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Journal of Diabetes Education

To Dispel Darkness Of Diabetes

DIET MANAGEMENT

EXERCISE

MEDICATION

An Official Publication of
Association of Diabetes Educators
(India)

Invokana®
canagliflozin 100mg tablets

- Control diabetes with confidence[1]
- Significant **HbA1C** reduction[1]
- **KgA1C** resolution[1]

MOTIVYST®
Canagliflozin 300mg

DOES MORE... MUCH MORE

More to Deliver

- Only **dual SGLT1 & SGLT2** inhibitor in India[2,3]
- **2.56%** HbA1C and **5.2%** weight reduction[4,5]
- **35%** Increase in **GLP1 and PYY** levels[6,7]

With CV and Renal Protection

HbA1C: Glycated Hemoglobin; CV: Cardiovascular; SGLT1: Sodium Glucose Linked Transporter 1; SGLT2: Sodium Glucose Linked Transporter 2; GLP1: Glucagon like peptide 1; PYY: Peptide YY

References: 1. Jakher M *et al.* Diabetes, metabolic syndrome and obesity:targets and therapy; **2.** Sokolov V *et al.* Dierentiating the SodiumGlucose Cotransporter 1 Inhibition Capacity of Canagliflozin vs. Dapagliflozin and Empagliflozin Using Quantitative Systems Pharmacology Modeling. CPT: pharmacometrics & systems pharmacology. 2020 Apr;9(4):222-9; **3.** Mohan V *et al.* Remogliflozin Etabonate in the Treatment of Type 2 Diabetes: Design, Development, and Place in Therapy. *Drug Design, Development and Therapy*. 2020;14:2487; **4.** Stenlöf K, *et al. Diabetes Obes Metab.* 2013;15(4):372–82; **5.** Lawrence A. Leiter *et al. Diabetes Care.* 2015;38:355–364; **6.** P. Song et al, *Expert Opinion On Therapeutic Targets*, Apr 2016; **7.** Polidori *et al. Diabetes Care.* Vol 36, Aug 2013.

Abridged Prescribing Information
For the use of a Registered Medical Practitioner or a Hospital or Laboratory
Canagliflozin tablets 100 mg / 300mg
INVOKANA®

Composition and Strength: Canagliflozin 100 mg / 300mg. Each 100 mg tablet contains 102 mg Canagliflozin hemihydrate, equivalent to 100 mg Canagliflozin. Each 300 mg tablet contains 306 mg Canagliflozin hemihydrate, equivalent to 300 mg of Canagliflozin. **Pharmaceutical form:** 100 mg - The tablet is yellow, capsule-shaped, immediate-release and film-coated, with "CFZ" on one side and "100" on the other side. 300 mg - The tablet is white, capsule-shaped, immediate-release and film- coated, with "CFZ" on one side and "300" on the other side. **Therapeutic Indications:** INVOKANA® is indicated as an adjunct to diet and exercise to improve glycemic control in adults with Type-2 Diabetic Mellitus. INVOKANA® is indicated to reduce the risk of major adverse cardiovascular events (cardiovascular death, nonfatal myocardial infarction and nonfatal stroke) in adults with type 2 diabetes mellitus and established cardiovascular disease. INVOKANA® is indicated to reduce the risk of end-stage kidney disease (ESKD), doubling of serum creatinine, cardiovascular (CV) death, and hospitalization for heart failure in adults with type2diabetes mellitus and diabetic nephropathy with albuminuria > 300 mg/day#. **Dosage and Administration:** The recommended starting dose for adult > 18 years is 100 mg or 300 mg once daily orally preferably before the first meal of the day. A starting dose of 100 mg once daily should be used in patients on loop diuretics and patients ≥ *75 years of age. (A) Dosage Recommendation for Glycemic Control and/or Reduction of a Major Adverse Cardiovascular Event (MACE) in Patients with CVD:* In patients with an eGFR 45 mL/min/1.73 m² to < 60 mL/min/1.73 m², the dose of INVOKANA® is limited to 100 mg once daily. The 300 mg dose may be considered for patients with an eGFR > 60 mL/min/1.73 m², who need tighter glycemic control and who have a low risk of adverse reactions associated with reduced intravascular volume with INVOKANA® treatment. *(B) Dosage Recommendation for Chronic Kidney Disease and Albuminuria (> 300 to ≤ 5000 mg/g):* In patients with an eGFR 30 mL/min/1.73 m² to < 90 mL/min/1.73 m², the dose of INVOKANA® is limited to 100 mg once daily. **Contraindications:** Hypersensitivity to the active substance or to any of the excipients. **Warnings and Precautions:** INVOKANA® has not been studied in pediatric patients (< 18 years), patients with type 1 diabetes and is therefore not recommended for use. INVOKANA® should not be used for the treatment of diabetic ketoacidosis or in patients with an eGFR< 45 mL/min/1.73 m² [CrCl < 45mL/min] for the purpose of glycemic lowering and/or Reduction of a Major Adverse Cardiovascular Event (MACE) in Patients with CVD. 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This serious rare infection, called necrotizing fasciitis of the perineum, is also referred to as Fournier's gangrene. **Drug Interactions:** The metabolism of INVOKANA® is primarily via glucuronide conjugation mediated by UDP glucuronosyl transferase 1A9 (UGT1A9) and 2B4. INVOKANA® neither inhibits cytochrome P450 CYP1A2, CYP2A6, CYP2C19, CYP2D6, or CYP2E1, CYP2B6, CYP2C8, CYP2C9, nor induces CYP1A2, CYP2C19, CYP2B6, CYP3A4 at higher than therapeutic concentrations. INVOKANA® is a P-glycoprotein (P-gp) substrate and inhibits P-glycoprotein mediated transport of digoxin with low potency. Please refer to full prescribing information for further details. **Pregnancy, Breast-feeding and Fertility:** There are no adequate and well controlled studies in pregnant women. INVOKANA® should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus. It is not known if INVOKANA® is excreted in human milk. A risk to the breast-fed child cannot be excluded. The effect of INVOKANA® on fertility in humans has not been studied. **Cardiovascular and renal outcomes:** INVOKANA® significantly reduced the risk of first occurrence of the primary composite endpoint of cardiovascular death, nonfatal myocardial infarction, or nonfatal stroke (HR: 0.86; 95% CI 0.75,0.97). Each MACE component contributed to the overall composite. Subjects treated with INVOKANA® had a lower risk of hospitalization for heart failure compared to those treated with placebo. In the CANVAS Program, for time to first adjudicated nephropathy event (doubling of serum creatinine, need for renal replacement therapy, and renal death), the HR was 0.53 (95% CI:0.33, 0.84) for canagliflozin (0.15 events per 100 patient-years) versus placebo (0.28 events per 100 patient-years). **Adverse reactions:** In clinical studies of INVOKANA® the most commonly reported adverse reactions during treatment (≥ 5%) were vulvovaginal candidiasis, urinary tract infection, and polyuria or pollakiuria. Other adverse reactions in clinical studies of INVOKANA® that occurred at a rate < 2% in placebo-controlled studies were adverse reactions related to reduced intravascular volume (postural dizziness, orthostatic hypotension, hypotension, dehydration, and syncope), skin rash, and urticaria. In the clinical development program, events of DKA were reported in 0.2% of patients treated with INVOKANA®. In long-term clinical studies of INVOKANA® in type 2 diabetes patients with established cardiovascular disease (CVD) or at least two risk factors for CVD, an approximately 2-fold increased risk of lower limb amputation (primarily of the toe and midfoot) has been observed in patients treated with INVOKANA®. **Overdose:** In the event of an overdose, it is reasonable to employ the usual supportive measures, e.g., remove unabsorbed material from the gastrointestinal tract, employ clinical monitoring, and institute supportive treatment as dictated by the patient's clinical status. Canagliflozin was negligibly removed during a 4-hour hemodialysis session. Canagliflozin is not expected to be dialyzable by peritoneal dialysis. **Storage:** Do not store above 30OC. Keep out of sight and reach of children.
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MOTIVYST® 100 mg significantly reduced the risk of the primary composite endpoint based on a time-to-event analysis [HR: 0.70; 95% CI: 0.59, 0.82; p<0.0001] MOTIVYST® 100 mg also significantly reduced the risk of hospitalization for heart failure [HR: 0.61; 95% CI: 0.47 to 0.80; p<0.001]. **Adverse reactions:** In clinical studies of MOTIVYST® the most commonly reported adverse reactions during treatment (≥ 5%) were vulvovaginal candidiasis, urinary tract infection, and polyuria or pollakiuria. Other adverse reactions in clinical studies of MOTIVYST® that occurred at a rate < 2% in placebo-controlled studies were adverse reactions related to reduced intravascular volume (postural dizziness, orthostatic hypotension, hypotension, dehydration, and syncope), skin rash, and urticaria. In the clinical development program, events of DKA, were reported in 0.2% of patients treated with MOTIVYST®. 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JOURNAL OF DIABETES EDUCATION

To Dispel Darkness of Diabetes

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CONTENTS

GLYCEMIC VARIABILITY AND ROLE OF NUTRITION

Meenakshi Sachdev*, M G Soundharya**

Introduction to Diabetes

Diabetes mellitus is a metabolic condition reflected due to abnormality in blood glucose levels and its epidemic clock is ticking at an alarming speed. Poor glycemic control increases the risk of complications and decreases life span when compared to healthy individuals. Complications associated with dysglycemia are classified as microvascular (affecting kidney, eyes and nerves) and macrovascular complications (heart disease and stroke). The two components of dysglycemia include chronic sustained hyperglycemia (including both fasting and chronic post-meal hyperglycemia) coupled with acute fluctuations (including glycemic peaks to nadirs).

Glycated haemoglobin (HbA1c) considered as the gold standard for evaluating blood glucose control is a risk indicator of Diabetes-related complications. According to several Diabetes associations, the treatment goal for HbA1c ranges from 6.5% to 7.5% for persons with diabetes. Lowering HbA1c levels by controlling both fasting and postprandial glucose has shown to bring down the risk level of diabetes associated complications. However, recent research has highlighted a game changing tool called *'Glycemic variability'* in assessing glucose control and preventing complications.

Defining Glycemic Variability (GV)

Glycemic variability (GV) is the *oscillations in blood glucose levels occurring throughout the day* along with hyperglycemic and hypoglycemic episodes. GV is considered as a vital tool in assessing glycemic control and may be a *better predictor of complications.*

Exactly how is Glycemic Variability Calculated?

The increasing importance and interest towards GV has provided impetus to several metrics for assessment of GV. The lack of a gold standard measurement for GV poses confusion for researchers and clinicians.

The percentage of hyperglycemia and hypoglycemic episodes used to measure the percentage of glucose values above or below the threshold is the most clinically applicable and intuitive parameter of GV. But these parameters can be difficult to use for research purposes. Hence the other parameters of GV that can be useful for research are standard deviation (SD), percentage coefficient of variation (%CV), mean amplitude of glycemic excursions (MAGE), weighted average of glucose values (MR), J index, mean of daily difference (MODD), continuous overall net glycemic action (CONGA), and fractal dimension (FD).

The simplest tool to assess GV is the SD of mean glycemia from continuous glucose monitoring data. This parameter provides both minor and major swings. Other methods based on SD can be used for more detailed assessments. Percentage CV (ration of SD to mean) provides the magnitude of values and the variations within. This allows for comparison between patients with different levels of mean blood glucose.

The most popularly used parameter, designed to evaluate major glucose fluctuations is MAGE along with mean and SD. The quality of glucose control can be measured using the J index.

MODD (The mean of daily difference) estimates interday glycemic variability. To determine GV within a fixed time window, COGNA can be used. FD (Fractal Dimension) uses the Higuchi algorithm and is an experimental method that

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describes the GV of small amplitudes and high frequency. Using GV along with other vital factors such as high blood glucose index and low blood glucose index could provide comprehensive assessment of glucose control. Calculating GV to assess the glycemic control despite some barriers such as cost, reimbursement and time consumption may provide a clear picture for clinicians and researchers.

Consequences of Glycemic Variability

The daily fluctuation in blood glucose is linked with endothelial dysfunction, inflammation and oxidative stress thereby leading to vascular damage. Both long-term and short-term GV is related to developing diabetes-related complications. Clinical studies have shown the association between GV and an increase in the mortality rate in intensive care unit (ICU), risk of diabetes complications, and post-meal beta-cell dysfunction. Strong evidence has also shown that GV increases short-term and long-term mortality and the length of stay in critically ill patients. The ICU-acquired infection rate was significantly higher for patients with increased GV. High GV can also shoot up the risk for hypoglycemia, reduce the psychological well-being of patients, quality of life, as well as increase a risk of cardiovascular disease.

Glycemic Variability and Hypoglycemia

Hypoglycemia or low blood glucose levels occur when the glycemic target is achieved with intensive diabetes management. Studies have reported that GV could predict future severe hypoglycemia better than HbA1c.

Glycemic Variability and Diabetes-related Microvascular Complications

A study found that GV could be an independent and borderline predictor of peripheral neuropathy, suggesting correlations between the nervous system and GV. In a 5-year follow-up prospective cohort study among people with diabetes, an association was found between the progression of diabetic retinopathy and higher CV (coefficient of variation) of fasting blood glucose, a measure of GV. Another study examined GV and mean blood glucose (MBG) and found that MBG was associated with diabetic retinopathy but not with nephropathy. In elderly people with diabetes, it is the magnitude of hyperglycemia (measured by mean fasting blood glucose and HbA1c) that can predict the development and progression of retinopathy.

Glycemic Variability and Cardiovascular Health

Changes in systolic and diastolic blood pressure were found to be positively associated with GV. Peaks in glucose levels may be an independent factor of carotid intima-media thickness (CIMT).

Glycemic Variability and Quality of Life

Quality of life adds along with GV, fasting blood glucose, postprandial glucose, and HbA1c to form the five glycemic pillars of effective diabetes management. Rather than the HbA1c and 24-hour average blood glucose values, a large GV has shown to be correlated with a low quality of life.

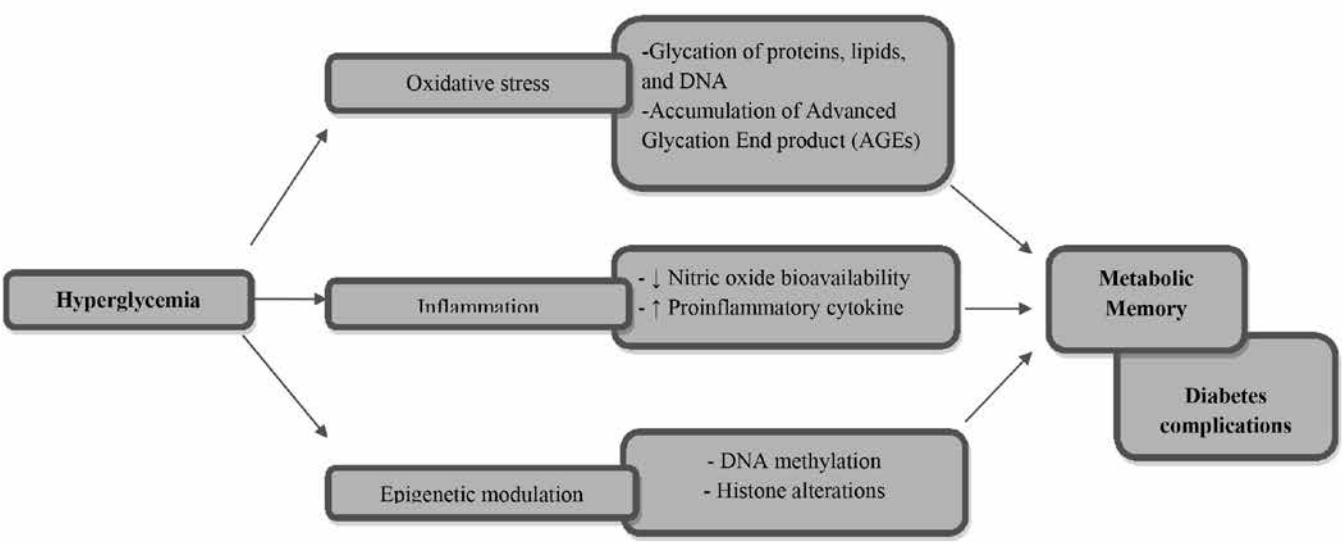
Metabolic Memory

The impact of glycemic variability on diabetes-related complications has been supported by many studies. Experimental evidence support that the risk of diabetes complications is associated with non-enzymatic glycation of proteins, chronic inflammation, epigenetic changes, and oxidative stress. This lays the foundation for metabolic memory theory.

Metabolic memory describes the beneficial *impact of intensive treatment of hyperglycemia and its effectiveness for many years,* regardless of the glucose levels in the later course of diabetes. Studies have suggested that early action for glucose homeostasis can prevent hyperglycemia-related side effects like oxidative stress and glycation of lipids and proteins.

Inflammation (which activates transcription factors and production of growth factors), oxidative stress (which enhances protein, lipid, and DNA glycation and accumulation of Advanced Glycation End Product) and epigenetic modulation (which leads to DNA methylation) sparked by hyperglycemia and other environmental factors sculpts the way to a negative metabolic memory. Therefore,

Figure 1:
Factors sculpting metabolic memory



Source: Berezin A., 2016

chronic hyperglycemia can trigger a negative metabolic memory which reduces the impact of good glycemic control and may also lead to organ damage.

Early aggressive interventions have shown to be instrumental in the management and prevention of diabetes-related complications. Early initiation of glycemic control is important in the case of metabolic memory. In cases of a *longer duration of poor control, the complications might remain* even if the hyperglycemia is normalized. Tight glycemic control was not significantly associated with all-cause and cardiovascular mortality and the risks of cardiovascular events like stroke. But it should be noted that good glycemic control is important for short-term and long-term survival after a Myocardial infarction attack in patients with diabetes.

Legacy Effect

The United Kingdom Prospective Diabetes Study (UKPDS) proposed that a positive 'glycemic legacy' supporting early treatment of hyperglycemia at the time of diagnosis prevents micro-and macrovascular complications in the long run. Trials from the UKPDS and DCCT (Diabetes Control and Complications Trial) stated that vascular complications may arise even when HbA1c is maintained under target. But the post-trial monitoring of UKPDS patients for about 10 years showed a reduction in the risk of microvascular complications with early treatment among both the insulin and metformin groups. The follow-up Epidemiology of Diabetes Interventions and Complications (EDIC) trial of DCCT among Type 1 diabetes patients also reported that patients who were on an intensive treatment had a lower incidence of microvascular complications.

Tight glycemic control for 3 to 5 years impedes cardiovascular disease but not all diabetes-related complications. Hence the theory of 'metabolic memory' suggests that a very early intensive treatment is needed to normalize metabolic control. Providing agents that turn down reactive species and glycation are also suggested to prevent long-term complications.

Reduction of Glycemic Variability (GV)

- **Lifestyle Modifications and Glycemic Variability**

  Glycemic control is the primary objective for the prevention of diabetes-related complications. The main factors that affect glycemic control are BMI, dyslipidemia, central obesity, and diabetes self-care practices

(glucose management and dietary control). The most challenging hurdle for people with diabetes is the adherence to preventive and therapeutic lifestyle modifications. In a study among 374 diabetes patients, it was found that about 88% of the patients were non-adhering to the diet recommended. The idea to be on a diet when diagnosed with conditions like diabetes can put off many people and makes it challenging for them to follow an optimal dietary pattern. Medical nutrition therapy (MNT) provides an evidence-based approach for the management of diabetes and its efficacy also has been demonstrated.

- **Role of Diet in Glycemic Variability**

  Bringing down GV can be a beneficial step towards decreasing diabetes-related complications than lowering HbA1c. Reduced GV means reduction in the occurrence of hypoglycemia and hyperglycemia. Hence, dietary intervention is a rewarding component in diabetes management.

Glycemic Variability and Macronutrients

Studies have revealed that among people with diabetes consuming an energy-restricted diet which is *low in carbohydrate* and high in unsaturated fats and lowers the CONGA, a parameter of GV.

Consuming adequate carbohydrates not exceeding more than half the total caloric intake and combined with protein (15% of total calories) is likely to be beneficial to maintain glucose stability. Consuming a low-carbohydrate diet can also aid in lowering variability markers.

A low carbohydrate diet contributes to euglycemia and lowered GV when compared to a high carbohydrate diet. A very low carbohydrate, high-fat breakfast can be sufficient in turning down post meal hyperglycemia. Foods *low in glycemic index (GI)* minimize fluctuations in blood glucose and have been acutely able to reduce GV and induce fat oxidation.

Replacing refined grains with whole grains is encouraged in diet plans for diabetes. A study found that consuming less processed whole grains for over 2 weeks improved glycemia in diabetes patients.

Role of Lente Carbohydrates

The gastrointestinal tract is manipulated to achieve a favourable glycemic response. Fibre and enzyme inhibitors are focused to alter the digestibility and slow release of carbohydrates. Choosing diets with slow-digesting 'Lente' carbohydrates portrays benefits similar to acarbose therapy. Studies have shown that administering vicious soluble fibre glucomannan and amylase-inhibiting phytochemicals from beans slows carbohydrate digestion.

GI and the second meal effect can be described as the GI of one meal influencing the postprandial glucose level of the following meal and is termed the 'second meal effect'. A study that compared a low and high GI breakfast followed by a standardized lunch reported that the low GI breakfast showed a significantly lower postprandial glucose reading.

Resistant starch (RS) resists digestion when it passes through the intestinal tract and is fermented by the colon microflora, thereby producing short-chain fatty acids. RS has been shown to reduce postprandial insulin and glucose levels, reduce fat storage, and increase satiety. There exists a bidirectional relationship between blood glucose and gut microbiota. Alterations in the gut microbiota can stimulate insulin resistance and affect glycemic control. Likewise, glycemia can influence the host response to specific microbes. These evidences support the importance of maintaining low glycemic variability. As a prebiotic, RS can boost the growth of beneficial microbes like Bifidobacteria and promote eubiosis in the gut microbiota. Studies have shown that rice containing RS helped reduce fasting insulin, postprandial glucose levels, and insulin resistance in prediabetes and diabetes patients.

Consuming a high protein diet has been linked with favourable improvements in insulin sensitivity and metabolic health, especially among obese, overweight, and insulin-resistant individuals. A high protein diet has reported a lower GV in morbidly obese women.

A diet high in fat and low in carbohydrate has shown a positive impact on glycemic control. But a study among children with Type 1 diabetes found no significant impact of fat consumption on postprandial GV.

Order of food intake starting with protein or vegetables and followed by carbohydrates is a novel behavioral strategy to reduce GV in individuals with prediabetes. A study has demonstrated that consuming pistachios with a high glycemic index meal can blunt postprandial spikes.

Conclusion

Glycemic variability (GV) is drawing the attention of health care providers as it is a physiological phenomenon that predicts the most important dimension of diabetes-'diabetes-related complications'. GV has poised to be an ideal metric to be considered over and above the standard glycemic parameters such as fasting blood glucose, postprandial blood glucose and HbA1c. Several studies have demonstrated the brighter side of GV in diabetes management. Adhering to a healthy lifestyle, utilizing pharmacological interventions in reducing GV will be an advantageous approach in diabetes management.

References for Further Reading:

1. Martinez, M., Santamarina, J., Pavesi, A., Musso, C., &Umpierrez, G. E. (2021). Glycemic variability and cardiovascular disease in patients with type 2 diabetes. BMJ open diabetes research & care, 9(1), e002032. https://doi.org/10.1136/bmjdrc-2020-002032
2. Gallwitz B. (2009). Implications of postprandial glucose and weight control in people with type 2 diabetes: understanding and implementing the International Diabetes Federation guidelines. Diabetes care, 32 Suppl 2(Suppl 2), S322–S325. https://doi.org/10.2337/dc09-S331
3. Colette, C., & Monnier, L. (2007). Acute glucose fluctuations and chronic sustained hyperglycemia as risk factors for cardiovascular diseases in patients with type 2 diabetes. Hormone and metabolic research = Hormon- und Stoffwechselforschung = Hormones et metabolisme, 39(9), 683–686. https://doi.org/10.1055/s-2007-985157
4. Czerwoniuk, D., Fendler, W., Walenciak, L., &Mlynarski, W. (2011). GlyCulator: a glycemic variability calculation tool for continuous glucose monitoring data. Journal of diabetes science and technology, 5(2), 447–451. https://doi.org/10.1177/193229681100500236
5. Satya Krishna, S. V., Kota, S. K., & Modi, K. D. (2013). Glycemic variability: Clinical implications. Indian journal of endocrinology and metabolism, 17(4), 611–619. https://doi.org/10.4103/2230-8210.113751
6. Lin, Y. H., Huang, Y. Y., Chen, H. Y., Hsieh, S. H., Sun, J. H., Chen, S. T., & Lin, C. H. (2019). Impact of Carbohydrate on Glucose Variability in Patients with Type 1 Diabetes Assessed Through Professional Continuous Glucose Monitoring: A Retrospective Study. Diabetes therapy : research, treatment and education of diabetes and related disorders, 10(6), 2289–2304. https://doi.org/10.1007/s13300-019-00707-x
7. Tettamanzi, F., Bagnardi, V., Louca, P., Nogal, A., Monti, G. S., Mambrini, S. P., Lucchetti, E., Maestrini, S., Mazza, S., Rodriguez-Mateos, A., Scacchi, M., Valdes, A. M., Invitti, C., &Menni, C. (2021). A High Protein Diet Is More Effective in Improving Insulin Resistance and Glycemic Variability Compared to a Mediterranean Diet—A Cross-Over Controlled Inpatient Dietary Study. Nutrients, 13(12), 4380. https://doi.org/10.3390/nu13124380
8. Alhatemi, G., Aldiwani, H., Alhatemi, R., Hussein, M., Mahdai, S., &Seyoum, B. (2022). Glycemic control in the critically ill: Less is more. Cleveland Clinic journal of medicine, 89(4), 191–199. https://doi.org/10.3949/ccjm.89a.20171
9. Drzewoski, J., Kasznicki, J., &Trojanowski, Z. (2009). The role of "metabolic memory" in the natural history of diabetes mellitus. PolskieArchiwumMedycynyWewnetrznej, 119(7-8), 493–500.
10. Bailey, C. J., Day, C., Campbell, I. W., & Schindler, C. (2012). Glycaemic control and cardiovascular outcome trials in type 2 diabetes. The British Journal of Diabetes & Vascular Disease, 12(4), 161–164. https://doi.org/10.1177/1474651412458958
11. Rodríguez-Gutiérrez, R., &Montori, V. M. (2016). Glycemic Control for Patients With Type 2 Diabetes Mellitus: Our Evolving Faith in the Face of Evidence. Circulation. Cardiovascular quality and outcomes, 9(5), 504–512. https://doi.org/10.1161/CIRCOUTCOMES.116.002901
12. Testa, R., Bonfigli, A. R., Prattichizzo, F., La Sala, L., De Nigris, V., &Ceriello, A. (2017). The "Metabolic Memory" Theory and the Early Treatment of Hyperglycemia in Prevention of Diabetic Complications. Nutrients, 9(5), 437. https://doi.org/10.3390/nu9050437
13. Bianchi, C., & Del Prato, S. (2011). Metabolic memory and individual treatment aims in type 2 diabetes--outcome-lessons learned from large clinical trials. The review of diabetic studies : RDS, 8(3), 432–440. https://doi.org/10.1900/RDS.2011.8.432
14. Ramachandran A, Venkataraman S, Moses A, Vijayakumar G (2015) Hyp-O-besity: Unmet Challenge in Management

of Type 2 Diabetes Mellitus and Cardiovascular Risk. J Diabetes Metab 6: 520. doi:10.4172/2155-6156.1000520

15. Jayaraman, S. (2012). Epigenetic mechanisms of metabolic memory in diabetes. Circulation research, 110(8), 1039-1041.
16. Ceriello A. (2012). The emerging challenge in diabetes: the "metabolic memory". Vascular pharmacology, 57(5-6), 133–138. https://doi.org/10.1016/j.vph.2012.05.005
17. Kakade, A., Mohanty, I.R., & Rai, S. (2018). Assessment of factors associated with poor glycemic control among patients with Type II Diabetes mellitus. Integrative Obesity and Diabetes, 4(3), 1-6. 10.15761/IOD.1000209
18. Mumu, S. J., Saleh, F., Ara, F., Afnan, F., & Ali, L. (2014). Non-adherence to life-style modification and its factors among type 2 diabetic patients. Indian journal of public health, 58(1), 40–44. https://doi.org/10.4103/0019-557X.128165
19. Forouhi, N. G., Misra, A., Mohan, V., Taylor, R., & Yancy, W. (2018). Dietary and nutritional approaches for prevention and management of type 2 diabetes. BMJ (Clinical research ed.), 361, k2234. https://doi.org/10.1136/bmj.k2234
20. Zhou, Z., Sun, B., Huang, S., Zhu, C., &Bian, M. (2020). Glycemic variability: adverse clinical outcomes and how to improve it?. Cardiovascular diabetology, 19(1), 102. https://doi.org/10.1186/s12933-020-01085-6

SELF-MONITORING OF BLOOD GLUCOSE (SMBG)

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INTRODUCTION

Self-monitoring of blood glucose (SMBG) as the name suggests, refers to measuring and recording of blood glucose values by the patient themselves (or their caregivers) at home using a blood glucose meter. The sample used in SMBG is capillary blood, collected from the fingertip. Although glucose meters for home use became available since the early 1980s, it was in 1987 when ADA launched guidelines for SMBG for the first time making an integral part of diabetes management.

IMPORTANCE OF SMBG

Good glycemic control is essential for preventing macro and microvascular complications of diabetes. Hence monitoring of glycemic control plays a crucial role in the management of diabetes and preventing its complications. SMBG is a simple, quick, and practical tool for glycemic monitoring at home. Although HbA1c, is regarded as the "gold standard" for measuring glycemic control, it does not reflect the fluctuations in blood glucose levels on a day to basis or within a single day. SMBG thus reflects glycemic variability and complements HbA1c in understanding the full picture. Moreover, SMBG gives real time data as opposed to FPG and 2-hr post prandial (PP) done in the laboratory, which are single point data and might not always correlate well with HbA1c.

Also, in certain conditions like hemoglobinopathies, malaria, anaemia and in mid to late gestation, where HbA1c is not reliable, SMBG is the tool of choice for monitoring glycemic control. In addition, SMBG acts as a motivator for patients and makes them proactive in modifying their diet and lifestyle which helps in weight management as well.

BARRIERS IN USING SMBG

Despite its importance and the numerous advantages that is has, SMBG remains a highly underutilized tool in our country. This is because there are a number of challenges or barriers, though mostly perceived, that are associated with its usage. The fear of pain and discomfort while pricking, affordability, inconvenience in carrying glucometers while traveling, the difficulty in integrating SMBG in their daily lifestyles, or the fear of undesirable readings are some of the factors that discourage patients to perform SMGB regularly. Moreover, most patients are not adequately aware regarding the importance of monitoring and the consequences of poor glycemic control. Educating patients regarding the long-term consequences of poorly controlled diabetes and the role of SMBG in managing diabetes, as well as training them on the proper technique and appropriate implementation of SMBG can help increase the acceptability and usage of this tool.

STRUCTURED SMBG AND GLUCOSE PATTERN MANAGEMENT

Instead of testing randomly, recording blood glucose levels in a structured manner helps us understand blood glucose patterns. A structured SMBG refers to tests done at predefined times of the day. To understand the impact of meals and activities on the blood glucose values, it is important to note down the type and portions of food ingested and physical activity done during the day. Understanding blood glucose patterns would help in deciding on a mutually agreeable

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action plan between the patient and the diabetes educator to maintain blood glucose targets.

TIME AND FREQUENCY OF TESTING

There is no consensus on the time and frequency of SMBG. A SMBG regimen has to be individualized based on factors like the type of diabetes, the treatment approach, the level of glycemic control, the patient's age and level of education and the availability of resources.

Below given are a few examples of commonly used regimen:

Intensive Regimen:

This is used in patients on intensive insulin therapy, in pregnancy (those on insulin), those at risk of hypoglycemia, in brittle diabetes and in acutely ill patients. Here 5-7 tests are done per day for one to three consecutive days or can be done in a staggered manner. For example, paired tests (pre and post meal) for alternating meals over one week as shown in Figure 1, Figure 2 and Figure 3.

Figure: 1

Example of Intensive Regimen: 7-point profile

	Pre-B.F	Post B.F	Pre-Lunch	Post-Lunch	Pre-Dinner	Post-Dinner	Bedtime
Mon							
Tues	X	X	X	X	X	X	X
Wed	X	X	X	X	X	X	X
Thurs	X	X	X	X	X	X	X
Fri							
Sat							
Sun							

Source: IDF, 2009

Figure: 2:

Example of Intensive Regimen: 5-point profile

	Pre-B.F	Post B.F	Pre-Lunch	Post-Lunch	Pre-Dinner	Post-Dinner	Bedtime
Mon							
Tues							
Wed	X	X		X	X	X	
Thurs	X	X		X	X	X	
Fri	X	X		X	X	X	
Sat							
Sun							

Source: IDF, 2009

Figure: 3

Staggered Regimen

	Pre-B.F	Post B.F	Pre-Lunch	Post-Lunch	Pre-Dinner	Post-Dinner	Bedtime
Mon	X	X					
Tues			X	X			
Wed					X	X	
Thurs	X	X					
Fri			X	X			
Sat					X	X	
Sun	X	X					

Source: IDF, 2009

Low intensity regimen (meal-based testing):

This uses less of number of tests and helps in understanding the effectiveness of treatment. Examples include one fasting and one paired test, per day twice a week (one weekday and one weekend) or just one paired test each day for alternate days (Figure 4). Bed-time or morning fasting test can detect fasting hyperglycemia, whereas, pre-lunch or pre dinner values can help in detecting an asymptomatic episode of hypoglycemia. (Figure 5 and Figure 6)

Figure: 4

Example of Low Intensity Regimen

	Fasting	Post B.F	Pre-L	Post L	Pre-Din	Post-Din	Bed time
Mon							
Tue							
Wed	X		X	X			
Thu							
Fri							
Sat							
Sun	X		X	X			

Source: IDF, 2009

Figure: 5

Detection of Fasting Hyperglycemia

	Fasting	Post B.F	Pre-L	Post L	Pre-Din	Post-Din	Bed time
Mon							X
Tue	X						
Wed							X
Thu	X						
Fri							X
Sat	X						
Sun							

Source: IDF, 2009

Figure: 6

Detection of Asymptomatic Hypoglycemia

	Fasting	Post B.F	Pre-L	Post L	Pre-Din	Post-Din	Bed time
Mon			X		X		
Tue							
Wed			X		X		
Thu							
Fri			X		X		
Sat							
Sun							

Source: IDF, 2009

SMBG RECOMMENDATIONS IN SPECIFIC DM TYPES AND TREATMENT APPROACHES

Type 1 and Type 2 Diabetes patients on intensive insulin regimen or on premix insulin:

SMBG is an integral part of the treatment in this group of patients and all patients must be thoroughly educated on SMBG and trained on glucose pattern management. For these patients, ideally a 7-point testing is recommended. At least 4 tests, 3 pre-meal (including fasting) and one post meal (ideally the heaviest meal) is recommended so as to economize the number of tests.

Type 2 Diabetes patients on OAD and/or lifestyle management:

In this group of patients, routine monitoring is not recommended unless the patient is at risk of hypoglycemia or is planning for pregnancy. Routine and frequent monitoring is suggested in case of new onset or uncontrolled diabetes. Apart from this, short term monitoring is suggested during acute illness or while starting corticosteroids.

Type 2 Diabetes patients on basal insulin with/ without OADs:

In this group of patients, fasting values are important for titrating insulin doses and thus, daily, or twice a week fasting tests are recommended. Correction of post-prandial glucose can be done after correcting the fasting levels.

Patients with Diabetes in Pregnancy:

SMBG plays a crucial role in pregnancy since tight glucose control is essential. Studies have shown that post prandial hyperglycemia is a predictor for macrosomia and may contribute to neonatal hypoglycemia. In pregnancy, 1 hour PP values are more likely to detect abnormal values. The IDF recommends minimum 4 tests per day, which are the fasting and one hour after each meal for this group. Women on insulin might require more intensive testing, ideally a 7-point regimen. Women managed on lifestyle modifications are advised to do one fasting and 3 hour tests at least once a week.

Elderly patients:

The glycemic targets should be relaxed in the elderly to avoid hypoglycemia. (Figure 7) Less intensive testing is suggested for this group and SMBG should focus on detecting and prevention of hypoglycemia in this group. While initiating therapy, one test per day, each day at different times is suggested. This can later be reduced to 2-3 times per week. Pre-lunch and pre dinner values are important in this group since they help in detecting an approaching or asymptomatic episode of hypoglycemia.

Figure 7:
Glycemic Targets in Elderly

Glycemic targets	Healthy Elderly	Elderly with intermediate health status	Elderly with poor health status
HbA1c (%)	<7.5	<8	<8.5
FPG/ Pre-prandial (mg/dL)	90-130	90-150	100-180
Bed-time glucose (mg/dL)	90-150	100-180	110-200

Source: ADA & AGS consensus, 2012

SMBG TESTING STEPS AND TECHNIQUE

1. Hands should be washed properly with soap and dried before testing. This is to avoid contamination of the blood sample with any food residue that might be there on the finger which can produce erroneous results.
2. Then the lancet has to be inserted in the lancing device and the device has to be prepared according to the instructions in the user manual.
3. Before using the blood glucose meter, it is very important to read the instructions in the user manual. The meter has to be prepared according to the instructions. Most meters are switched on with the insertion of the strips.
4. Before lancing, the finger should be massaged gently to increase the blood flow. The *sides of the 3rd, 4th or 5th finger* should be chosen for pricking and not the centre as the capillaries are found on the sides of the

fingers. It is very important to change the sides to avoid sore fingers. Alcohol should not be used to wipe the lancets because that would remove the silicone covering and make the lancing process painful. It is important to choose an appropriate depth for lancing. A calloused finger would require a greater depth for piercing.

5. After lancing, place the drop of blood on the strip. The finger should not be squeezed forcefully but can be gently milked if required. The results will be displayed in a few seconds.

CHOICE OF METERS AND ACCURACY STANDARDS:

There are numerous glucose meters available in the market today. However, it is very important to choose a meter wisely so as to get the results that are reliable, because therapeutic decisions would be made based on the glucose values recorded using it. It is important to choose a meter which is robust, accurate and precise as well as affordable at the same time. The meter should be compliant with the revised ISO 15197: 2013 standards, which states:

1. 95% of blood glucose results should reach the following standard:
    a. Within ± 15 mg/dL of laboratory results at concentrations < 100 mg/dL
    b. Within ± 15% of laboratory results at concentrations ≥ 100 mg/dL
2. 99% of the individual glucose results must fall within zones A and B of the Consensus Error Grid for Type 1 DM.

Control Test:

A control test is performed to ensure that the meter is working properly or that the test strips are reading the blood glucose levels accurately. This is done by using a "control solution", which is a solution with a known glucose concentration and a *p*H similar to human blood. The control test results should be within the target range for that solution, which is mentioned on the label of the test trip box. A control test is recommended if the glucose reading is suspected to be wrong or strip vials are damaged, strips are exposed to extreme weather conditions or the meter is dropped accidentally.

SUMMARY

SMBG, a simple and practical tool for glycemic monitoring at home and together with HbA1c forms an integral part of monitoring diabetes control. Despite its importance and convenience, it is not utilized adequately, mainly due to lack of awareness regarding utility and lack of guidance on its use. Education regarding the importance of glycemic control in preventing long term complications of diabetes and the role of SMBG in achieving it, as well as training on implementing a structured SMBG using the right technique is important. In addition, the monitoring skills of patients should be assessed annually using a structured assessment.

References for Further readings:

1. Rao, P.V., Makkar, B.M., Kumar, A. *et al.* 2018. RSSDI consensus on self-monitoring of blood glucose in types 1 and 2 diabetes mellitus in India. *Int J Diabetes Dev Ctries* **38,** 260–279. https://doi.org/10.1007/s13410-018-0677-3
2. Bookwalter, C.M. 2019. Unlocking the Full Potential of Self-Monitoring of Blood Glucose, *US Pharmacist*. 44(10):29-32
3. Danne, T. 2022. Self-monitoring of Blood Glucose (SMBG): From Theory to Clinical Practice. *Medscape Education Diabetes & Endocrinology*
4. Parsons, S., Luzio, S., Bain, S. *et al.* 2017. Self-monitoring of Blood Glucose in Non-Insulin Treated Type 2 Diabetes (The SMBG Study): study protocol for a randomised controlled trial. *BMC Endocr Disord* **17,** 4 . https://doi.org/10.1186/s12902-017-0154-x
5. NHS. UK. 2020. Guidance for self-monitoring of blood glucose (SMBG) www.elmmb.nhs.uk/_resources/assets/attachment/full/0/6261.pdf
6. Bedfordshire & Luton joint prescribing committee. 2019. Guidelines on self-monitoring of blood glucose (SMBG) in non-insulin treated Type 2 diabetic patients for maintaining glycaemic control.
7. International Diabetes Federation. 2009. Self-Monitoring of Blood Glucose in Non-Insulin treated Type 2 Diabetes
8. Kirkman MS, Briscoe VJ, et.al. 2012. Consensus Development Conference on Diabetes and Older Adults. Diabetes in older adults: a consensus report. J Am Geriatr Soc.60(12):2342-56. doi: 10.1111/jgs.12035. Epub 2012. PMID: 23106132; PMCID: PMC4525769.

PHYSICAL ACTIVITY & DIABETES
SAY "YES" TO FITNESS AND "NO" TO DIABETES

Harish Ranjani*, Sharma Nitika**

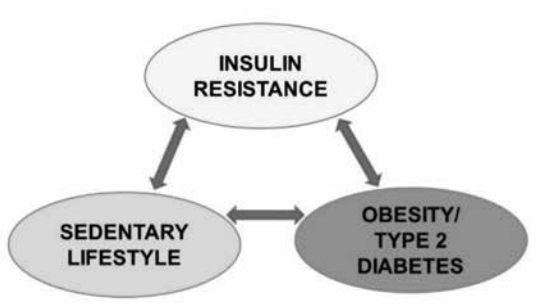
Introduction

Every year around 41 million deaths are caused due to non-communicable diseases (NCDs) and of these 85% of deaths occur in low- and middle-income countries. In 2017, it was estimated that approximately 4.7 million deaths have occurred in India due to NCDs that comprised 49% of all-cause mortality, of which 2.4% were from diabetes alone. It was estimated that 77 million individuals had diabetes in India in 2019, which is expected to rise to over 134 million by 2045. Two key factors responsible for rapid rise in the incidence of diabetes in developing countries are dietary habits and sedentary lifestyle and physical inactivity. A large percentage of people in India are inactive and less than 10% engage in recreational physical activity. There is sufficient evidence to show the role of lifestyle modifications and/or pharmacological therapies in preventing or delaying 25 - 40% of incidence diabetes in high-risk individuals.

Dietary interventions can prevent and control Type 2 diabetes mellitus (T2D) by improving energy balance, insulin resistance and blood glucose control. While physical activity can enhance insulin sensitivity and glucose tolerance and contributes to both weight loss and prevention of weight gain. This not only helps in reducing the risk of Type 2 but also helps in better management of diabetes and its co-morbidities by reducing blood pressure and optimization of lipoprotein profile (Figure 1).

Figure 1:
Interaction between insulin resistance, sedentary lifestyle, and Obesity/Type 2 diabetes

A Vicious Cycle



Source: Weber, M. B etal, 2016

Physical activity, Exercise and Sedentary Behaviour

Physical activity and exercise are two terms that are often used interchangeably but they are not the same. Physical activity is any bodily movement produced by skeletal muscles that requires energy expenditure while exercise is a subset of physical activity that is planned, structured and repetitive and has as a final or an intermediate objective: the improvement or maintenance of physical fitness. Sedentary behaviour on the other hand is defined as engaging in activities at the resting level of energy expenditure, which includes sleeping, sitting, lying down etc.

Components of exercise

The incidence of T2D is inversely proportional to the participation in physical activity. A systematic review that analysed 20 cohort studies, reported this inverse relationship with Type 2 incidence. Additionally, average risk reduction of exercise

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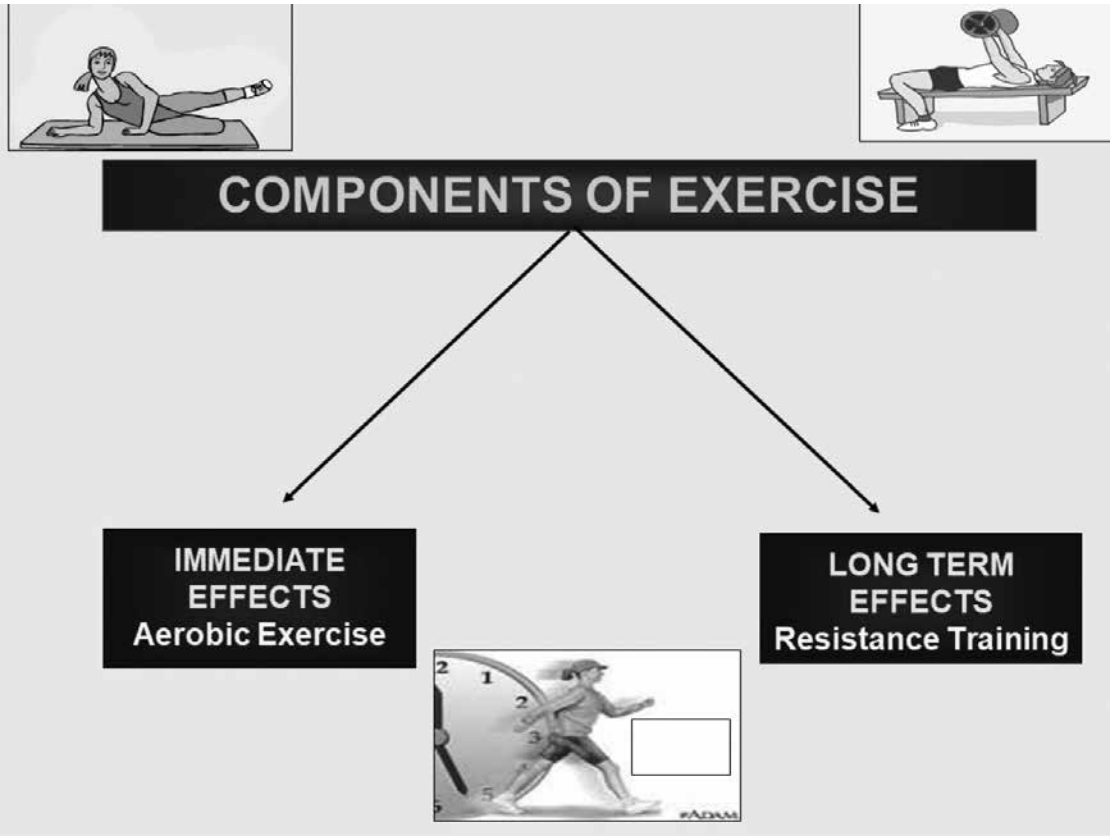
intervention was calculated to be 42% when the most active participants were compared to the least active participants. It was also found that even small changes in physical activity level leads to a great reduction in incidence of Type 2 diabetes.

Before starting a well-rounded exercise programme, it is very important to understand effect of different components of exercise on the body (Figure 2).

Figure 2:
Components of Exercise



Source: Iaccarino, G.etal, 2021

Effect of aerobic exercise - Aerobic exercise improves oxygen consumption and increases the functioning of the cardiovascular and respiratory systems. Aerobic exercises comprise of swimming, cycling, treadmill, walking, rowing, running and jumping rope. It helps improves the physiological parameters like fasting blood-glucose level and lipid profile. Additionally, it can restore the endothelial function thereby reducing arterial stiffness, a complication in Type 2.

Moderate to high volumes of aerobic activity are associated with noticeably lower cardiovascular and overall mortality risks in both Type 1 and Type 2 diabetes. Aerobic training increases cardiorespiratory fitness, decreases insulin resistance, and improves lipid levels and endothelial function in Type 1 diabetes and fasting blood glucose, triglycerides, blood pressure and insulin resistance in Type 2.

- **Effect of resistance training -** Diabetes leads to low muscular strength and functional status. Resistance exercises are exercises that have to be performed against some resistance. Examples of resistance exercises include exercises with free weights, weight machines, body weight or elastic resistance bands. Resistance training has shown to improve insulin sensitivity especially in elderly, daily

energy expenditure and favourable effect on blood pressure. It also helps improve insulin sensitivity of skeletal muscle by increasing lean muscle mass and strength and bone mineral density, which could further enhance functional status and glycemic control.

Overall, exercise enhances glucose metabolism by increasing both insulin-mediated and non–insulin mediated glucose uptake. Even low-intensity aerobic exercise lasting ≥60 minutes boosts insulin action in obese, insulin-resistant adults for at least 24 hours. The improved insulin sensitivity occurs because of increased number and activity of glucose transport proteins (especially the GLUT4 isoform), both in muscle and adipose tissue. Glycogen synthase activity results in increased glycogen synthesis and non-oxidative glucose disposal. Exercise also reduces adipose tissue mass and preserves or increases lean body mass, which increases insulin sensitivity.

Recommendations

It is recommended that adults should participate in at least 150 minutes of moderate-to-vigorous activity (MVPA) per week which can basically involve 30 mins every day or around 40-50 mins thrice weekly, along with two to three sessions of resistance training per week. Prolonged sitting should be interrupted every 30 min for blood glucose benefits, particularly in adults with Type 2.

Exercise prescription

It is a well-established fact that regular exercise has numerous health benefits. Sedentary lifestyle and physical inactivity are key modifiable risk factors for rising NCDs and hence it is very important to routinely assess and prescribe structured exercise and increased lifestyle activity to everyone. Exercise prescription is based on the three components of activity: frequency, duration, and intensity. An adult is advised to thus follow the FITT principle while following an exercise prescription. FITT stands for Frequency (45 mins), Intensity (moderate to vigorous intensity), Type (any aerobic exercise such as walking/jogging etc. and resistance training), Time (for at least 3 days and 2 days respectively) per week.

Role of exercise in diabetes prevention and management

Exercise interventions have shown to improve health and prevent and manage many chronic non-communicable diseases and stress. A randomized, controlled, translation trial (D-CLIP) of 578 overweight/obese Asian Indian adults with prediabetes, compared standard care to a culturally tailored lifestyle education curriculum based on the US Diabetes Prevention Program (DPP), plus stepwise addition of metformin (500 mg, twice daily). Three-year follow up showed that the relative reduction in diabetes incidence was 9.8 % (34.9% in the control group and 25.7% in the intervention group developed diabetes). D-CLIP-step-wise diabetes prevention program besides resulting in a 32% reduced three-year diabetes risk also showed that reduction of diabetes incidence was almost 50% in participants who had a BMI of >/=27 at baseline, thus showing weight loss is an important risk factor in diabetes prevention.

In another study (WINGS), physical activity (PA) patterns were studied in 795 pregnant women with and without GDM, and a Model of Care (WINGS-MOC) intervention was evaluated. It was found that PA levels were inadequate amongst this group of pregnant women studied. However, a low-cost, culturally appropriate MOC could bring about significant improvements in PA in women with GDM. These changes were associated with improved glycemic control and reduction in adverse neonatal outcomes.

Church TS et al conducted a randomized control trial on sedentary individuals with Type 2. The results showed that a combination of aerobic and resistance training for 9 months significantly lowered glycosylated haemoglobin levels in the

intervention group as compared to a non-exercise control group.

Barriers and Facilitators

It is imperative to recognise the challenges to making lifestyle changes especially exercise among people with diabetes. Low-level physical activity is known to contribute to poor health outcomes in people with diabetes. Reasons for physical inactivity include time constraints, self- consciousness, lack of confidence, physical inability, lack of knowledge, health limitations, lack of encouragement from family members, discomfort with the attire, expensive club and gym memberships, inability to access exercise facilities, unfavourable weather conditions and exercise not being considered "culturally acceptable". The Indian Council of Medical Research- India Diabetes (ICMR-INDIAB) study showed that physical inactivity was higher in Indian women (67.2%) than in men (54.9%). This data is supported by the D-CLIP study that revealed gender differences in the perceived barriers to exercise showing women having more socio-cultural barriers compared to their male counterparts. However, potential known facilitators included more information about physical activity and group exercise with people of the same gender or speaking the same language.

Conclusion

Evidence suggests that exercise undoubted plays an important role in fostering general wellbeing, to support healthy ageing, and to prevent and manage Non Communicable Diseases (NCDs). Therefore, there is an urgent need to take steps to encourage physical activity to stem NCDs especially the twin epidemics of diabetes and obesity.

Culturally appropriate lifestyle interventions that take into account age, gender, medical conditions and physical strength is vital to facilitate a physically active lifestyle. Effective physical activity interventions should also focus on providing social support and self-efficacy, reducing barriers to exercise and making social and built environment changes.

References for Further Reading:

1. World Health Organization. Global Action Plan for the prevention and control of noncommunicable diseases. 2013–2020. 2012.
2. World Health Organization. Noncommunicable diseases factsheet. 2019. http://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases
3. G.R. Menon, L. Singh, P. Sharma, et al. National burden estimates of healthy life lost in India, 2017: An analysis using direct mortality data and indirect disability data Lancet Global Health, 7 (12) (2019), pp. e1675-e1684
4. IDF DIABETES ATLAS Ninth edition 2019. (n.d.). Diabetesatlas.Org. Retrieved June 16, 2022, from https://www.diabetesatlas.org/upload/resources/material/20200302_133351_IDFATLAS9e-final-web.pdf
5. Anjana RM, Pradeepa R, Deepa M, et al. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: phase I results of the Indian Council of Medical Research-INdia DIABetes (ICMR-INDIAB) study. Diabetologia. 2011;54(12):3022-3027.
6. Anjana, R.M., Pradeepa, R., Das, A.K. et al. Physical activity and inactivity patterns in India – results from the ICMR-INDIAB study (Phase-1) [ICMR-INDIAB-5]. Int J Behav Nutr Phys Act 11, 26 (2014). https://doi.org/10.1186/1479-5868-11-26
7. Ramachandran A, Snehalatha C, Mary S, Mukesh B, Bhaskar AD, Vijay V; Indian Diabetes Prevention Programme (IDPP). The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1). Diabetologia 2006;49:289–297
8. Weber, M. B., Ranjani, H., Staimez, L. R., Anjana, R. M., Ali, M. K., Narayan, K. M. and Mohan, V., The stepwise approach to diabetes prevention: results from the D-CLIP randomized controlled trial. Diabetes Care, 2016, 39, 1760–1767
9. Way KL, Hackett DA, Baker MK, Johnson NA. The Effect of Regular Exercise on Insulin Sensitivity in Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis. Diabetes Metab J. 2016;40(4):253-271. doi:10.4093/dmj.2016.40.4.253
10. Piercy KL, Troiano RP. Physical Activity Guidelines for Americans From the US Department of Health and Human Services. Circ Cardiovasc Qual Outcomes. 2018;11(11):e005263.
11. Physical activity. (n.d.). Who.int. Retrieved July 7, 2022, from https://www.who.int/news-room/fact-sheets/detail/physical-activity

12. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. Public Health Rep. 1985 Mar-Apr;100(2):126-31.

13. Warburton DE, Charlesworth S, Ivey A, Nettlefold L, Bredin SS. A systematic review of the evidence for Canada's Physical Activity Guidelines for Adults. Int J Behav Nutr Phys Act. 2010;7:39.

14. Anjana, R. M. et al., Diabetes in Asian Indians – how much is preventable? Ten-year follow-up of the Chennai Urban Rural Epidemiology Study (CURES-142). Diabetes Res. Clin. Pract., 2015, 109, 253–261

15. Iaccarino, G., Franco, D., Sorriento, D. *et al.* Modulation of Insulin Sensitivity by Exercise Training: Implications for Cardiovascular Prevention. *J. of Cardiovasc. Trans. Res.* **14,** 256–270 (2021).

16. Sluik D, Buijsse B, Muckelbauer R, et al. Physical activity and mortality in individuals with diabetes mellitus: a prospective study and meta-analysis. Arch Intern Med 2012;172:1285–1295

17. Sheri R. Colberg, Ronald J. Sigal, Jane E. Yardley, Michael C. Riddell, David W. Dunstan, Paddy C. Dempsey, Edward S. Horton, Kristin Castorino, Deborah F. Tate; Physical Activity/ Exercise and Diabetes: A Position Statement of the American Diabetes Association. Diabetes Care 1 November 2016; 39 (11): 2065–2079.

18. Jiahao L, Jiajin L, Yifan L. Effects of resistance training on insulin sensitivity in the elderly: A meta-analysis of randomized controlled trials. J Exerc Sci Fit. 2021;19(4):241-251.

19. Poehlman ET, Dvorak RV, DeNino WF, Brochu M, Ades PA (2000) Effects of resistance training and endurance training on insulin sensitivity in nonobese, young women: a controlled randomized trial. J Clin Endocrinol Metab 85: 2463–2468.

20. Wang B, Luo X, Li RR, Li YN, Zhao YC. Effect of resistance exercise on insulin sensitivity of skeletal muscle. World J Meta-Anal 2021; 9(2): 101-107.

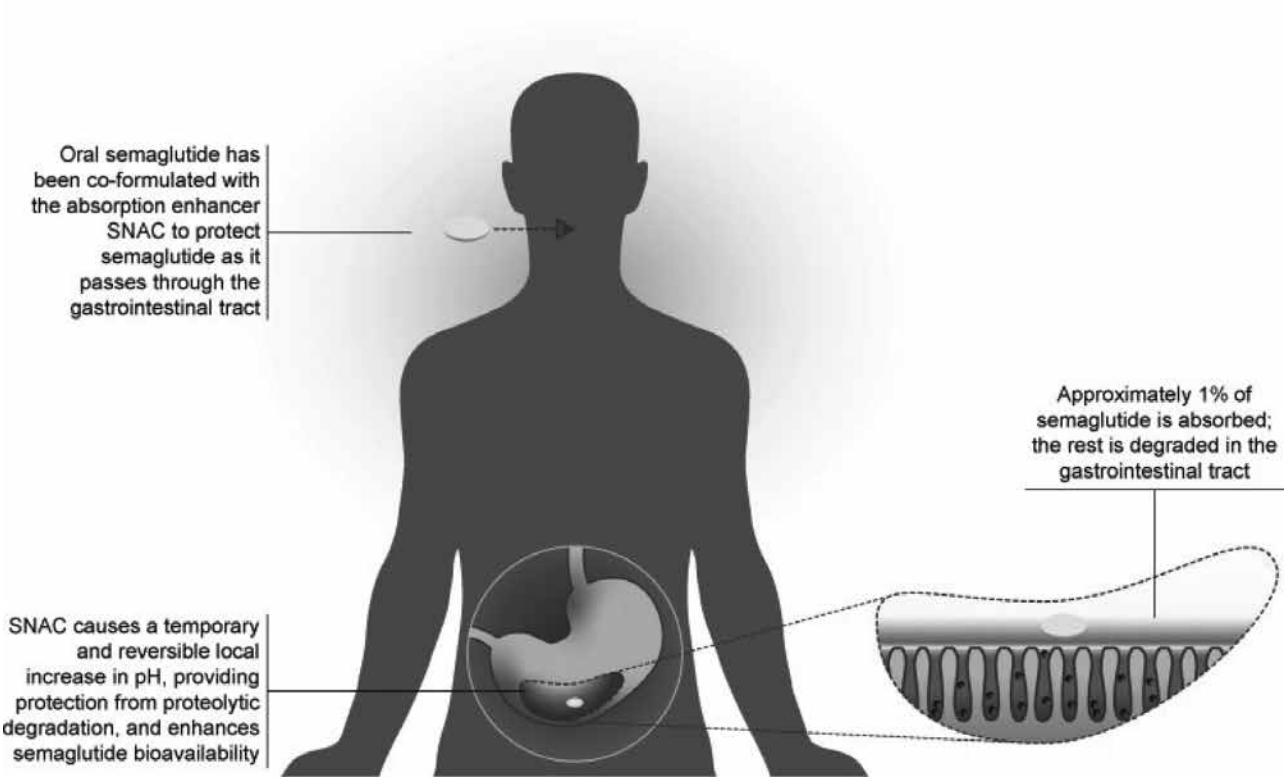
QUESTION AND ANSWERS

Q. 1 Is weight reducation better with Oral Semaglutide or Injectable Semaglutide?

Ans. Use of oral SGLT2i therapy has been greater than that for injectable GLP-1RAs suggesting a preference for oral therapies. The unmet need for an oral GLP-1RA has led to the development of oral semaglutide. This is a coformulation of semaglutide (the subcutaneous formulation of which was more effective than other GLP-1RAs including exenatide , dulaglutide and liraglutide with the absorption enhancer sodium N(8[2hydroxybenzoyl] amino) caprylate (SNAC) in a tablet. SNAC protects semaglutide from degradation in the stomach and helps to increase its absorption (Figure 1), thus overcoming two of the main barriers to the oral delivery of a peptide-based molecule. Once administered, either orally or by injection, semaglutide has a half-life of approximately one week. However, because of greater variation in drug exposure between individuals with oral versus subcutaneous administration , oral semaglutide is dosed once daily rather than the once-weekly schedule used with subcutaneous semaglutide. Oral semaglutide may be an attractive option for use by primary-care providers (PCPs) and their patients, potentially encouraging earlier and more adherent use of GLP-1RAs to enhance glycaemic control.

Figure 1:

Mechanism of Absorption for Oral Semaglutide



Source: Seidu, S. & Mellbin, et al, 2020.

A wide range of studies in recent years have shown the dramatic health benefits of weight loss in people with Type 2 diabetes and obesity. In people with obesity, bariatric (weight-loss) surgery has been shown to promote remission of both Type 2 diabetes and prediabetes: meaning that blood glucose levels are normal without taking any glucose-lowering medications. But bariatric surgery is not the only potentially effective option — measures like low-calorie diets and meal replacements have also been shown to promote weight loss and diabetes remission. At the same time, there are new drug treatments for obesity — namely semaglutide and liraglutide that are unprecedented in their effectiveness in producing weight loss and are expected to be used much more widely once their manufacturers increase the supply to catch up with the enormous demand for these drugs.

But improved glucose control and diabetes remission are not the only potential benefits from weight loss in people with Type 2 diabetes and obesity. Studies have shown that weight loss may improve symptoms of diabetic peripheral neuropathy. Additionally, remission of diabetes following bariatric surgery is linked to a lower risk for cancer.

Q.2 Which equation will you recommend for eGFR and why?

Ans. Glomerular filtration rate (GFR) is the best overall index of kidney function. Normal GFR varies according to age, sex, and body size and declines with age. The National Kidney Foundation recommends using the CKD-EPI Creatinine Equation (2021) to estimate GFR.

Selecting an Equation:

The Modification of Diet in Renal Disease (MDRD) Study Equation and the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) Equation are the most widely used IDMS traceable equations for estimating GFR in patients age 18 and over. For estimating GFR from serum creatinine in patients under age 18 (including infants, toddlers, children, and teens), the Bedside Schwartz Equation should be used.

Both the MDRD Study and CKD-EPI Equations include variables for age, gender, and race, which may allow providers to observe that CKD is present despite a serum creatinine concentration that appears to fall within or just above the normal reference interval. Direct comparison of the MDRD and CKD-EPI Equations to other equations such as Cockcroft-Gault and to creatinine clearance measured from 24-hour urine collections has demonstrated this superiority.

Note that creatinine clearance should be considered for assessing kidney function when the patient's basal creatinine production is very abnormal. This may be the case with patients of extreme body size or muscle mass (e.g., obese, severely malnourished, amputees, paraplegics, or other muscle-wasting diseases) or with unusual dietary intake (Eg. vegetarian, creatine supplements).

The MDRD Equation:

The following is the IDMS-traceable MDRD Study Equation (for creatinine methods calibrated to an IDMS reference method):

GFR (mL/min/1.73 m2) = 175 × (Scr)-1.154 × (Age)-0.203 × (0.742 if female) × (1.212 if African American):

The equation does not require weight or height variables because the results are reported normalized to 1.73 m^2 body surface area, which is an accepted average adult surface area.

The equation has been validated extensively in Caucasian and African American populations between the ages of 18 and 70* yrs with impaired kidney function (eGFR < 60 mL/min/1.73 m2) and has shown good performance for patients with all common causes of kidney disease.2

**The equation has not been validated in patients older than 70, but an MDRD-derived eGFR may still be a useful tool for providers caring for patients older than 70 years old.*

The CKD-EPI Equation

The CKD-EPI equation uses a 2-slope "spline" to model the relationship between GFR and serum creatinine, age, sex, and race. The equation is given in the following table for creatinine in mg/dL (see Appendix for creatinine in μmol/L). The equation can be expressed in a single equation (see table legend) or as a series of equations for different race, sex, and creatinine conditions (see table rows).

Table 1: CKD EPI Equation for Estimating GFR Expressed for Specified Race, Sex and Serum Creatinine in mg/dL

Adult	Female	≤ 0.7	GFR = 144 × (Scr/0.7)-0.329 × (0.993)Age
Adult	Female	> 0.7	GFR = 144 × (Scr/0.7)-1.209 × (0.993)Age
Adult	Male	≤ 0.9	GFR = 141 × (Scr/0.9)-0.411 × (0.993)Age
Adult	Male	> 0.9	GFR = 141 × (Scr/0.9)-1.209 × (0.993)Age

Source: Ann Intern Med; 2009

CKD-EPI equation expressed as a single equation:

GFR = 141 × min (Scr /κ, 1)α × max(Scr /κ, 1)-1.209 × 0.993Age × 1.018 [if female]

where:

Scr is serum creatinine in mg/dL,
κ is 0.7 for females and 0.9 for males
α is -0.329 for females and -0.411 for males
min indicates the minimum of Scr /κ or 1 and
max indicates the maximum of Scr /κ or 1.

A laboratory that reports eGFR numeric values > 60 mL/min/1.73 M^2 should use the CKD-EPI Equation, because the CKD-EPI Equation is more accurate for values > 60 mL/min/1.73 m^2 than is the MDRD Study Equation. However, the influence of imprecision of creatinine assays on the uncertainty of an eGFR value is greater at higher eGFR values and should be considered when determining the highest eGFR value to report.

RECIPES

CUCUMBER SOYA PANCAKES

Ingredients

50 gm thickly grated cucumber

50 gm soya flour

50 gm semolina (rava)

½ finely chopped coriander

1 tbsp low fat curd

Salt to taste

1 tsp oil for cooking

Procedure:

1. To make soya flour (you can buy soy granules or chunks and finely churn it into a coarse mixture in a blender). To make cucumber soya pancakes – combine all the ingredients like, finely chopped cucumber, soya flour, semolina (rava) along with 1 cup of water in a bowl and mix well to make a batter of dropping consistency.
2. Heat a non-stick tava (griddle) and grease it lightly using ¼ tsp of oil.
3. Pour a ladleful of the batter on it and spread in a circular motion to make a pancake in a round shape.
4. Cook, using ¼ tsp of oil, till it is golden brown in colour from both sides.
5. Repeat the same procedure for rest of the pancakes.
6. Serve hot with nutritious green chutney

Provides 3 servings

Nutritional information per serving:

Energy (kcal)	Carbohydrate (gm)	Protein (gm)	Fats (gms)	Vitamin C (mg)	Glycemic Index
272	35	21	4	2	Medium

Special features:

- A healthy recipe for breakfast
- A protein rich recipe

SPINACH RAITA

Ingredients

100 gm chopped spinach (you can blend it in a mixture)

200 gm fresh low fat curd, finely whisked

Salt to taste

½ tsp finely chopped green chillies

Freshly ground black pepper to taste

Procedure:

1. To make, spinach raita, take a deep bowl and put curd into it
2. Beat the curd well with the help of a whisk. We are whisking the curd becauses it enhances the texture and mouthfeel of the raita
3. Add salt for taste to the mixture
4. Add chopped green chillies for spice. Add chillies according to your spice tolerance level.
5. Add about a pinch of ground black pepper to enhance the taste of the raita
6. Finally add the chopped blended spinach into the curd
7. Mix all the ingredients well together and refrigerate the raita for a period of 30 minutes
8. Serve the palak raita chilled with a plate of hot parathas.

Provides 2 servings

Nutritional information per serving:

Energy (kcal)	Carbohydrate (gm)	Protein (gm)	Fat (gm)	Calcium (mg)	Glycemic Index
72	4	4	4	220	Low

Special Features:

- A healthy recipe for mid-morning snack
- A calcium rich recipe

JJ

HOW KNOWLEDGEABLE ARE YOU?

1. Taking nutrient supplements can lead to unintended consequences by
   A. Fostering a reliance on supplements for key nutrients and components instead of whole foods
   B. Cause Diarrhea
   C. Providing too much fiber, leading to constipation
   D. Reduces cost of food

2. Which one of these is a nutrient blocker?
   A. Voglibose
   B. Metformin
   C. Pioglitazone
   D. Dapagliflozin

3. Which of the following is not a symptom of hypoglycemia?
   A. Shakiness
   B. Palpitation
   C. Sweating
   D. Increased Alertness

4. Which of the following regimens offers the best blood glucose control for persons with Type 1 diabetes?
   A. A single anti-diabetes drug
   B. Once daily insulin injection
   C. A combination of oral anti-diabetic medications
   D. Three or four injections per day of different types of insulin

5. Which of the following nutrients is rich in short and medium chain fatty acid?
   A. Milk
   B. Peanut oil
   C. Sunflower oil
   D. Almond oil

6. Bulk of undigested matter is made up of
   A. Glycogen
   B. Cellulose
   C. Galactose
   D. Stearic acid

7. All of the following statements about omega-3 fatty acids are true except:
   A. They help to maintain healthy triglyceride and high-density lipoprotein
   B. They have significantly contributed to the obesity epidemic
   C. They are necessary for healthy infant growth and development
   D. They play an important role in the production of hormones that govern numerous metabolic and biological processes

8. What is the side effect of statins?
   A. Muscle Pain
   B. High uric acid
   C. Arthritis
   D. None of the above

9. Hyperglycemic hyperosmolar non ketotic state (HONK) and is characterized by :
   A. A very high blood glucose (>700 mg/dl)
   B. A very high concentration of sodium in blood
   C. Absence of ketoacidosis
   D. All the above

10. Dressings that are safe to be used for a diabetic ulcer
   A. Saline and ointment
   B. Betadine solution
   C. Alcoholic cleansing agent
   D. Eusol Solution

ANSWERS:

1. A	2. A	3. D	4. D	5. A	6. B	7. B	8. A
9. D	10. A						

MYTHS AND FACTS

1. **Myth: Fad diets will help me lose weight and keep it off**

   Fact: Fad diets are not the best way to lose weight and keep it off. These diets often promise quick weight loss solutions if you strictly reduce what you eat or avoid some types of foods. Some of these diets may help you lose weight at first. But these diets are hard to follow. Most people quickly get tired of them and regain any lost weight. Fad diets may be unhealthy. They may not provide all of the nutrients your body needs.

   Research suggests that safe weight loss involves combining a reduced caloric diet with physical activity for losing weight. Making healthy food choices, eating small portions and building exercise into your daily life is the optimum strategy. Combining, these habits may be a healthy way to lose weight and keep it off. These habits may lower your chances of developing heart disease, high blood pressure and risk for diabetes.

2. **Myth: Fast foods are always an unhealthy choice. You should not eat them while dieting.**

   Fact: Many fast foods are unhealthy and many affect weight gain. However, if you do eat fast food, choose menu options with care. Both at home and away, choose healthy foods that are nutrient rich, low in calories and small in portion size. To choose healthy, low- calorie options, check the labels or nutrition facts.

   Try these tips:

   - Avoid "value" combo meals, which tend to have more calories than you need in one meal
   - Choose fresh fruits items or non-fat or low fat yogurt for dessert
   - Limit your use of toppings that are high in fat and calories, such as cheese, regular mayonnaise and salad dressings.
   - Pick steamed or baked items over fried ones
   - Sip on water or fat-free milk instead of soda

3. **Myth: Grain products such as bread, pasta and rice are fattening. I should avoid them when trying to lose weight**

   Fact: A grain product is any food made from wheat, rice, oats, cornmeal, barley or another cereal grain. Grains are divided into two subgroups, whole grains and refined grains. Whole grain contains the entire grain kernel – the bran, germ and endosperm. Examples include brown rice and whole-wheat bread, cereal and pasta. Refined grains are milled, a process that removes bran and germ. This is done to give grains a finer texture and improve their shelf life, but it also removes dietary fiber, iron and many B vitamins. People who eat whole grains as part of a healthy diet may lower their chances of developing chronic diseases. To lose weight, reduce the number of calories you consume in and increase the amount of physical activity you do each day. Create and follow a healthy eating plan that replaces less healthy options with a mix of fruits, veggies, whole grains, protein foods and low-fat dairy.

4. **Myth: Lifting weights is not a good way to lose weight because it will make me "bulk up"**

   Fact: Lifting weights or doing activities like pushups and crunches on a regular basis can help you build strong muscles, which can help you burn more calories. To strengthen muscles, you can lift weights, use large rubber bands (resistance bands), do push-ups or sit ups or do household tasks that make you lift or dig. Doing strengthening, activities 2 or 3 days a week will not "bulk you up". Only intense strength training can build up large muscles.

   Tip: Guidelines for physical activity recommend that adults should do activities at least two times a week to strengthen muscles. The guidelines also suggest that adults should get 150 to 300 minutes of moderately intense or vigorous aerobic activity each week—like brisk walking or biking.

5. **Myth: Physical activity only counts if I can do it for long periods of time.**

   Fact: You do not need to be active for long periods to achieve your 150 to 300 minutes of activity each week. Experts advise doing aerobic activity for periods of 10 minutes or longer at a time. You can spread these sessions out over the week. Plan to do at least 10 minutes of physical activity three times a day on 5 or more days a week. This will help you meet the 150-minute goal. While at work, take a brief walking break. Use the stairs. Get off the bus one stop early. Whether for a short or long period, bursts of activity may add up to the total amount of physical activity you require each week.

JJ

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Graduates in Nutrition, Nursing, Pharmacy, Occupational and Physiotherapy.

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How will I get the course material?

All course material is available online on our website.

What are the course fees?

The standard fees for the course are INR 10,000/- only.

Where can I get more information about this course?

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- To secure highest marks in the current year.

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Association of Diabetes Educators (ADE)

(For eligibility criteria: Check Website www.diabeteseducatorsindia.com)

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E-mail id: ……

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Work Experience: ……

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Currently employed at: ……

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Certificates attached*: ……

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Please pay the membership fees through NEFT / RTGS to the following bank account.

The details are as folllows:

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Account type: Savings Account

Name of the bank: Bank of India

Account number: 006610110001734

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Dr. Chandalia's HDDT aims to enhance the quality of Diabetes education in India by creating a world-class research and education environment and to build up a platform of networking and knowledge sharing within diabetologists and/or diabetes educators.

Challenges in Diabetes Education 2022 places special emphasis on supporting educational initiatives that have the potential to improve and significantly revolutionize diabetes care, enhance self-management and/or support patients with Type 1 or Type 2 Diabetes Mellitus. The educator should describe an individual or group case history and identify the problem in diabetes education. Furthermore, s/he should describe the plan of education to resolve the issue, partly or totally. The issue described may be related to patient perceptions, knowledge, behaviors and implementation of advice given. S/He should describe her struggle in resolving the issue including her triumphs and failures, the methodologies used and ethical, socio-economic and behavioral aspects of the case.

General Rules and Regulations regarding the eligibility Criteria for the Award

- The applicant of the Award should be a citizen of India and member of Association of Diabetes Educators.
- The case discussion should be on the subject of Diabetes Education.

The best case chosen by a group of referees will be awarded "Challenges in Diabetes Education Award- 2022" - which will carry a cash prize of Rs 10,000. The awardee will get the opportunity to present the case in the annual meeting of Association of Diabetes Educators and publish it in the journal of Diabetes Education.

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***OAD:** Oral Antidiabetic Drugs
Reference: Standl E, et al. Diabetes Care. 2016; 39(Suppl 2): S172-S179.

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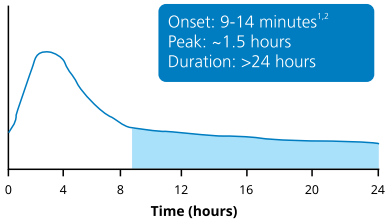

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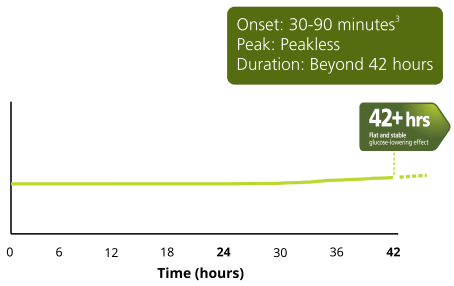

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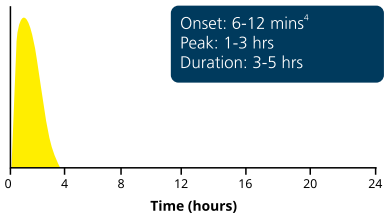

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