

# An Overview on Equipment and Preparation for Insulin

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**Abstract:** For the treatment of diabetes, a chronic illness that impacts millions of people globally, insulin preparations are crucial. The various insulin formulations—rapid-acting, short-acting, intermediate-acting, and long-acting insulins—are described in this abstract. Each is intended to fulfill particular therapeutic requirements depending on the patient's blood glucose levels and lifestyle. The initiative also looks at the many tools used to administer insulin, such as insulin pumps, insulin pens, and conventional syringes. With pre-set doses for convenience, insulin pens offer a more user-friendly alternative to syringes, which can be heavy and difficult to use. Continuous insulin delivery from insulin pumps improves glucose control and increases mobility in day-to-day activities. In order to guarantee the efficacy and safety of insulin and related devices, it is also stressed how crucial it is to handle, store, and dispose of them properly. The ultimate goal of this initiative is to improve patient outcomes and diabetes management by increasing knowledge about insulin formulations and administration instruments. In conclusion, the project offers a thorough rundown of insulin varieties and delivery tools, emphasizing their importance in the efficient management of diabetes

**Keywords:** diabetes

## I. INTRODUCTION

Insulin preparations that are available, such as combination, long-acting, and rapid-acting insulins. Along with discussing the necessity of handling and storing insulin correctly to maintain its efficacy, we will also look at the tools needed for insulin delivery, including syringes, insulin pens, and needles. It is critical for people with diabetes, their caregivers, and medical professionals to comprehend the function of each step in the insulin administration process. The ultimate goal of this project is to improve patient outcomes and the quality of life for people with diabetes by offering a thorough review of the instruments and methods that enable safe and efficient insulin administration.

For those with diabetes, insulin is an essential hormone for controlling blood glucose levels. For people whose bodies are unable to use insulin efficiently or do not create enough of it, insulin therapy is necessary. The forms of insulin—rapid-acting, short-acting, intermediate-acting, and long-acting—as well as their distinct functions in blood sugar regulation will be discussed in the introduction. Additionally, insulin's role in facilitating cells' absorption of glucose and its importance in averting consequences linked to uncontrolled diabetes. Additionally, we will examine the several ways that insulin is delivered, like diabetic injections and insulin pumps, stressing the significance of appropriate administration practices and patient education. by giving a comprehensive explanation of insulin and how it is used to treat diabetes.

### What is Insulin ?

Insulin is a naturally occurring hormone your pancreas makes that's essential for allowing your body to use sugar (glucose) for energy.

Hyperglycemia is the result of either insufficient insulin production by the pancreas or improper insulin use by the body. Diabetes is the effect of this.

**What is the function of insulin?**

Insulin transports blood glucose into all of your body's cells. Both the food and beverages you eat and the natural release of glucose stored in your body (glycogen) are sources of glucose. Your body uses glucose as its primary and preferred energy source. Every cell in your body needs energy. Consider insulin to be the key that unlocks your body's cells. Glucose can leave your circulation and enter your cells, where it can be used as fuel, once insulin unlocks your cell doors. Insufficient insulin prevents glucose from entering your cells, causing it to accumulate in your blood. Diabetes and elevated blood sugar are the results of this.

**Where does insulin get made?**

Insulin is produced by your pancreas. More precisely, the hormone is produced by beta cells in the pancreatic islets of Langerhans. Your pancreas distributes insulin straight into your bloodstream; this is its endocrine role. In order to aid in digestion, your pancreas also performs an exocrine function by releasing enzymes into specific ducts.

**How does insulin work diabetes?**

By transferring glucose from the bloodstream into cells, where it can be stored or used as fuel, the hormone insulin helps control blood sugar levels:

**How it operates :**

Insulin allows glucose to enter cells by binding to receptors on cell membranes.

**What it does:**

Insulin instructs the liver on how much glucose to create during a fast and aids cells in using it as fuel.

**How it is used to treat diabetes:**

Insulin is taken by people with diabetes to help their bodies better respond to insulin or to replace what their bodies are unable to make

**Diabetes:**

Diabetes mellitus is another name for diabetes. a collection of illnesses that cause high blood glucose, or an excess of blood sugar. The most prevalent kinds

**II. INSULIN PREPARATION**

Table 1: Pharmacokinetic properties of insulin preparations.			
Insulin Preparations	Onset of action (h)	Peak effect (h)	Duration of action (h)
<b>Short-acting (clear)</b>			
Regular insulin	0.5-1	1-3	6-10
Insulin lispro	0.25-0.5	0.5-1.0	3-5
Insulin aspart	0.17-0.33	0.5-1.0	4-5.3
Insulin glulisine	0.25-0.41	0.5-1.0	4-6.3
Technosphere insulin	<0.25	0.5-1.5	2-3
<b>Long-acting (clear)</b>			
NPH	1-2	6-14	16-24
Insulin detemir	3-4	6-8	6-24
Insulin glargine	1-2	Flat	24
Insulin degludec	1-2	Flat	42
<b>Mixtures (cloudy)</b>			
Isophane/regular insulin 70/30, 50/50	0.5-1	2-12	18-24
NPL/lispro mix 75/25	5 min	7-12	1-24

NPH: neutral protamine Hagedorn, NPL: neutral protamine lispro

**Short-acting Insulins**

During meals, these insulins are used to meet the patient's insulin needs. Since the insulin is in a soluble form and exists as an equilibrium mixture of monomers, dimers, tetramers, hexamers, and higher association states, the preparations are easily identifiable. Short-acting formulations include both ordinary human insulin and insulin analogs with a fast onset of action. They often feature small levels of zinc (for increased stability and shelf life) and are transparent solutions with a neutral pH. Insulin molecules typically exist as dimers, but when two zinc ions are added to the formulation, they can unite to form hexamers. When phenolic substances like phenol and meta-cresol are present, the hexamers that are created typically show additional stability. The optimal times to administer conventional human insulin and rapid-acting insulin prior to meals are 45 and 15 minutes, respectively, according to a number of clinical investigations

**Regular Insulin**

Standard insulin is a crystalline zinc-insulin product that has a USP insulin unit/mL strength of 100 or 500. The product packets are color labeled with diagonal white stripes, orange for 100 unit/mL and brown for 500 unit/mL, to further add caution against inadvertent use of the incorrect strength. Postprandial and late postprandial hypoglycemia are the main drawbacks of regular insulin use. It is recommended to administer this injection 30-45 minutes prior to eating. Regular insulin has dose-dependent duration, peak effect, and onset time. Unlike other insulin analogs, it can be given intravenously to treat diabetic ketoacidosis. If a regular insulin product has already frozen, it should be thrown away. There are various preventive precautions to be performed including dumping cloudy preparation and solution where particle materials are present. Before removing the dose, the vial needs to be vigorously shaken to prevent precipitation, aggregation formation, or potency loss. Insulin that has been refrigerated should be warmed to room temperature before use to minimize injection site discomfort. Insulin vials should be stored in their boxes and shielded from heat sources and direct light. Compared to other areas like the thighs and buttocks, the ~~abdomen~~ <sup>belly</sup> of abdomen absorbs

regular insulin more quickly after injection.<sup>8</sup> Neutral protamine Hagedorn (NPH) insulin and regular insulin should never be combined in the same syringe and should never be used with continuous infusion insulin pumps. It can be given intravenously or subcutaneously and works well with normal saline (0.9% NaCl), dextrose (5% or 10%), and potassium chloride at 50 mmol/L (40 mEq/L).

### **Insulin Lispro**

Insulin lispro is an insulin analog wherein the proline at site B28 is reversed with the lysine at B29. It is given as a continuous subcutaneous infusion using specific externally controlled infusion devices, or as a subcutaneous bolus using a pen or conventional syringe. It should be diluted to a ratio of 1:1 or 1:2 with the sterile vehicle supplied by the manufacturer for improved dosage accuracy in pediatric patients.<sup>10</sup> When insulin is administered alone in the syringe, the site-related differences in absorption are less than those caused by other factors. It is recommended to administer insulin lispro injection using the manufacturer's multiple-dose vial, disposable injectable pen, or injection cartridge that has not been opened. When insulin is used alone in the syringe, the differences in absorption related to the site of administration are less than those associated with conventional insulin. The original, unopened multiple-dose vial, disposable injectable pen, or injection cartridge that came with the manufacturer should be used to give insulin lispro injection. Discoloration, turbidity, or unusual viscosity are signs of degradation or contamination, and the vial or cartridge should be thrown out if the substance displays any of these characteristics. It is advised to change the infusion site and settings (100 units/mL) for insulin lispro when using an external insulin pump once a week or anytime the temperature goes over 37°C. Don't deliver 200 units/mL via an infusion pump or combine 100 units/mL of insulin with any other insulin.

### **Insulin Aspart**

Aspartic acid replaces proline once at position B28 in insulin aspart.<sup>11</sup> In most cases, it is administered along with specific long-acting insulin (such NPH) to address patients' basal insulin requirements who have diabetes.<sup>12</sup> Insulin aspart protamine and insulin (70/30) is a fixed dose combination that should only be administered subcutaneously; intravenous administration is not recommended.<sup>13</sup> Before using a vial containing the mixture, gently roll it between your hands ten times or more until the suspension appears evenly opaque and hazy. Additionally, when combining insulin aspart with NPH, the insulin aspart is removed first, followed by the NPH mixture and an instant injection. It is recommended against mixing insulin aspart with crystalline zinc insulin preparations, according to compatibility data. Insulin aspart should not be combined with other analogs in a fixed dose combination. Since it acts faster and for a shorter period of time than conventional insulin, a meal should be consumed right away after injection.<sup>14</sup> In an effort to reduce dispensing problems caused by name similarity, a color code has been implemented.

### **Insulin Glulisine**

Because lysine replaces asparagine at position B3 and glutamic acid exchanges lysine at location B29, insulin glulisine differs from human insulin. This biosynthetic product has all the necessary qualities and is meant to be administered parenterally. The subcutaneous method, 15 minutes before meals, shows a faster start and shorter duration of action when administered at a dose rate of 0.5-1 unit/kg/day.<sup>15</sup> In a hospital setting, it can also be given intravenously on its own for glycemic control at a dose of 0.05–1 unit/mL in normal saline under medical supervision.<sup>16, 17</sup> It is usually administered continuously via subcutaneous injection pump or in combination with long-acting basal insulin. It is injected subcutaneously using an injection pen or a regular insulin syringe. Additionally, an externally controlled infusion device is used to administer it continuously by subcutaneous infusion into the abdomen wall. It cannot be used with Ringer's injection or dextrose. It should be mixed exclusively with NPH insulin and when mixed, ensuring that it is taken into syringe first. After mixing, the mixture needs to be given right away; intravenous administration of this mixture is not advised. Insulin glulisine should not be diluted or combined with any other insulins when administered in an external infusion pump. The product needs to be kept between 2 and 8°C in the refrigerator. The formulation needs to be thrown out if it accidentally freezes or comes into contact with heat (37°C).

### **Technosphere Insulin**

Technosphere insulin is a recombinant human regular insulin formulation in the form of dry powder that is inhaled and absorbed through the pulmonary tissue. This fast-acting powder insulin is breathed during meals to help people with type 1 and type 2 diabetes better control their blood sugar levels.<sup>18</sup> Technosphere should not be used by the patient in cases of diabetic ketoacidosis as a long-acting insulin substitute. With type 1 diabetes, it needs to be used in conjunction with long-acting insulin. Technosphere insulin is a tiny, whistle-shaped device that is produced as a color-coded, single-use cartridge that contains 4, 8, or 12 units just before a meal. It is not suggested for use in children under the age of eighteen and is not approved for use in smokers who are regular smokers or who have recently quit. Patients with asthma and chronic obstructive pulmonary disease should not use it.<sup>19</sup> Technosphere should be inhaled once each cartridge using an inhaler at the start of each meal. Make sure the cartridge has been at room temperature (around 25 °C) for at least ten minutes before inserting it into the inhaler. It is important to take precautions, such as not cleaning the inhaler, not leaving cartridges in it, and keeping the mouthpiece cover on until the next dose.

### **Long-acting Insulin Preparation**

#### **NPH:**

NPH is a protamine and native insulin equivalent mixture in injection-grade water that has been phosphate buffer-adjusted to a pH of 7.1–7.4.<sup>20</sup> Particle size less than 30 µm, rod-shaped insulin crystals make up this opaque solution. For uniform absorption, the preparation should be clear of big particles after gentle shaking. The formulation has an expiration date of 24 to 36 months from the date of manufacturing. NPH is supplied in 100 unit/mL strength vials or 10 mL multiple dose containers. This insulin formulation typically has a dosage range of 10–80 units subcutaneous. The action profile is determined by the dose; specifically, lesser doses have shorter durations of action and inferior and prior peaks, whereas large doses have the reverse effect. NPH insulin is generally absorbed quickly from belly fat, comparatively slowly from the lateral thigh and posterior upper arms, and slowest from the superior buttocks region. Patients should exercise caution if they see any icing or clumping of this insulin at first, as this indicates a discernible decrease in potency. It is not appropriate to inject this type of insulin intravenously. Since the precipitate contains the active component, the vial needs to be gently shaken to ensure a consistent mixture that will allow for precise dosing calculations. Before withdrawing each dose, you can accomplish this by gently shaking, inverting, or whirling the vial a few times. Shaking vigorously should be avoided as this causes foaming, which makes it difficult to assess a dose accurately. Under subcutaneous injection, NPH should be given quickly (less than 5 seconds) to avoid clogging at the needle tip. Insulin that has been chilled to room temperature before usage will lessen injection site irritation. Prefilled syringes and unopened suspension vials should be kept in the refrigerator between 2 and 8°C; they shouldn't be exposed to sunlight, extreme heat (above 30°C), or freezing temperatures (below 2°C).

### **Insulin Detemir**

In this insulin analog, the lysine at position 29<sup>22</sup> is joined to myristic acid, a 14-C fatty acid chain, whereas the threonine at position B30 has been severed. Using an injection pen or standard insulin syringe, subcutaneous injection of insulin detemir is given once or twice a day. The extended duration and sluggish absorption are caused by the properties of self-association and protein binding. This basal insulin peaks between 6 and 8 hours after it starts to act, usually between 3 and 4 hours.<sup>23</sup> Insulin detemir's duration of effect is dose-dependent. The duration of effect varies from 5 to 12 hours when delivered at low doses (0.1–0.2 units/kg), 20 hours at moderate doses (0.6 units/kg), and 24 hours at high doses (>0.6 units/kg). Acute mixing of insulin detemir with ordinary insulin or its rapid-acting equivalents is not possible. Because of its strong self-association and albumin binding, soluble insulin detemir has a longer half-life because of its delayed systemic absorption. The dose, if taken once daily, ought to be taken right before bed or with dinner. On the other hand, individuals with type 2 diabetes have received it once daily in the morning. The ratio of NPH to insulin detemir is 1:1, with small adjustments made as needed by keeping an eye on blood sugar levels.

### **Insulin Glargine**

Insulin glargine differs from regular insulin in that two arginine residues are added to the carboxyl terminus of the B chain and asparagine is substituted with glycine at amino acid 21 of the insulin A chain. Insulin glargine formulation is

neutralized and generates microprecipitates at the injection site when it is injected into subcutaneous tissue (pH of 4.0 to preserve solubility). This insulin analogue is generally not combined with other insulins; instead, it is best to use a separate syringe to reduce the risk of contamination, which could result in a reduction in efficacy. The period of basal insulin secretion can last up to 24 hours, with the commencement of effect occurring within 1-2 hours. It is often used in conjunction with other insulins or infrequently with oral antidiabetic medications because it just affects basal secretion. When switching from twice daily NPH insulin to once daily insulin glargine, it is advisable to lower the starting dose of NPH insulin by around 20% of the total daily dose during the first week and then adjust based on the patient's reaction. However, it is not advised to adjust the starting dose when switching from once-daily NPH insulin to once-daily insulin glargine. The US Food and Drug Administration (FDA) has approved a stronger formulation (300 units/mL).<sup>26</sup> Moreover, a prefilled pen with a dosage strength of 450 units per 1.5 milliliters is offered

### **Insulin Degludec**

It is an ultra-long-acting (42 h) insulin analogue in which hexa-decanedioic acid is conjugated to B-29 and B-30 threonine is removed.<sup>27</sup> The multihexamers depot that forms at the injection site and the gradual release of monomers are what cause the prolonged duration of action. For subcutaneous injection, the mixed product consists of insulin degludec and insulin aspart (70/30). A fixed ratio combination of insulin degludec and liraglutide, an agonist of glucagon-like peptide 1, is another insulin degludec product. It can be purchased as an injectable combination of 3.6 mg/mL liraglutide solution and degludec-100 unit/mL

### **Mixtures**

#### **1) Isophane / regular insulin:**

A prescription drug called isophane insulin, sometimes referred to as NPH insulin, helps manage blood sugar levels in people with diabetes.

**How it operates :** An intermediate-acting insulin that aids in the body's usage of glucose, or sugar, as fuel is isophane insulin. It lowers blood sugar by raising the body's amounts of the hormone insulin.

#### **When to apply it :**

When combined with a nutritious diet and regular exercise, isophane insulin helps avoid diabetic consequences like kidney damage, blindness, and nerve issues.

#### **How to handle It :**

Insulin isophane is administered subcutaneously. Although it can be used alone or in conjunction with other oral diabetic medications, it is frequently used in conjunction with a shorter-acting insulin.

#### **Adverse consequences :**

The following are serious side effects of isophane insulin: Severe headache, disorientation, slurred speech, or impaired motor skills severe visual symptoms, like abrupt blindness or impaired vision severe cardiac symptoms, like rapid or erratic heartbeats Precautions Those who have an insulin allergy or are suffering from hypoglycemia (low blood sugar) should not use isophane insulin. Additionally, those under the age of eighteen are not permitted to utilize it.

#### **How to handle if dosage Missing:**

an injection might cause hyperglycemia, a disease in which your blood sugar levels rise too high. Get in touch with your physician and use a home blood sugar meter to check your blood sugar levels.

#### **2) NPL/lispro mix 75/25 :**

One drug used to treat and control diabetes mellitus is called NPH (neutral protamine Hagedorn) insulin.

#### **How it operates :**

By raising the body's insulin levels, isophane insulin, an intermediate-acting insulin, aids in the body's utilization of glucose as fuel. It functions by facilitating the absorption of glucose by cells from the muscles, fat, and liver.

### **Applications :**

Diabetes is treated using isophane insulin, frequently in conjunction with diet and exercise. It can be taken with or without other diabetes medications.

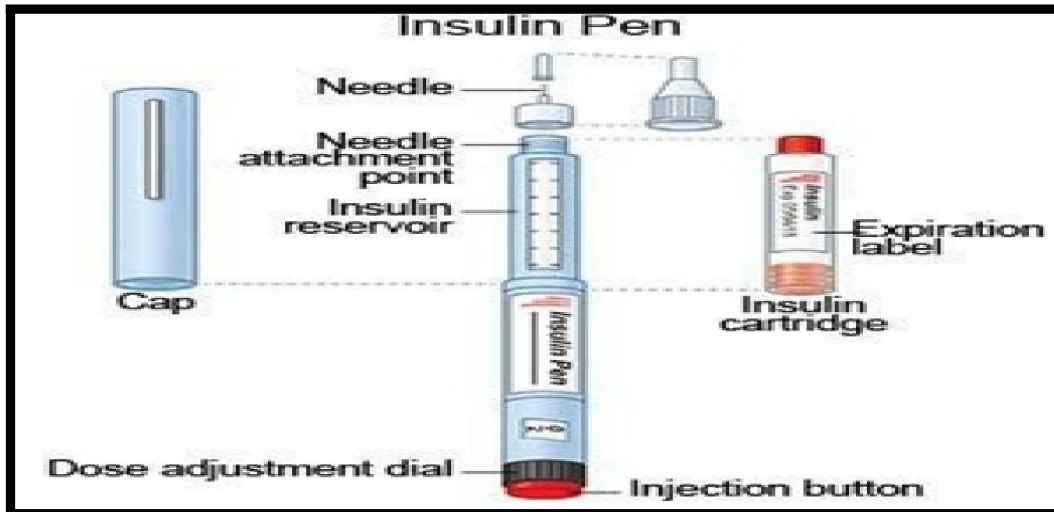


**Adverse consequences:**

Hypoglycemia, or low blood sugar, can be brought on by isophane insulin and cause symptoms including hunger, weakness, and lightheadedness. Severe headache, disorientation, slurred speech, and vision loss are further severe adverse effects

**Equipment for insulin administration:**

**Insulin Pen :**



An insulin pen is a device that delivers insulin into the body to help control blood sugar levels.

**What it is :**

A pen-shaped device that contains insulin in a cartridge and a needle for injection

**How it works :**

A user twists or snaps on a new needle, dials the dose, and injects the insulin into the fatty tissue under the skin

**Who uses it :**

People with diabetes who need insulin to control their blood sugar

**Benefits :**

Insulin pens are more convenient and discreet than syringes and vials, and they can be more accurate for doses less than 5 IU

**Types :** Insulin pens can be disposable or reusable, and some newer models can connect to a smartphone app

**Parts of an insulin pen:**

**Insulin reservoir:** The insulin in the pen is kept in this transparent plastic container. You can see how much insulin is left in the pen as well as the "quality" of the insulin, such as whether it is clear or hazy. You can change the insulin cartridges (reservoirs) in certain pens. When the insulin reservoir runs out, you discard the other pens, which are disposable.

**Pen cap:** When the pen is not in use, the cap shields the insulin reservoir from harm.

**Rubber seal:** A single-use injection needle is connected to the rubber seal.

**Needle:** Insulin pen needles are single-use, you can only use them once before discarding them. A sterile protective container is included with every needle. Before administering an injection, you take the needle out of the container and fasten it to the pen. Pen needles are available in various diameters.

**Dosage knob:** This is a knob you turn to select the insulin dose you need.

**Dosage window:** This shows the number of units of insulin you select using the knob.

**Injection button:** Once you inject the pen needle, you press the injection button to give the insulin dose.

**Label:** The label tells you the type and brand of insulin in the pen and its expiration date.

**Insulin Cartridge :** Insulin cartridges are used in insulin pens to deliver insulin into the body

**Smart Insulin pen:**

A smart insulin pen is an attachable or reusable tool that tracks and records insulin injections and can improve insulin management for diabetics.



**How it works :**

The time and quantity of insulin injected are automatically recorded by a smart insulin pen, which can be linked to a smartphone app to transmit this data.

**Advantages:** Smart insulin pens are useful for: Calculating the dose: determining how much insulin to administer by taking into account blood sugar levels and carbohydrate consumption Doses missed: Notifying and reminding people when a dose is missed Quality of insulin: keeping an eye on the insulin's temperature and expiration date Avoiding insulin stacking, which can result in hypoglycemia, involves adding more insulin while the preceding dose is still active



**Reusable Insulin Pen :**

One kind of insulin delivery tool that can be filled with insulin cartridges and used again once the cartridge is empty is a reusable insulin pen. Initially more costly than disposable pens, reusable pens eventually cost roughly the same since replacement cartridges are less expensive.



**Durability :**

Reusable pens have a longer lifespan and are more resilient than disposable pens.

**Features:** To aid with dose dialing and lower the possibility of error, certain reusable insulin pens come equipped with tactile, visual, and auditory feedback.

**Dose accuracy:** Reusable insulin pens have the potential to meet dose accuracy requirements more precisely.

**Correction of dosage:** Newer reusable insulin pens include the ability to adjust a chosen dosage without causing insulin loss

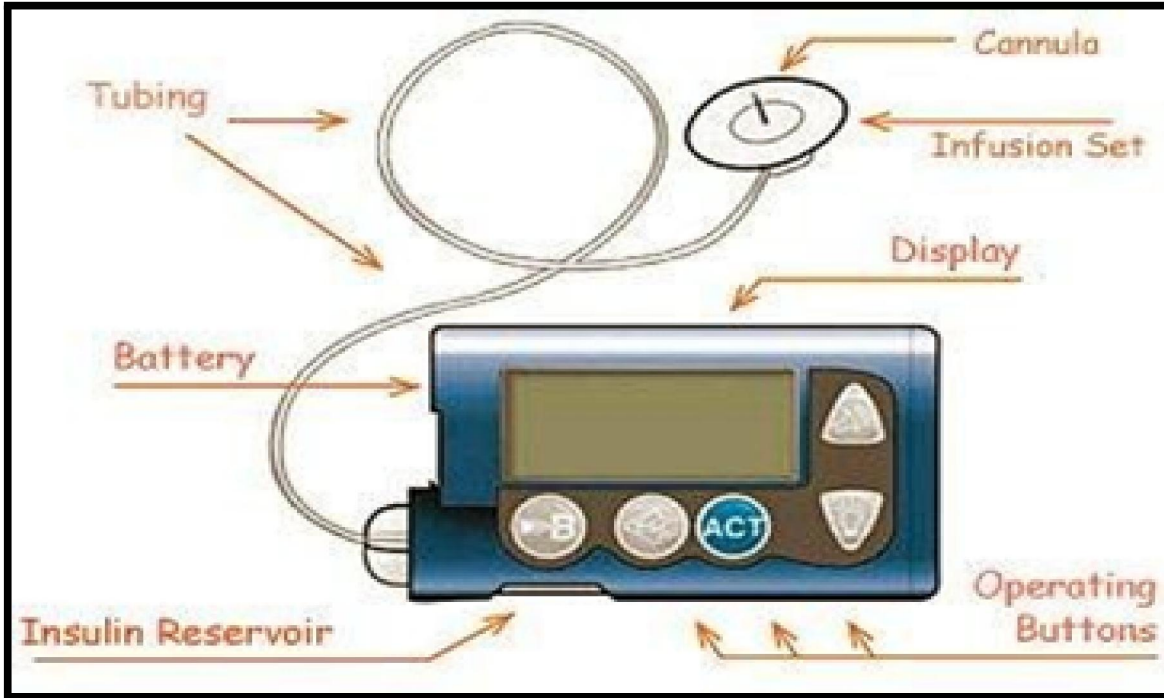
**Disposable Insulin Pen :**

The entire pen is thrown away when the insulin cartridge is empty or the pen has been used for a certain amount of time



**Insulin Pump :**

An insulin pump is a small, wearable device that delivers insulin to people with diabetes:



**How it works :**

The pump delivers insulin through a catheter inserted under the skin. It can deliver insulin continuously or in a rapid bolus dose before meals.

**Benefits:**

- Manage blood glucose levels
- Avoid injections
- Adjust insulin based on activity level
- Reduce risk of hypoglycemia

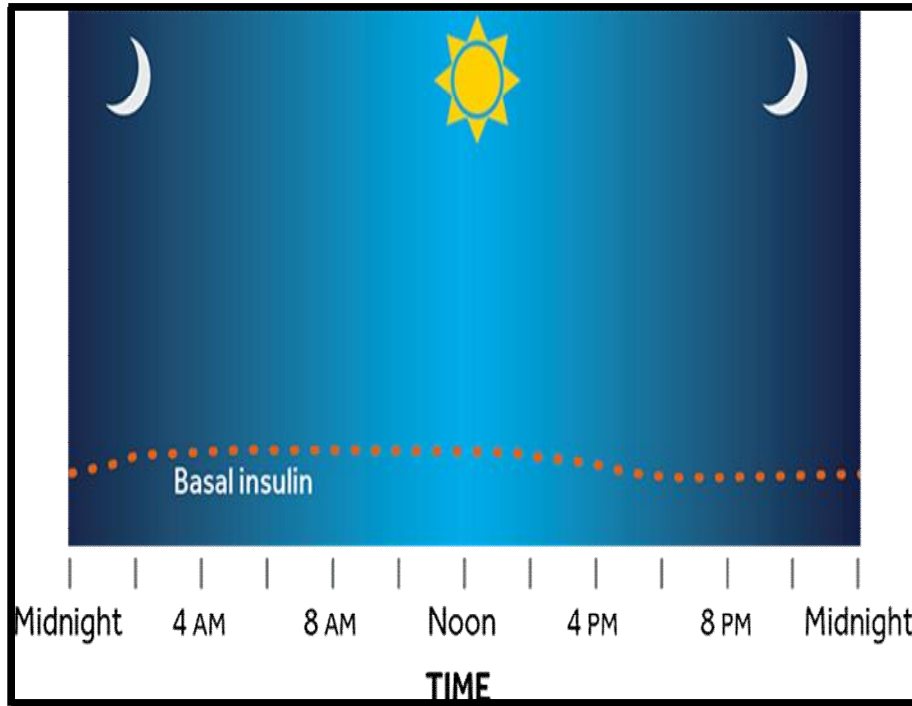
**How it's used :** Insulin pumps are programmed for each person wearing it. Most people use their pump continuously, but it's not a permanent part of the body

**What is insulin pump therapy?**

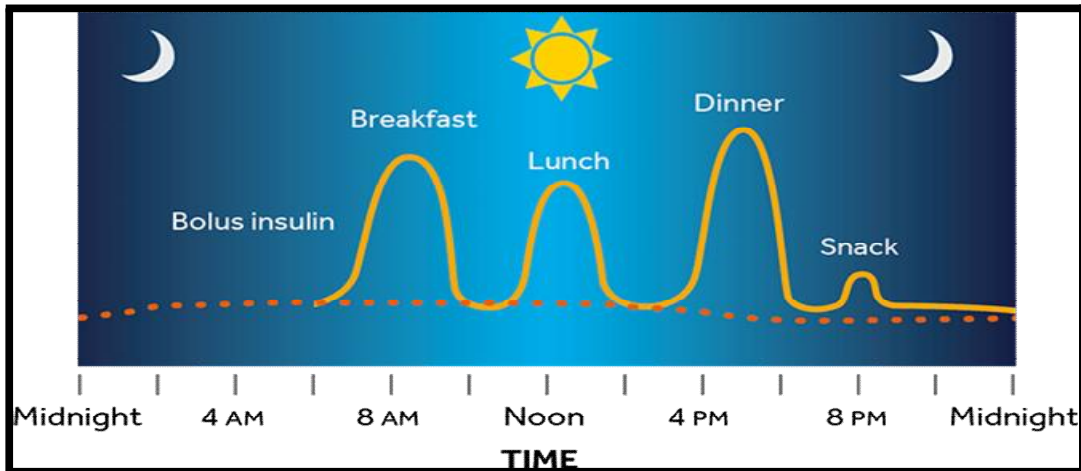
An insulin pump is a small device that can help you manage your diabetes. It delivers continuous and customized doses of rapid-acting insulin 24 hours a day to match your body's needs. The pump provides insulin to your body in two ways:

**Background (basal) insulin :**

Small amounts of insulin that are released continuously throughout the insulin



**Mealtime (bolus) insulin :**



Additional insulin can be delivered on demand to match food intake or to correct high blood sugar.

**Insulin Injection :**

In order to treat diabetes, syringe insulin delivery involves injecting insulin into the body



**How it operates:**

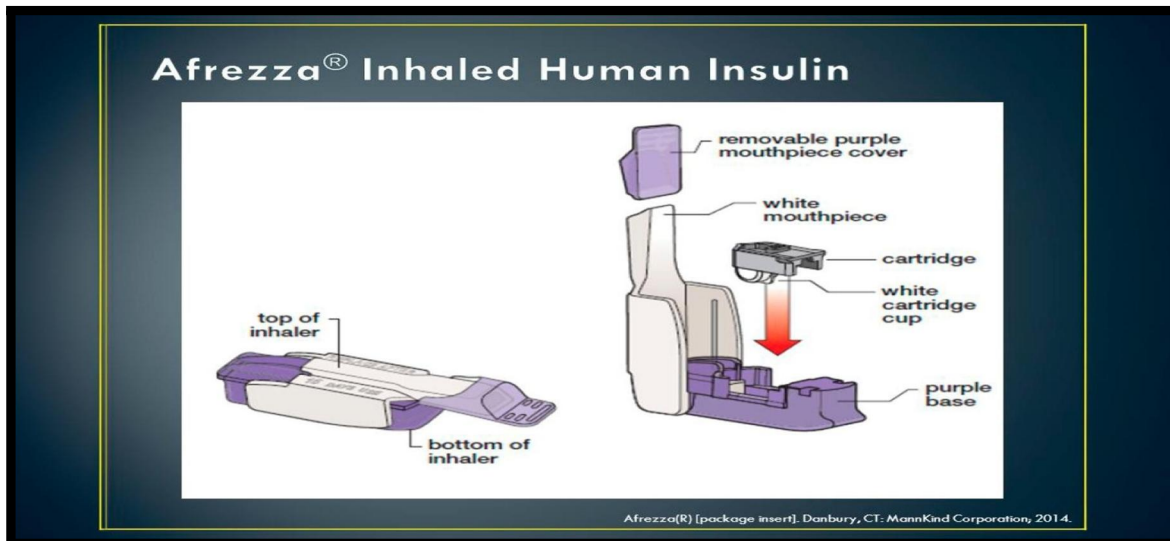
Insulin is injected into the subcutaneous tissue, which is the adipose tissue directly beneath the skin. This resembles the pancreatic secretions that occur naturally.

**Types of syringes:**

Insulin syringes are single-use plastic tubes with a short, thin needle and a plunger. They are available in several sizes; the most popular ones can carry 30, 50, or 100 units of insulin.

**Sites of injection:** Usually, insulin is injected into the buttocks, thighs, arms, or belly. Steer clear of injecting close to scars, the navel, groin, or joints. The injection procedure involves cleaning the injection site with a cotton ball or alcohol wipe, pinching the skin, and then slowly injecting the insulin

**Insulin Inhaler:**



An insulin inhaler is a tool used to treat diabetes that administers powdered insulin into the lungs.

**How it operates:**

The insulin the body typically produces is replaced by inhaled insulin, which is a synthetic form of the hormone. Through the lungs, it enters the bloodstream and aids in the transfer of blood sugar to various tissues for energy.

**Benefits:**

Compared to injectable insulin, inhaled insulin is absorbed more rapidly and begins to function more quickly.

**Uses:**

Type 1 and Type 2 diabetes are treated with inhaled insulin.

**How to apply:**

Before eating, you use the inhaler to inhale the insulin. You can modify your dosage and get instructions on how to use the device from a healthcare professional.

**Serious side effects from inhaled insulin :**

Heart failure, low potassium, and abrupt lung issues. People with long-term lung conditions like asthma or COPD shouldn't use it

**III. CONCLUSION**

For diabetes to be effectively managed, insulin preparations and the tools needed to administer them are essential. Patients and healthcare professionals can create individualized treatment programs by knowing the several forms of insulin, including rapid-acting, short-acting, intermediate-acting, and long-acting formulations. The simplicity and precision of insulin delivery are greatly impacted by the selection of administration tools, such as diabetic syringes, insulin pens, and insulin pumps. Each approach has benefits and, by offering flexibility and ease in everyday activities, can improve the quality of life for people with diabetes. Furthermore, to guarantee safety and effectiveness, appropriate instruction on how to handle, store, and dispose of insulin and associated equipment is essential. Patients can improve overall health outcomes, lower their risk of complications, and attain better glycemic control by giving priority to these factors. In the end, effective diabetes care requires a thorough understanding of insulin preparations and delivery equipment, enabling people to live healthier lives.

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