

Journal of Diabetes Education

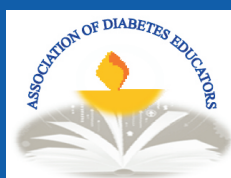
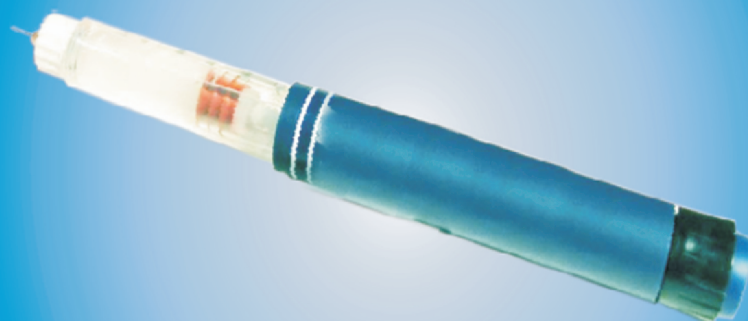
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Tresiba® aP1

Generic Name: Insulin degludec (Monocomponent, biosynthetic r-DNA origin) **Brand Name:** Tresiba® Penfill®, Tresiba® FlexTouch®, 100 units/mL solution for subcutaneous injection. **Presentation:** Tresiba® Penfill®, Tresiba® FlexTouch®, 1 ml solution contains 100 units insulin degludec (equivalent to 3.66 mg insulin degludec). One cartridge/pre-filled pen contains 300 units of insulin degludec in 3 mL solution. **Indication:** Treatment of diabetes mellitus in adults, adolescents and children from the age of 1 year. **Dosing and administration:** Tresiba® is a basal insulin for once-daily subcutaneous administration at any time of the day, preferably at the same time every day. Initiation: Patients with type 2 diabetes mellitus. The recommended daily starting dose is 10 units followed by individual dosage adjustments. Patients with type 1 diabetes mellitus. Tresiba® is to be used once daily with mealtime insulin and requires subsequent individual dosage adjustments. Tresiba® is for subcutaneous use only. Tresiba® must not be administered intravenously as it may result in severe hypoglycaemia. Tresiba® must not be administered intramuscularly as it may change the absorption. Tresiba® must not be used in insulin infusion pumps. Patients should be instructed to always use a new needle. Injection sites should always be rotated within the same region in order to reduce the risk of lipodystrophy and cutaneous amyloidosis. **Children:** Tresiba® can be used in adolescents and children from the age of 1 year. **Pregnancy and lactation:** The treatment with Tresiba® may be considered during pregnancy, if clinically needed. Careful monitoring of glucose control is recommended and the insulin dose adjusted on an individual basis. There is no clinical experience with Tresiba® during breast-feeding. **Elderly:** Tresiba® can be used in elderly. **Special populations and conditions:** Tresiba® can be used in renal and hepatic impaired patients. **Contraindications:** Hypersensitivity to the active substance or to any of the excipients. **Special warnings and precautions:** Hypoglycaemia - Omission of a meal or unplanned strenuous physical exercise may lead to hypoglycaemia. Hypoglycaemia may occur if the insulin dose is too high in relation to the insulin requirement. Hypoglycaemia - Administration of rapid-acting insulin is recommended in situations with severe hypoglycaemia. Inadequate dosing and/or discontinuation of treatment in patients requiring insulin may lead to hyperglycaemia and potentially to diabetic ketoacidosis. Skin and subcutaneous tissue disorders - Patients must be instructed to perform continuous rotation of the injection site to reduce the risk of developing lipodystrophy and cutaneous amyloidosis. There is a potential risk of delayed insulin absorption and worsened glycaemic control following insulin injections at sites with these reactions. A sudden change in the injection site to an unaffected area has been reported to result in hypoglycaemia. **Undesirable effect:** With insulin preparations, allergic reactions may occur. Lipodystrophy and cutaneous amyloidosis may occur at the injection site and delay local insulin absorption. Continuous rotation of the injection site may help to reduce or prevent these reactions. Injection site reactions occurred in patients treated with Tresiba®. These reactions are usually mild and transitory and they normally disappear during continued treatment. **Shelf-life:** The shelf life of the drug product is 30 months when stored at 2°C-8°C. **Storage:** Before first use: Store in a refrigerator (2°C – 8°C). Keep away from the freezing element. Do not freeze. Protect from light. After first opening or carried as a spare: product may be stored for a maximum of 8 weeks. Do not store above 30°C. Tresiba® FlexTouch® can be stored in a refrigerator (2°C – 8°C). Tresiba® Penfill® should not be refrigerated. Protect from light. **Disclaimer:** The abbreviated package insert is updated from the CSCO approved package insert dated 09 Aug 2024 for Tresiba® Penfill® and Tresiba® FlexTouch®. Tresiba®, Penfill®, NovoFine® and NovoWells® are trademarks owned by Novo Nordisk A/S, Denmark. Imported by Novo Nordisk India Private Limited, Bangalore. Note: For detailed information on this product, please refer to full package insert. * The full prescribing information can be obtained at no cost from Novo Nordisk. For full prescribing information please contact +91-080-40303200 or write to us at inAgree@novonordisk.com or reach us at Novo Nordisk India Private Limited, Nit Tower-2, Floor 1 & 2, Embassy Mangaya Business Park, Nagavara Village, Kasaba Hobli, Bangalore-560 045, India.

Fiasp® aP1

Generic Name: Insulin aspart **Presentation:** Fiasp® FlexTouch® 3 mL, Fiasp® Penfill® 3 mL, Fiasp® Vial 10 mL. All presentations contain 100 units/mL insulin aspart. **Indications:** Treatment of diabetes mellitus in adults, adolescents and children from the age of 1 year. There is no clinical experience with the use of Fiasp® in children below the age of 1 year. **Dosage and administration:** Fiasp® is a mealtime insulin for subcutaneous administration up to 20 minutes before the start of the meal, with the option to administer up to 20 minutes after starting the meal. Dosing with Fiasp® is individual and determined in accordance with the needs of the patient. Fiasp® given by subcutaneous injection should be used in combination with intermediate-acting or long-acting insulin given at least once a day. In a basal-bolus treatment regimen approximately 50% of this requirement may be provided by Fiasp® and the remaining by intermediate-acting or long-acting insulin. The individual total daily insulin requirement in adults, adolescents and children may vary and is usually between 0.5 and 1 unit/kg/day. Blood glucose monitoring and insulin dose adjustment are recommended to achieve optimal glycaemic control. **Initiation:** The recommended starting dose in insulin naïve patients with type 1 diabetes is approximately 50% of the total daily insulin dose and should be divided between the meals based on the site and composition of the meals. As a general rule, 0.2 to 0.4 units of insulin per kilogram of body weight can be used to calculate the initial total daily insulin dose in insulin naïve patients with type 1 diabetes. In type 2 diabetes mellitus patients, the suggested initial dose is 4 units at one or more meals. The number of injections and subsequent target and the size and composition of the meals. Dose adjustment may be considered daily based on self-measured plasma glucose (SMPG) on the previous day(s) according to Table 1. * Pre-breakfast dose should be adjusted according to the pre-lunch SMPG the previous day. * Pre-lunch dose should be adjusted according to the pre-dinner SMPG the previous day. * Pre-dinner dose should be adjusted according to the bedtime SMPG the previous day. No dose adjustment of faster aspart is required if the patient's SMPG falls in the range of 71-106 mg/dL. Alternatively, if the patient's SMPG falls below 71 mg/dL, reduce the dose of faster aspart by 1 unit and if the patient's SMPG falls above 106 mg/dL, increase the dose of faster aspart by 1 unit. **Paediatric population:** Fiasp® can be used in adolescents and children from the age of 1 year. **Pregnancy and lactation:** Fiasp® can be used in pregnancy. No restrictions on use during breast-feeding. Elderly (≥65 years old): The safety and efficacy of Fiasp® have been established in elderly patients aged 65 to 75 years. The therapeutic experience in patients >75 years of age is limited. Special populations and conditions: Renal impairment may reduce the patient's insulin requirements. In patients with renal impairment, glucose monitoring should be intensified and the dose adjusted on an individual basis. Hepatic impairment may reduce the patient's insulin requirements. In patients with hepatic impairment, glucose monitoring should be intensified and the dose adjusted on an individual basis. **Contraindications:** Hypersensitivity to the active substance or to any of the excipients. **Special warnings and precautions:** Hypoglycaemia: Omission of a meal or unplanned, strenuous physical exercise may lead to hypoglycaemia. Hypoglycaemia may occur if the insulin dose is too high in relation to the insulin requirement. Inadequate dosing or discontinuation of treatment may lead to hyperglycaemia and diabetic ketoacidosis. Patients must be instructed to perform continuous rotation of the injection site to reduce the risk of developing lipodystrophy and cutaneous amyloidosis. There is a potential risk of delayed insulin absorption and worsened glycaemic control following insulin injections at sites with these reactions. A sudden change in the injection site to an unaffected area has been reported to result in hypoglycaemia. Transferring a patient to another type or brand of insulin should be done under strict medical supervision. **Undesirable effect:** Lipodystrophy and cutaneous amyloidosis may occur at the injection site and delay local insulin absorption. Continuous rotation of the injection site within the given injection area may help to reduce or prevent these reactions. **Shelf-life:** The shelf life of the drug product is 30 months when stored at 2-8°C. The expiry date of the drug product is indicated on the carton label. **Special precautions for storage:** Store in a refrigerator (2°C-8°C). Do not freeze. Keep away from the freezing element. **Disclaimer:** The abbreviated package insert is updated from the CSCO approved package insert for Fiasp® FlexTouch® dated 22 Mar 2024, Fiasp® Penfill® dated 27 May 2024 and Fiasp® Vial 10 mL dated 10 Jun 2024. Fiasp® and Apis bull logo is a registered trademark owned by Novo Nordisk A/S and registered in Denmark. Imported by Novo Nordisk India Private Limited, Bangalore. * For full prescribing information please contact +91-080-40303200 or write to us at inAgree@novonordisk.com or reach us at Novo Nordisk India Private Limited, Nit Tower-2, Floor 1 & 2, Embassy Mangaya Business Park, Nagavara Village, Kasaba Hobli, Bangalore-560045, India. Note: For detailed information on this product, please refer to full package insert.*

#Compared to Insulin Aspart (NovoRapid®)

Reference: 1. Kala E et al. *Advanced Therapy*. 2018;18(3):529-36. 2. Tresiba® pack insert as per CSCO approved (CNA-110121/24/2024-e-offer dated 22 Jul 2024). 3. Fiasp® CSCO approved pack insert version dated 10 Jun 2024. 4. Hesse T et al. *Clin Pharmacokinet*. 2017;56:551-559.

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GLYCEMIC INDEX: EFFECT OF PHYSICAL STATE AND PROCESSING OF FOODS

Shilpa Varma*

ABSTRACT

The glycemic index (GI) and glycemic load (GL) are widely used tools to classify carbohydrate-containing foods based on their impact on postprandial blood glucose levels. Beyond carbohydrate composition, the physical state and degree of processing of foods significantly influence glycemic responses. This article explores the scientific basis of GI and GL, examines how structural and processing factors modify glycemic responses and emphasizes the importance of adhering to holistic nutritional guidelines. Evidence suggests that minimally processed foods with intact structures generally produce lower glycemic responses, while refined and highly processed foods elevate glycemic impact. Practical dietary principles integrating GI/GL with overall nutritional quality are essential for metabolic health and chronic disease prevention.

INTRODUCTION

Carbohydrate-containing foods vary widely in their ability to raise blood glucose levels after ingestion. The concept of the glycemic index (GI), introduced in 1981, was developed to classify foods based on their postprandial glycemic response relative to a reference food such as glucose (1).

Over time, glycemic load (GL) emerged as a complementary metric incorporating both the quality (GI) and quantity of carbohydrates consumed (2).

Understanding the role of food structure and processing is critical, as these factors often determine glycemic response more than carbohydrate type alone.

CONCEPT OF GLYCEMIC INDEX

The glycemic index is defined as the incremental area under the blood glucose response curve (AUC) after consumption of 50 g of available carbohydrate from a test food, expressed as a percentage of the response to a standard reference (glucose or white bread) (1).

Foods are classified as:

- Low GI: ≤ 55
- Medium GI: 56-69
- High GI: ≥ 70

High-GI foods are rapidly digested and absorbed, leading to sharp increases in blood glucose and insulin levels, whereas low-GI foods produce slower, more sustained responses (3). Physiologically, rapid glucose absorption stimulates insulin secretion, which may subsequently lead to reactive hypoglycaemia and increased hunger (4).

GLYCEMIC LOAD: A MORE PRACTICAL METRIC

While GI reflects carbohydrate quality, it does not account for portion size. Glycemic load (GL) provides a more realistic measure:

$$GL = \frac{GI \times \text{carbohydrate (g per serving)}}{100}$$

Thus, a food with a high GI but low carbohydrate content (e.g., watermelon) may have a low GL and minimal overall glycemic impact (5).

GL is therefore more relevant in clinical and dietary planning contexts.

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PHYSIOLOGICAL AND CLINICAL IMPORTANCE OF GI AND GL

Numerous studies have linked high-GI and high-GL diets to adverse metabolic outcomes, including:

- Increased risk of Type 2 diabetes
- Cardiovascular disease
- Obesity
- Fatty Liver (MASLD)

A large prospective study demonstrated that diets with a high glycemic index were associated with increased cardiovascular events and mortality (6). Conversely, low-GI/GL diets improve glycemic control, lipid profiles, and insulin sensitivity (7). However, GI alone should not be interpreted in isolation, as some low-GI foods may still be energy-dense or nutritionally poor.

DETERMINANTS OF GLYCEMIC INDEX

The glycemic response to food is influenced by multiple factors:

Macronutrient Composition

- Fat and protein slow gastric emptying - lower GI
- Fiber reduces glucose absorption

Type of Starch

- Amylose - slower digestion (lower GI)
- Amylopectin - rapid digestion (higher GI)

Organic Acids

- Acetic acid (vinegar), citric acid slow gastric emptying

Food Matrix and Structure

- Intact cell walls - reduced enzymatic access
- Disrupted structure - faster digestion

EFFECT OF PHYSICAL STATE OF FOODS ON GLYCEMIC INDEX

The physical form of food is one of the most critical determinants of glycemic response.

Whole vs Ground vs Pureed

Whole grains have lower glycemic index (GI) because they are digested more slowly. Ground

flour has higher GI due to faster digestion and absorption of carbohydrates. Pureed foods have the highest GI as processing breaks down the food structure, allowing glucose to enter the bloodstream more rapidly.

Mechanical disruption increases surface area, enhancing enzymatic digestion and glucose absorption.

Particle Size

Larger food particles are digested more slowly, leading to a gradual rise in blood glucose levels. Fine particles such as refined flour are digested quickly, causing rapid glucose release and a faster increase in blood sugar levels.

Liquid vs Solid

- Liquids empty faster from the stomach
- Result: higher glycemic response compared to solid equivalents

Gelatinization and Retrogradation

- Cooking (especially moist heat) gelatinizes starch - increases GI
- Cooling forms resistant starch - reduces GI

EFFECT OF FOOD PROCESSING ON GLYCEMIC INDEX

Processing significantly alters the structural integrity of carbohydrates, thereby modifying glycemic response.

Refining and Milling

- Removal of bran and germ reduces fiber
- Leads to rapid digestion and high GI
- Example: white rice vs brown rice

Extrusion Processing

- Used in breakfast cereals and snack foods
- High temperature + pressure - gelatinized starch
- Produces very high GI foods

Cooking Methods

- Boiling vs baking vs frying affects GI differently
- Overcooking increases starch digestibility

Fermentation

- Produces organic acids - lowers GI
- Example: sourdough bread

Instantization

Instant oats have the highest glycemic index (GI) because they are more processed and digested quickly. Rolled oats have a moderate GI due to less processing. Steel-cut oats have the lowest GI as they are digested more slowly.

Sugar and Additives

- Added sugars increase glycemic response
- However, fat addition may lower GI but not necessarily improve health quality

More processed foods tend to have higher GI values due to partial pre-digestion of carbohydrates (Table 1) (5).

Table 1**Examples of Processing and GI Changes (5)**

Food Type	Processing Level	Glycemic Impact
Whole apple	Intact	Low GI
Apple juice	Extracted liquid	Higher GI
Whole grain wheat	Intact kernel	Low GI
Whole wheat flour	Milled	Moderate GI
White bread	Refined + baked	High GI
Steel-cut oats	Minimal processing	Low GI
Instant oats	Highly processed	High GI

These examples highlight how structural integrity determines metabolic response more than carbohydrate content alone.

IMPORTANCE OF ADHERING TO NUTRITIONAL GUIDELINES

While GI and GL provide useful insights, dietary recommendations should be grounded in broader nutritional principles:

Focus on Whole Foods

- Minimally processed foods naturally have lower GI and higher nutrient density.

Balanced Meals

- Combining carbohydrates with protein, fat, and fiber reduces glycemic excursions.

Portion Control

- GL emphasizes that quantity matters as much as quality.

Dietary Patterns

- Mediterranean and plant-based diets inherently promote low-GI eating patterns.
- Avoid over-reliance on GI alone
- Some foods with low GI (e.g., chocolate) may still be unhealthy due to fat or sugar content.

LIMITATIONS OF GLYCEMIC INDEX

Despite its utility, GI has several limitations:

- Inter-individual variability in glycemic response
- Influence of mixed meals
- Standardized testing conditions do not reflect real-life eating
- Does not account for nutrient density

Therefore, GI should be used as one component of dietary planning, not the sole determinant.

PRACTICAL DIETARY PRINCIPLES FOR GLYCEMIC CONTROL

Based on current evidence, the following principles are recommended:

Prefer Low-GI Carbohydrates

- Whole grains, legumes, vegetables

Minimize Ultra-Processed Foods

- Refined cereals, sugary snacks, packaged foods

Maintain Food Structure

- Choose intact grains over flours
- Prefer whole fruit over juices

Optimize Cooking Methods

- Avoid overcooking
- Incorporate cooling (resistant starch formation)

Combine Macronutrients

- Add protein and healthy fats to carbohydrate meals

Emphasize Dietary Patterns

- Focus on overall diet quality rather than isolated GI values

CONCLUSION

The glycemic index and glycemic load are valuable tools for understanding carbohydrate quality and quantity, respectively. However, the physical state and degree of processing of foods are equally, if not more, influential determinants of glycemic response.

Minimally processed foods with intact structures generally produce lower glycemic responses and confer metabolic advantages. In contrast, refined and highly processed foods elevate glycemic impact and are associated with increased risk of chronic diseases.

A prudent dietary approach integrates GI and GL within the context of whole-food-based,

balanced, and minimally processed dietary patterns, ensuring optimal metabolic health and disease prevention.

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ROLE OF BEHAVIORAL MEDICINE IN DIABETES MANAGEMENT

Shobha Udipi*

INTRODUCTION

About 77 million persons in India live with Type 2 Diabetes Mellitus and another 25 million with prediabetes (1). Management of diabetes mellitus aims at controlling blood glucose and preventing development of micro- and macro-vascular complications, including ketoacidosis, neuropathy, retinopathy, nephropathy, stroke, foot wounds, gangrene, cardiovascular disease (e.g., myocardial infarction, heart failure, atherosclerosis, aneurysm), and eventually death. Diabetic foot ulceration is a very important cause of hospitalization and often amputation, particularly in those persons whose diabetes is not well managed.

Diabetes mellitus places a burden on persons living with diabetes. Given different personality types, socio-economic circumstances, support systems and levels of understanding, the burden may be perceived as light to heavy to very heavy. Once an individual is diagnosed with diabetes, the most critical requirement from the patient is to be vigilant and be careful about his/her carbohydrate intake (in terms of amount and type/quality), the timing and dosage of the oral hypoglycemic agents in case of Type 2 diabetes and insulin, particularly when self-administered by persons with Type 1 or Type 2 diabetes. Additionally, persons with diabetes need to undertake exercise daily and also learn to manage stress, besides monitoring blood sugar routinely. Essentially these demands or responsibilities can overwhelm the person and some may feel anxious, others may even feel frustration when adoption of appropriate behavior, does not yield the expected/desired results (2,3). For the individual, the challenge is to adapt/modify their behaviors and lifestyle lifelong. Added to this challenge is that the

treatment/management protocols could well change for effective management. Non-compliance often occurs because the routines may interfere with lifestyle or is associated with difficulties in adaptation due to professional and/or occupational demands and the person may not like to adopt the recommended change (3,5).

DISTRESS AND/OR DEPRESSION: A FACTOR IN DIABETES CONTROL

What is required is to provide motivation because some persons may be experiencing depression. It has been reported that persons with diabetes may be twice as likely to experience depression in contrast to those who do not have diabetes mellitus. Depression can be an important factor to consider, as it can lead to poor diabetes control and an increased risk of complications (2,7). Anxiety about blood sugar, possibilities of complications and the ups and downs related to daily management can be causes of worry, disrupt self-care and disturb blood sugar levels (7,9). Poor control of blood sugar can also be distressing and control by caregivers, added to which constant directions may be a cause of distress.

ROLE OF EDUCATOR

Essentially the role of the diabetes educator is to promote behavior patterns (health behavior) to enable the person to maintain good health, restore health in case of illness/ailments/problems and to promote health improvement (6). The educator should be capable or should develop the capacity to impact the individual's health positively.

Areas that the educator needs to focus on are self-monitoring of blood glucose levels, eating healthily, undertaking regular physical activity,

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taking medications as prescribed, timely visits to the doctor as recommended, as well as encouraging the person to undergo eye and foot examinations regularly and periodically; in a way that the person can cope with and manage his or her condition (6).

Deviations from recommended or desirable behaviors occur when there is limited or no adherence to recommended practices such as exercise or carbohydrate counting; or when persons consume foods that are not desirable, for example, refined grains and sweets (3).

APPROACHES THAT CAN BE ADOPTED

Some approaches have been reported in the literature, although these may possibly be different for children, adolescents and adults (1,4).

Antecedent based approaches

An individual's behavior can be influenced by antecedent events, such as adding prompts or modifying the context in which the behavior occurs, thereby increasing the likelihood of performing the desired response (1). The reminders could be either written or vocal. With the popularity of cell-phones, prompts may be sent on cell-phones to encourage the person to adopt the desired set of behaviors. This has been suggested particularly for persons with Type 1 diabetes (4). The traffic light concept has been used, wherein foods can be categorized as per their energy density. The colors green and yellow have been used to depict foods having lower energy density whereas red depicts higher energy density. In one study, youth who were advised to eat more foods from the green category lost more weight as compared to those who were recommended to consume less foods from red category, suggesting that positive recommendations possibly encourage adoption of appropriate behavior (4).

Consequence-Based Approaches

These generally have used positive reinforcement that has also been referred to contingency management (1). In a very early study in the 1980's, parents were advised to praise

their children who have T1DM, for adoption of appropriate behavior in terms of glucose monitoring. The adherence to the regimen recommended was appreciable and at follow up the glycosylated hemoglobin levels had reduced as well after a period of 5 weeks (1,4).

Gamification

Use of games has been explored and with easy accessibility and availability of cell-phone technology, it has been considered as a means to disseminate the education interventions to encourage adoption of appropriate behaviors (4,8). Some investigators have used educational video games aimed at improving the diabetes. Also, software has been used in a 4- week trial, for diabetes management, for example to predict one's blood glucose levels based on three earlier readings for blood glucose. The software allowed for graphic display of blood glucose, insulin doses and carbohydrate intake in order to help the players to estimate their blood glucose more effectively. Those who were participating in the game group, transmitted their glucose values more, hyperglycemia was much less and HbA1c improved. Also, the knowledge about diabetes management increased (4).

Similarly, video games (Exergames) have been developed to track and enhance physical activity. Depending on the physical activity engaged in, in-game virtual rewards were given. During gym classes, children who were relatively inactive, increased their physical activity and weight loss was better among overweight or obese adolescents. In older adults, the exergames were observed to improve balance (4). One example of a commercially successful exergame is "Pokémon Go".

Thus, when working with the person with T2DM, T1DM and the caregiver(s), behavioral health must be factored in by integrating mental health (2,7). This will necessarily start with screening for mental health eg., depression and anxiety as part of standard diabetes care provided. Also, emotional well-being must be seriously considered.

Psychological interventions or psychotherapy like cognitive behavioral therapy has been used with good results in helping persons with diabetes to manage their emotional distress (7). Cognitive behavioral therapy can be effectively used to identify a person who has negative thought patterns related to their health challenge and conditions and help them to develop better health-related coping strategies. Issues addressed include diabetes distress, burnout and anxiety to help them adhere closely to the management plan developed (7,9).

DIABETES SELF-MANAGEMENT EDUCATION (DSME)

The purpose of these programs is to impart knowledge and skills to help the person manage this disorder effectively (6). DSME needs to include blood sugar monitoring, nutrition, exercise and psychological support. Through DSME, practical guidance is to be given and improve the ability for overcoming barriers to self-care. It must be reiterated here that all the psychological interventions must be done by a trained counsellor who is trained in psychology and counselling. Self-management could be improved by helping a person to overcome and resolve any ambivalence or doubts that he or she could have about behavior change (6,7).

SUPPORT GROUPS AND PEER NETWORKS

Forming support groups (for example the Juvenile Diabetes Foundation or others) provide a platform and forum for individuals to share experiences, learn from others and get emotional support (4,7). It can help reduce the feeling of being alone or isolated, a feeling of being different from the rest of their 'healthy' peers. It can help improve knowledge, decision making, skill in self-management and address the behavior to meet their needs and goals, such that together the health-care team and the person with diabetes move confidently towards favourable clinical outcomes and health status, without incurring excessive and unnecessary costs. It can also do so for family and caregivers.

Hence, for diabetes educators it is worthwhile to remember that the approach should not be strictly educational, nor should it be such that the educator issues directives. In the UK, it has been seen that counselling should occupy an important place in the intervention rather than only emphasizing didactic education (3). It is important to pay attention to personal barriers and the context including the different environments and challenges faced viz at home, school, work place, peers, colleagues, teachers, employers and confidantes. Lack of such a support could constrain behavior change.

Other factors that are important considerations are how well the patient comprehends or understands and interprets the information, guidelines and recommendations. Besides this, how meaningful and personally relevant the person finds the advice given based on the person's resources and health beliefs; will decide how often the counsellor-educator must provide feedback and support as well as evolve the most suitable way to gain access to the person whether through text or WhatsApp message or a phone call (3).

In summary, the educator's efforts must address empowerment, mindfulness, autonomy or self-determination and self-confidence ultimately promoting habitual favourable or appropriate behavior.

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WEIGHT LOSS MAINTENANCE THERAPY

LONG-TERM APPROACH TO SUSTAINABLE HEALTH

Sonal Jani*

INTRODUCTION

Weight loss maintenance therapy is a structured, long-term, multidisciplinary approach designed to prevent weight regain after initial weight loss. It represents the stage of treatment where weight loss may slow or stabilize as the focus shifts toward maintaining healthy habits and building confidence in everyday life.

Long-term weight management is often challenging because obesity is considered a chronic and relapsing condition. Research shows that lifestyle modifications such as healthy eating, regular physical activity, proper sleep, stress management and behavioral changes can help individuals lose weight successfully. However, sustaining these changes over the long term remains a significant challenge for many people. After weight loss, the body commonly adapts by reducing energy expenditure, making it harder to maintain the reduced weight. In addition, maintaining dietary discipline, exercise routines and lifestyle habits can become mentally exhausting over time. Easy access to high-calorie foods and increasingly sedentary lifestyles further increase the risk of weight regain (1).

Despite these challenges, weight loss maintenance therapy plays a crucial role in long-term health and wellbeing. A successful weight management journey can be divided into two important phases:

- Weight Loss
- Weight Loss Maintenance

This article explores the importance of weight loss maintenance therapy and the key strategies that can help individuals sustain healthy lifestyle changes over time.

KEY STRATEGIES FOR WEIGHT LOSS MAINTENANCE

Successful weight maintenance involves a combination of:

- Healthy diet
- Regular exercise
- Adequate sleep
- Stress management
- Behavioral modification and lifestyle changes

These strategies work together to support physical health, emotional wellbeing and long-term sustainability.

ROLE OF DIET IN WEIGHT LOSS MAINTENANCE

Long term obesity management depends on the integration of nutritional, behavioral, psychological and lifestyle components rather than on any single dietary strategy (2). Weight loss maintenance is about supporting appetite, energy levels and overall wellbeing in a realistic and sustainable way. A simple, balanced diet tailored to individual needs is easier to continue over the long term.

BEHAVIOURAL MODIFICATIONS RELATED TO EATING HABITS

Mindful Eating

Mindful eating involves paying close attention to hunger and fullness cues, emotions and eating behaviors (3). It encourages awareness of:

- *What you are eating* – noticing colors, smells, textures and flavors
- *Why you are eating* – distinguishing true hunger from emotional triggers
- *How you are eating* – eating slowly and without distractions

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- ***When you are eating*** – recognizing physical hunger and stopping when satisfied

Studies suggest that mindful eating may improve long-term eating behaviors and help maintain healthy blood glucose levels and body weight (4).

Self-Monitoring

Tracking food intake, body weight, physical activity and habits can improve accountability and help individuals make informed lifestyle decisions. Self-monitoring also helps identify patterns that may contribute to weight regain (5).

Consistency Throughout the Week

Healthy eating habits should continue on weekends and holidays. Consistency plays an important role in long-term success.

Managing Slip-Ups

Occasional overeating or setbacks are normal. Instead of feeling guilty, individuals should return to healthy habits with a positive mindset.

Adequate Hydration

Regular water intake may promote fullness and support metabolism, both of which are beneficial for weight maintenance.

Ongoing Support

Web-based tools, mobile applications, support groups and health coaches can provide continuous guidance and accountability, reducing the likelihood of returning to unhealthy habits.

ROLE OF EXERCISE IN WEIGHT LOSS MAINTENANCE

Regular physical activity is one of the most important components of long-term weight management. Exercise helps balance calories consumed and calories burned, supports metabolism and improves overall health. Researchers suggest that exercising for at least 30 minutes daily may help maintain weight loss especially when combined with healthy eating habits (6), (7).

Exercise also offers additional benefits, including:

- Improved cardiovascular health

- Better muscle strength and endurance
- Increased energy levels
- Enhanced mood and mental wellbeing
- Improved sleep quality

Studies show that regular exercise intervention improve sleep quality and support weight loss (8).

Behavioural Modifications Related to Exercise

Reframe Exercise as Self-Care

Exercise should not only be viewed as a way to burn calories. Instead, focus on how movement improves energy, strength, confidence and emotional wellbeing (9).

Choose Enjoyable Activities

Long-term adherence improves when individuals participate in activities they genuinely enjoy such as walking in a group, dancing, swimming, cycling, yoga and strength training (9).

Group Activities and Support

Joining fitness groups or community programs may increase motivation, accountability and consistency.

Yoga and Physical Activity

Research suggests that yoga and physical exercise may help reduce cravings, improve emotional regulation and support stress management (10).

SLEEP AND WEIGHT LOSS MAINTENANCE

Adequate sleep plays a vital role in maintaining body weight and overall health. Research indicates that sleeping less than seven hours can impact overall health including risk of weight regain (11).

Poor sleep affects hormones involved in appetite regulation, including:

- **Leptin** – the hormone that promotes fullness
- **Ghrelin** – the hormone that stimulates hunger

Sleep deprivation may increase hunger, cravings, fatigue and reduced motivation for exercise and healthy eating (12).

Short sleep duration or poor sleep quality was associated with weight regain after weight loss in adults with obesity (13).

Healthy Sleep Habits

Do's

- Maintain a consistent sleep schedule
- Exercise regularly during the day
- Keep the bedroom cool, quiet and relaxing
- Take a warm shower before bedtime

Don'ts

- Avoid late-night heavy meals
- Limit caffeine and alcohol intake
- Avoid screen time before sleep
- Avoid excessive daytime naps

IMPACT OF STRESS ON WEIGHT REGAIN

Stress significantly affects eating behavior and weight maintenance. Stress can trigger emotional eating, impulsive eating, binge eating and cravings for highly palatable foods rich in sugar and fat (14). Emotional eating is also likely to report more unhealthy dietary habits, higher levels of depression, anxiety, stress and more disordered eating (15).

Stress Management Techniques

Mindfulness

Mindfulness practices help individuals observe thoughts and emotions without reacting impulsively. Studies show that mindfulness improves emotional regulation, stress resilience and self-control (16), (17).

Introspection

Self-reflection through journaling, meditation or quiet reflection can improve self-awareness and emotional understanding (18).

Self-Care

Prioritizing enjoyable and meaningful activities supports emotional wellbeing and reduces stress.

Healthy Lifestyle Habits

Healthy eating, adequate sleep, regular exercise

and social support all contribute to improved mood and stress reduction.

Yoga and Breathing Exercises

Yoga, breathing exercises and relaxation techniques help calm the nervous system and reduce stress hormone levels. Research also suggests that yoga improves emotional regulation and brain function related to stress management. (10)

KEY PRINCIPLES FOR LONG-TERM WEIGHT LOSS MAINTENANCE SUCCESS (9)

Shift from Restriction to Balance

Instead of focusing on strict dieting, emphasize balanced nutrition and sustainable eating habits.

Focus on Progress, Not Perfection

Weight maintenance is a long-term journey. Occasional setbacks are normal and should be approached with patience and self-compassion.

Celebrate Non-Scale Victories

Improved energy, better sleep, increased strength, improved mood and enhanced confidence are all important signs of progress.

Build Sustainable Habits

Consistency matters more than temporary perfection. Small daily habits create lasting results over time.

Seek Support and Accountability

Support from healthcare professionals, fitness communities, friends, family or health coaches can improve motivation and long-term adherence.

CONCLUSION

Weight loss maintenance is not about perfection or extreme restriction. It is about building realistic, sustainable habits that support physical and emotional wellbeing over time.

Long-term success requires a balanced approach involving healthy eating, regular exercise, adequate sleep, stress management and positive behavioral changes. While maintaining weight loss can be challenging, consistent lifestyle

habits, self-awareness, patience and ongoing support can make the journey more manageable and rewarding.

Ultimately, weight loss maintenance therapy is not simply about keeping weight off; it is about creating a healthier, more balanced and fulfilling life.

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QUESTIONS AND ANSWERS

Q. Why walking after meals is important in diabetes management?

- A.** Walking after meals is a simple and effective way to improve blood sugar control, particularly for people with diabetes or prediabetes. Research shows that even a short walk of 5–10 minutes after eating can help reduce post-meal blood sugar spikes, while walking for about 15 minutes after meals may provide even greater benefits. The effect is most noticeable within 60–90 minutes after eating, when blood glucose levels rise the most. Walking helps muscles use glucose more efficiently, improves insulin sensitivity, and reduces the negative effects of prolonged sitting. Regular post-meal walking may also help lower HbA1c levels and reduce the risk of long-term complications such as heart disease and stroke. Even light walking after meals is more beneficial than remaining seated and can be easily included in a daily routine for better diabetes management.

Q. How do GLP-1 receptor agonists help in both glucose control and weight management?

- A.** GLP-1 receptor agonists are a class of medications used in the management of Type 2 diabetes that help improve blood

glucose control while also supporting weight reduction. These medicines mimic the action of the natural hormone glucagon-like peptide-1 (GLP-1), which is released from the intestine after meals.

They help lower blood glucose levels through several mechanisms: stimulating insulin secretion in a glucose-dependent manner; reducing glucagon secretion, which decreases glucose production by the liver; slowing gastric emptying which leads to a slower rise in post-meal blood glucose, thus improving postprandial glucose control.

GLP-1 receptor agonists also promote weight loss by increasing fullness (satiety) and reducing appetite, which may often lead to lower calorie intake. Because of these effects, they are increasingly used in people with Type 2 diabetes who may also have overweight or obesity.

In addition to glucose and weight benefits, some GLP-1 receptor agonists have shown cardiovascular benefits, including reduction in the risk of major cardiovascular events in selected high-risk individuals. Common side effects may include nausea, vomiting, diarrhea, bloating or reduced appetite, especially during the initial phase of treatment.

RECIPES

MAKHANA BHEL CHAAT



INGREDIENTS

60 g roasted Makhana

20 g roasted Chana

100 g chopped Onion, Tomato, Cucumber and Capsicum

1 tbsp Pomegranate seeds

50 g skim Paneer

Green mint chutney according to taste

A pinch of black pepper and chaat masala

Fresh Coriander leaves

Lemon juice

METHOD

1. Mix all ingredients just before serving.
2. Toss with chutneys and lemon.

PROVIDES 3 SERVINGS

Nutritional Information Per Serving

Energy (kcal)	Protein (grams)	Carbohydrate (grams)	Fat (grams)	GI
200	10	35	2	Low

SPECIAL FEATURES

- Protein rich
- Low Glycemic Index

GREEK YOGURT VEGETABLE SALAD



INGREDIENTS

100 g skim Greek yogurt (or hung curd)
 50 g Cucumber, finely chopped
 30 g Tomato, chopped
 20 g Carrot, grated
 20 g Capsicum, finely chopped
 Few fresh Coriander, chopped
 Few fresh Mint leaves, chopped
 A pinch of Black pepper
 A pinch of Salt
 Lemon juice

METHOD

1. Combine the chopped cucumber, tomato, carrot and capsicum in a bowl.

2. Add the skim Greek yogurt and mix gently.
3. Season with black pepper and a small amount of salt.
4. Add lemon juice and mix well.
5. Garnish with fresh coriander and mint leaves.
6. Serve chilled.

PROVIDES 2 SERVINGS

Nutritional Information Per Serving

Energy (kcal)	Protein (grams)	Carbohydrate (grams)	Fat (grams)	GI
90	11	15	1	Low

SPECIAL FEATURES

- High Protein
- Low Glycemic Index

HOW KNOWLEDGEABLE ARE YOU?

1. Which recently introduced diabetes therapy is administered only once weekly?
 - A. Regular insulin
 - B. Insulin icodec
 - C. NPH insulin
 - D. Insulin lispro
2. Which technology allows automatic adjustment of insulin delivery based on glucose readings?
 - A. Smartwatch
 - B. Nebulizer
 - C. Closed-loop insulin delivery system
 - D. ECG monitor
3. Which class of medications has shown benefits in reducing hospitalization for heart failure in people with diabetes?
 - A. Sulfonylureas
 - B. Thiazolidinediones
 - C. Alpha-glucosidase inhibitors
 - D. SGLT2 inhibitors
4. Which diabetes medication class is widely used for both glycemic control and obesity management?
 - A. Antihistamines
 - B. GLP-1 receptor agonists
 - C. Proton pump inhibitors
 - D. Calcium supplements
5. Time in Range (TIR) has become an important parameter in diabetes care because it reflects:
 - A. Kidney function
 - B. Liver enzyme levels
 - C. Daily glucose control within target range
 - D. Bone mineral density
6. Which liver condition is increasingly recognized in people with obesity and Type 2 diabetes?
 - A. Hepatitis B
 - B. MASLD (Metabolic dysfunction-associated steatotic liver disease)
 - C. Liver abscess
 - D. Wilson's disease
7. Which wearable device continuously tracks glucose levels through a sensor placed under the skin?
 - A. Pulse oximeter
 - B. Continuous Glucose Monitor (CGM)
 - C. Spirometer
 - D. Holter monitor
8. Which of the following is a major advantage of telemedicine in diabetes care?
 - A. Eliminates the need for glucose monitoring
 - B. Allows remote consultation and follow-up
 - C. Permanently cures diabetes
 - D. Replaces insulin therapy completely
9. Which oral drug class is now also approved in many countries for chronic kidney disease management, even in some non-diabetic patients?
 - A. SGLT2 inhibitors
 - B. Sulfonylureas
 - C. DPP-4 inhibitors
 - D. Biguanides only
10. Which hormone works opposite to insulin by increasing blood glucose levels?
 - A. Glucagon
 - B. Estrogen
 - C. Melatonin
 - D. Serotonin

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

MYTHS AND FACTS

Myth: If you do not have any symptoms, it means your blood sugar is under control.

Fact: Medical evidence shows that high blood sugar can silently damage the body even when a person feels completely well. Many people do not experience symptoms until blood sugar levels become significantly elevated and early symptoms are often mild. Therefore, absence of symptoms does not always mean diabetes is well controlled. Regular blood glucose monitoring and HbA1c testing are important to detect uncontrolled diabetes early and prevent complications affecting the eyes, kidneys, nerves, heart, blood vessels and liver.

Myth: Skipping meals helps control diabetes.

Fact: Skipping meals does not improve diabetes control and may actually worsen blood glucose management. Research shows that skipping breakfast can increase average blood glucose levels, contribute to insulin resistance and is associated with poorer glycemic control. Missing meals, especially breakfast or lunch, may also lead to higher post-meal glucose spikes later in

the day. Regular, balanced meals help maintain more stable blood sugar levels, improve energy balance and support better diabetes management. For most people with diabetes, following a consistent meal pattern with appropriate portions is more beneficial than skipping meals.

Myth: I can stop cholesterol medicine once my lipid levels improve.

Fact: Cholesterol levels often improve because the medication is working. Stopping the medicine without medical advice may cause cholesterol levels to rise again, increasing the risk of heart disease and stroke. In people with diabetes, cholesterol-lowering medicines such as statins are often continued long-term because they help protect the heart and blood vessels, even when lipid levels become normal. Rarely, high LDL-cholesterol may be due a reversible cause like in hypothyroidism. When the causative disease (hypothyroidism) is well controlled, cholesterol lowering medication may not be required. Important to remember that most of the times high LDL-cholesterol is genetic and likely to persist.

DIABETES EDUCATOR CERTIFICATE COURSE

Dr Chandalia's DENMARC in association with Help Defeat Diabetes Trust (HDDT) presents to you a Certificate course for Diabetes Educators (CDE)!

Help Defeat Diabetes Trust (HDDT) is a registered, non-profit public trust, having amongst its many objectives, the main objective of promoting education and awareness about diabetes among people from different fields.

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- **All course material** is available online on our website.
- **Course fee:** INR 10,000/-.
- **At the end of the course**, a 100-question MCQ exam will be held, providing an immediate result.
- **Upon successfully passing the test**, a certificate of training by *Dr. Chandalia's DENMARC* and HDDT is issued.
- **Every year**, HDDT gives a prize of Rs. 10,000/- to the student who secures the highest marks in the final examination.
- **For more details**, visit our website or email us at helpdefeatdiabetesinfo@gmail.com.

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Association of Diabetes Educators (ADE)

(For eligibility criteria: Check Website www.diabeteseducatorsindia.com)
(Kindly print, duly fill, scan and upload)



Name Age:..... Gender:.....

Address

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Telephone: Res: Office: Cell:

E-mail id:

Educational Qualifications:.....

.....

Work Experience:

.....

Currently employed at:

.....

Certificates attached:

.....

How do you wish to participate in the ADE activities?

- ☐ Update my knowledge and skills
- ☐ As a faculty in ADE's Educational Activities
- ☐ Organizational Activities as Office Bearer

Please pay the membership fees (Rs.2000/-) through NEFT / RTGS/online to the following bank account. The details are as follows:

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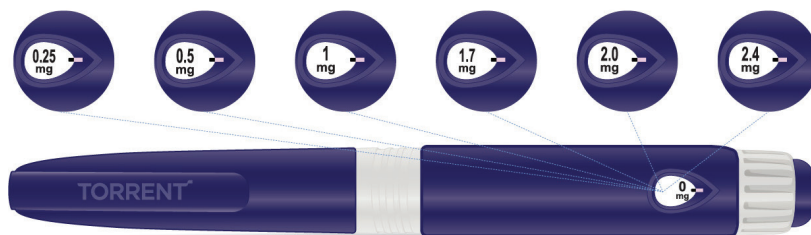
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PwT2D - People with Type 2 Diabetes | PwO - People with Obesity

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