging your body's battery—without it, insulin doesn't work efficiently"). Educating on the importance of sleep hygiene, this should include guidance for shift workers, who face particular challenges in synchronizing sleep-wake cycles with medication regimens.
- **Referral:** Refer to sleep specialists for suspected OSA or insomnia.
- **Tech use:** Encourage sleep trackers (e.g., smart watches) to identify patterns.
- **Holistic care:** Address comorbid depression/anxiety, which disrupts sleep and glycemic control.

Concluding thoughts

"Sleep is the missing pillar in diabetes management—optimizing it can be as impactful as pharmacotherapy." Screening and intervention for sleep disorders should be routine in diabetes care, akin to foot exams or retinopathy checks.

Interpreting Blood Report: Lipid Profile

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The lipid profile is a blood test that measures key lipids (fats) in the blood and includes the following, as shown in the table below. While lipids are essential for cell function, elevated levels can lead to atherosclerosis and increase the risk of heart disease and stroke. This test helps assess an individual's cardiovascular risk.

Parameter	Normal range	Risk	Associated conditions
Total cholesterol	<200 mg/dL	High levels suggest higher coronary artery disease (CAD) and stroke risk; it is also important to consider high-density lipoprotein (HDL) and low-density lipoprotein (LDL) levels along with them.	Atherosclerosis, hypertension, cardiovascular events
LDL cholesterol (bad cholesterol)	<100 mg/dL	High levels promote cholesterol deposition in arterial walls, leading to plaque formation.	CAD, peripheral artery disease, stroke
HDL cholesterol (good cholesterol)	Men: >40 mg/dL Women: >50 mg/dL	Low HDL fails to remove excess cholesterol, increasing cholesterol deposition.	Cardiovascular disease
Triglycerides	<150 mg/dL	High levels are linked to insulin resistance and pancreatitis.	Cardiovascular disease, stroke, pancreatitis, fatty liver
Very low-density lipoprotein (VLDL) cholesterol	<30 mg/dL	Elevated VLDL indicates high triglyceride levels and contributes to plaque formation.	Atherosclerosis, liver dysfunction

Lipid profile is critical in identifying early cardiovascular risk and is most effective when interpreted alongside clinical risk factors such as diabetes, obesity, smoking, and family history.

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Types of Sleep Apnea

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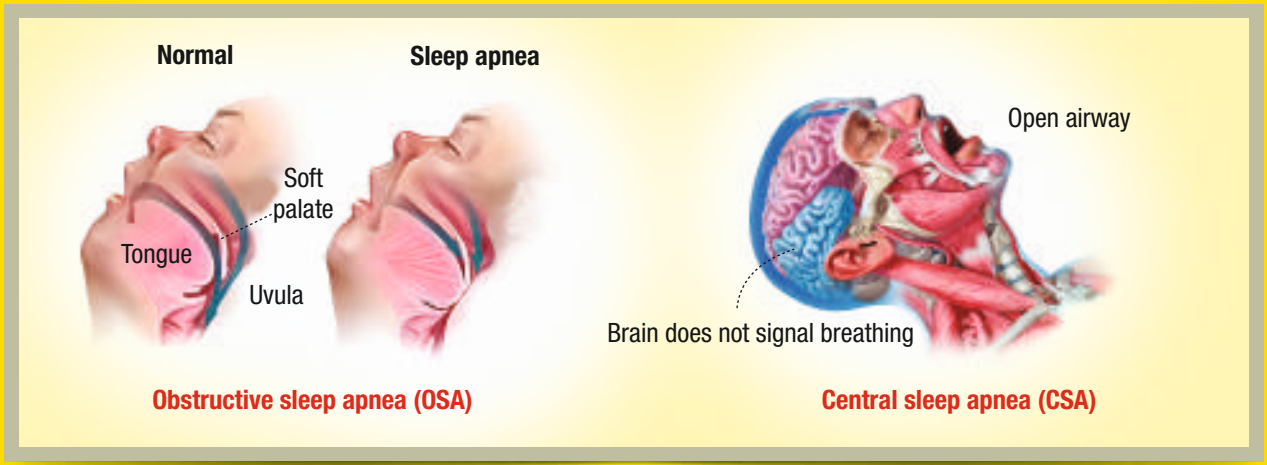
There are the following three types of sleep apnea:

1. **Obstructive sleep apnea (OSA)**

- OSA is the most common form of sleep apnea, where airway blockages cause breathing pauses during sleep despite respiratory effort.
- Causes: Obesity, enlarged tonsils, nasal obstructions, or structural airway issues.
- Symptoms: Loud snoring, choking or gasping, daytime fatigue, and sleep disturbances.
- Treatment: Lifestyle changes like weight loss, continuous positive airway pressure (CPAP), surgery, or oral devices.

2. **Central sleep apnea (CSA)**

- In CSA, breathing stops temporarily during sleep due to impaired brain signals controlling respiration.
- Causes: Often linked to heart failure, stroke, opioid use, high-altitude exposure, and neurological disorders.
- Symptoms: Waking up abruptly with shortness of breath, excessive daytime drowsiness, fatigue, mood instabilities, insomnia, and poor sleep. CSA patients are often not obese and may not snore.
- Complications: Untreated CSA can lead to systemic and pulmonary hypertension, arrhythmias (e.g., atrial fibrillation), mood disorders, memory issues, chronic fatigue, and increased cardiovascular mortality.
- Treatment: Non-pharmacological approach includes CPAP, bilevel positive airway pressure (BiPAP), nocturnal oxygen therapy, and phrenic nerve stimulators. Pharmacologic options include acetazolamide, buspirone, mirtazapine, theophylline, etc.
- Effective care involves sleep physicians, cardiologists, respiratory therapists, pharmacists, and primary care providers.



3. Complex sleep apnea syndrome (treatment-emergent CSA)

- A combination of CSA and OSA that can develop during OSA treatment (e.g., CPAP).
- Treatment: Adaptive ventilation therapy, adjusting CPAP settings.

Each type requires a tailored approach to diagnosis and treatment, aiming to improve sleep quality and prevent long-term health complications.

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Strategies to Modify Sleep Behavior in Diabetes

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Sleep is a vital yet often overlooked component in the comprehensive management of diabetes. Addressing poor sleep behaviours through modifiable lifestyle strategies can significantly improve metabolic outcomes and quality of life. This article outlines evidence-based interventions—encompassing behavioural, nutritional, environmental, and physical activity approaches—to help improve sleep behaviour among those living with diabetes.

1. Optimize sleep hygiene and behavioural patterns

Sleep hygiene forms the cornerstone of behavioural interventions. Key strategies include:

- **Consistent sleep-wake schedule:** Maintaining regular sleep and wake times reinforces circadian rhythm stability, which is critical for glucose metabolism and insulin sensitivity.

- **Sleep-conducive environment:** Creating a cool, quiet, and dark bedroom environment helps enhance melatonin secretion and sleep onset. Reducing screen exposure before bedtime is also vital, as blue light disrupts circadian rhythm and melatonin production.
- **Cognitive behavioral therapy for insomnia:** This may be especially useful for individuals experiencing diabetes-related distress or anxiety, both of which commonly impair sleep.

2. Incorporate nutrition strategies

Emerging research highlights that dietary interventions significantly influence sleep quality. For people with diabetes, these include:

- **Chrono-nutrition:** Aligning meal timing with circadian rhythms—e.g., avoiding late-night meals—supports better sleep quality and glucose control.
- **Low glycemic index (GI) foods:** Diets rich in whole grains, vegetables, and legumes, and low in processed sugars, are associated with improved sleep latency and duration.

- **Sleep-supporting nutrients:** Magnesium, melatonin, tryptophan, and certain antioxidants (found in cherries, kiwis, and nuts) promote better sleep onset and quality by influencing neurotransmitter synthesis.
- **Regular fish consumption:** Fish, especially fatty varieties like salmon, sardines, and mackerel, are rich in omega-3 fatty acids and vitamin D, both of which are associated with improved sleep efficiency and reduced sleep latency. Studies suggest that these nutrients may help regulate serotonin and melatonin levels, contributing to better circadian alignment and mood stabilization.

3. Promote regular physical activity

Physical activity has been linked to improvements in both sleep quality and insulin sensitivity. Recommendations include:

- **Moderate aerobic exercise:** Activities such as walking, swimming, or cycling, particularly performed during daytime or early evening, enhance slow-wave sleep (deep sleep) and reduce sleep onset latency.
- **Avoid intense late-night workouts:** High-intensity or late-evening workouts can increase core body temperature and alertness, disrupting sleep initiation.

4. Manage emotional and psychological stressors

Psychological factors, including depression, anxiety, and diabetes-related distress, are major contributors to sleep disturbances. Interventions should include:

- **Stress reduction techniques:** Practices such as mindfulness, meditation, and guided breathing can reduce hyperarousal and support sleep onset.
- **Mental health support:** Screening for depression and anxiety should be routine, and appropriate mental health support should be provided, especially for individuals struggling with sleep and diabetes self-management.

5. Utilize technology and wearables

Wearable devices and home-based monitoring tools are increasingly useful in tracking sleep behaviour. These tools can:

- **Objectively measure sleep:** Devices like actigraphy and smartwatches help track sleep duration, disturbances, and patterns, which can guide personalized interventions.
- **Facilitate self-monitoring:** When combined with glucose monitoring, these tools help individuals understand the interplay between their sleep and blood glucose levels.

Intervening across multiple domains—including behavioral routines, nutrition, physical activity, and psychological support—can meaningfully enhance sleep quality and glycemic control. Future interventions should further explore integrated, personalized strategies using technology and interdisciplinary support to sustain long-term sleep health in people with diabetes.

Key points

- Optimizing sleep hygiene and maintaining a consistent sleep schedule improves circadian rhythm and insulin sensitivity.
- Nutritional strategies like chrono-nutrition, low-GI foods, magnesium-rich foods, and regular fish consumption enhance sleep quality and metabolic health.
- Regular physical activity supports both sleep hygiene and glycemic control, while intense late-night workouts should be avoided.
- Managing psychological stress and making use of wearable technology can help better understand and support sleep hygiene.

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Diabetes Educator's Toolkit:
Skill of the Month: Motivational Interviewing

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Motivational interviewing (MI) is a collaborative conversational approach used by healthcare providers to engage patients in addressing health-related issues. MI as a strategy has been shown to improve adherence to treatment in individuals with diabetes. It aims to foster patient introspection and empower them to find their own motivation for change. MI blends specific techniques, such as asking open-ended questions and demonstrating empathy, with a strong emphasis on patient-centered care.

Five principles of motivational interviewing

1. **Empathy:** Understanding an individual's feelings, expectations, challenges, especially their ambivalence (mixed feelings) regarding change, is important. MI helps people with diabetes look at this ambivalent behavior in a non-judgmental way and helps them make better choices regarding their health.
2. **Avoiding argument:** Refraining from directly challenging the person with diabetes, as this triggers them and leads to resistance, instead, the focus could be on reflective listening.
3. **Supporting self-efficacy:** To strengthen the confidence of a person with diabetes by making them believe in their own ability to make and maintain the required change.
4. **Rolling with resistance:** Acknowledging and exploring resistance rather than opposing it while gently guiding toward a gradual change helps shift the focus with less negativity.
5. **Developing discrepancy:** Help the person recognize the gap between their current behavior and their health goals. It encourages internal motivation and helps them see why change might matter.

MI shifts the dynamic from "telling" to "engaging," from compliance to partnership, making it a valuable approach in diabetes management. Motivational interviewing shifts the dynamic between the diabetes educator and the person with diabetes, in contrast to the traditional approach, which expects the person with diabetes to simply follow the guidance provided. MI recognizes the person with diabetes as the expert in their own life and the diabetes educator as a guide who supports them in making better health decisions, leading to improved health outcomes.

Resources:

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Frequently Asked Questions on Rest and Regulate – The Sleep-Diabetes Link

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1. Doctor, I have frequent night-time urination, severely disrupting my sleep. I'm also having high morning sugars. Is this linked to my diabetes? What's causing this, and how can I fix it to improve both my sleep and sugar control?

Ans. Poorly controlled diabetes leads to glucosuria, where excess glucose in urine osmotically draws water, increasing night-time urine volume and disrupting sleep. High glucose levels at night often lead to high fasting blood glucose levels in the morning. This also could be due to hormonal dysregulation associated with impaired sleep. Increased counter-regulatory hormones like cortisol and adrenaline promote glucose production and decrease insulin sensitivity, causing elevated glucose levels in the morning.

It is important to address underlying hyperglycemia through better diabetes management, including healthy eating, avoiding high sugar or high carbohydrate foods, especially post-evening hours, doing regular exercise, and following the prescribed medication to reduce glucosuria. If glucose levels are consistently high, speak to your doctor to understand if any modifications are needed. Optimizing fluid intake timing and treating bladder issues (if any) can also help with nocturia, further supporting sleep health.

2. My 68-year-old father has type 2 diabetes with erratic glucose levels, and he now needs continuous positive airway pressure (CPAP) for sleep apnea. How does sleep apnea affect his blood glucose levels? Will CPAP therapy help with diabetes control? Also, are there any challenges in managing both conditions together, like monitoring glucose levels or giving insulin with the machine on?

Ans. Yes, sleep apnea can make it harder to control your father's glucose levels. When someone has sleep apnea, their breathing stops and starts during sleep. This lowers oxygen levels and causes the body to release stress hormones like cortisol, which can raise blood glucose levels and increase insulin resistance, making diabetes harder to manage.

Using a CPAP machine helps keep the airway open, improving oxygen flow and sleep quality. Over time, this can lower stress hormone levels, improve insulin sensitivity, and lead to better blood glucose control. Studies show that regular CPAP use can help reduce HbA1c levels and blood glucose swings.

There are no major challenges to using CPAP alongside diabetes care. It doesn't interfere with giving insulin or checking sugars. In fact, better sleep often means your father will feel more energetic and stay more consistent with his diabetes routine. So yes, CPAP can help not just his sleep, but also his overall diabetes management.

3. Doctor, my 17-year-old with type 1 diabetes (T1DM) was diagnosed with insomnia, and her sugars are spiking. Is poor sleep likely the cause of these high readings in a teen with T1DM? How does it work? What safe sleep strategies can help stabilize her blood sugar?

Ans. Yes, poor sleep can significantly affect blood glucose control in teens with T1DM. When your daughter doesn't get enough sleep or has insomnia, her body produces more stress hormones like cortisol that can increase blood glucose levels and also make the body more resistant to insulin, meaning even her usual insulin dose may not work as well.

In teenagers, hormonal shifts and irregular sleep patterns are already common. Add diabetes to the mix, and it can lead to unpredictable glucose spikes, particularly overnight or in the early morning hours. Chronic sleep deprivation may also affect her mood, appetite (leading to more carb cravings), and energy levels, making it harder to manage diabetes day-to-day.

Safe sleep strategies that may help include:

- Keeping a consistent bedtime and wake-up schedule—even on weekends.
- Limiting screen time at least 30–60 minutes before bed.
- Creating a calm bedtime routine (e.g., warm shower, reading, deep breathing).
- Avoiding excess caffeine intake, especially after early evening hours, practicing healthy eating, and encouraging physical activity to support both sleep hygiene and glucose control.
- Monitoring her blood glucose levels before bed to avoid undetected lows that can disrupt sleep.

Improving her sleep can support better insulin sensitivity and more stable blood glucose levels.

Did You Know: Extra Hour of Screen Time is Tied to 59% Higher Insomnia Risk

This is a digital age; usage of smartphones and social media has completely taken control of our lives.

Screen usage at bedtime: Screen usage during bedtime has an impact on sleep quality and, in turn, affects overall physical and mental well-being. This is because blue light emitted by smartphones disrupts the circadian rhythm, suppresses melatonin (the hormone responsible for regulating the sleep cycle), and causes sleep disturbances. Sleeplessness may result in various other health problems like obesity, hypertension, high glucose levels, and mental health issues like anxiety, depression, etc.

Screen times differ according to different activities like gaming, browsing for studies, academic, office work, and social media. Night screen time at bed is considered the worst as it affects sleep quality and induces sleep disorders like insomnia.

A study conducted by Hjetland GJ, *et.al*. 2025 reported that a one-hour increase in screen time after going to bed is associated with a 59% higher risk of having insomnia and a reduction in sleep duration of 24 minutes.

Reducing screen exposure, especially in the hour before bedtime, can significantly improve sleep quality and overall health. Adopting screen-free bedtime routines and prioritizing good sleep hygiene may help lower the risk of insomnia. Making conscious digital choices today can pave the way for better rest and well-being tomorrow.

Resources:

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Role Play

Scenario – Mr. XYZ, a 53-year-old man with diabetes, has come to visit the diabetes educator. He's been having trouble sleeping soundly, and sometimes feels a bit shaky and sweats a lot during the night.

Diabetes educator: Good morning, Mr. XYZ! How are you doing?

Mr. XYZ: Good morning. Honestly, not so great. I'm feeling tired all the time, my sleep is not sound. Also, for the last few days, I have been waking up drenched in sweat. My fasting blood glucose levels are also high, ranging between 200–270 mg/dl. I don't understand why.

Diabetes educator: Apart from fasting, how are your blood glucose levels during the day?

Mr. XYZ: I have not been checking during the day.

Diabetes educator: I advise you to check all pre- and post-meals. Especially post-dinner and midnight to 3 am values should be checked. As it is possible that your glucose levels are dropping low during midnight, and profuse sweating is a symptom of hypoglycemia. So to confirm this, it is important to check glucose levels at this time.

Mr. XYZ: If I am going low, why are my fasting glucose levels high?

Diabetes educator: When your glucose levels drop low, the body recognizes it and in response to that, it releases certain hormones that increase blood glucose levels. This elevates fasting blood glucose levels.

Mr. XYZ: Oh! What can I do about it?

Diabetes educator: First and foremost is frequent monitoring of glucose levels. Eat healthy and exercise regularly. If you are going into hypoglycemia repeatedly, speak to your doctor to understand if any changes in pharmacotherapy are required.

Mr. XYZ: Alright, but what about the sleep problem? I toss and turn a lot.

Diabetes educator: To improve sleep quality, in addition to managing glucose levels, you should try the following:

- Limit screen time: Keep your phone and TV off at least 60 minutes before bedtime.
- Relax your mind: Gentle yoga, deep breathing exercises, or meditation before sleeping can help calm your body.
- Stick to a routine: Try sleeping and waking up at the same time every day, even on weekends.
- Cut back on caffeine: Avoid coffee or carbonated beverages after 5 pm.

Mr. XYZ: Thank you. This was helpful. I'll start checking my blood glucose levels regularly and follow your tips.

Diabetes educator: Great! All the best!

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Additional information is available on request.

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*In case of any adverse events, kindly contact: pv@usv.in

For the use of registered medical practitioner, hospital or laboratory.*

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