

# Management of Diabetes



# Types of insulin

(Basal) vs. (bolus/prandial insulin)



**Table 171-2** Representative Profiles of Insulin

<b>INSULIN</b>	<b>ONSET</b>	<b>PEAK ACTION</b>	<b>DURATION</b>
<b>Very Short Acting</b> Lispro, aspart, glulisine	5–15 minutes	30–90 minutes	3–5 hours
<b>Short Acting</b> Regular	30–60 minutes	2–3 hours	5–8 hours
<b>Intermediate Acting</b> Neutral protamine Hagedorn (NPH) (isophane)	2–4 hours	4–10 hours	10–16 hours
<b>Long Acting</b> Glargine	2–4 hours	None	20–24 hours
Detemir	2–4 hours	6–14 hours	16–20 hours

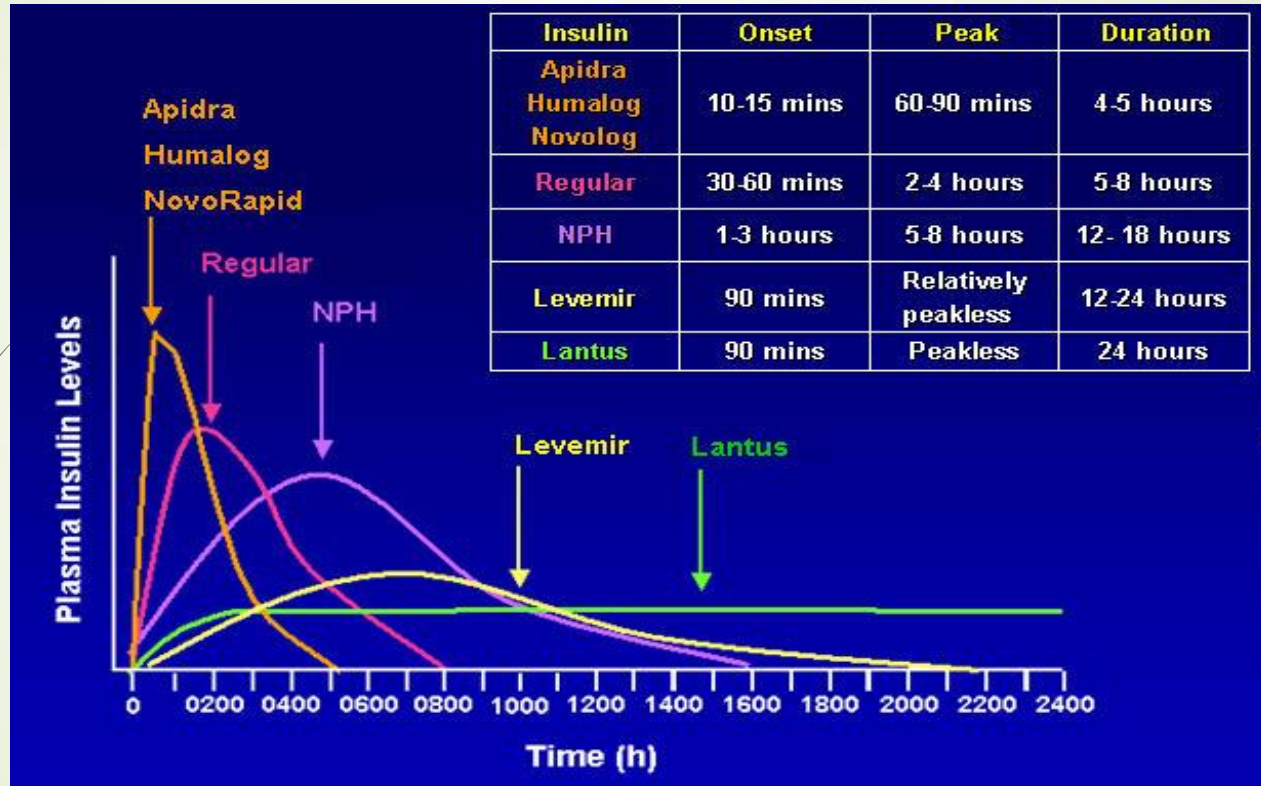
Data from Wolfsdorf JI, editor: Intensive Diabetes Management, ed 4, Alexandria, VA, 2009, American Diabetes Associations.



# Examples of insulin


- Lispro=Humalog
- Aspart=Novolog
- Glulisine= Apidra
- Regular (Human Insulin)= actrapid
- Glargine=lantus
- Detemir= levemir
- NPH 70%/Regular insulin 30% (premixed insulin) = mixtard or humulin 70/30
- Others

# Insulin action profile





# Target control

1. Postprandial hyperglycemia
  2. Between-meal hypoglycemia
  3. Nighttime hypoglycemia
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# Bolus/Prandial insulin

## 1. V.short acting, Ultrashort (rapid acting):

- ▶ less postprandial hyperglycemia
- ▶ Less Between-meal hypoglycemia and Nighttime hypoglycemia
- ▶ 3 times daily if alone (can be given 4 times)/ twice if in premixed insulin solutions (according to the regime)

## 2. Short-acting:

- ▶ More postprandial hyperglycemia (in comparison to rapid-acting insulin).
- ▶ More Between-meal hypoglycemia and Nighttime hypoglycemia (in comparison to rapid-acting insulin).
- ▶ 3 times daily/ twice if in mixtard (according to the regime)



# Basal insulin


## 1. Intermediate acting (twice daily)



- ▶ More postprandial hyperglycemia (in comparison to long acting insulin).
- ▶ More Between-meal hypoglycemia and Nighttime hypoglycemia (in comparison to long acting insulin).

## 2. Long acting (once daily → Lantus,,,,,,,,,,,,, twice daily → Detemir)

- ▶ Less postprandial hyperglycemia
- ▶ Less Between-meal hypoglycemia and Nighttime hypoglycemia
- ▶ More physiological



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- ▶ — We suggest a **target A1C of <7.0 percent** for children and adolescents, consistent with guidelines from the American Diabetes Association (ADA) and the International Society for Pediatric and Adolescent Diabetes (ISPAD) .
  - ▶ To achieve a target A1C of <7.0 percent, target blood glucose levels are approximately 90 to 130 mg/dL before meals, and 90 to 150 mg/dL at bedtime and overnight

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- As A1C decreased, the incidence of severe hypoglycemic episodes increased .
  - As A1C decreased, so did the risk of long-term sequelae.
  - It is important to recognize that patients with erratic diabetes control and wide glycemc excursions may achieve a similar A1C as patients with more stable glucose levels if the mean blood glucose levels are similar. (very important)

# How to give insulin?

- ▶ Total daily insulin 0.5-1.0 u/kg/day
- ▶ Prepubertal children usually require lower doses, and the dose requirement may be as low as 0.25 units/kg for a variable period following diagnosis. Higher doses are needed in pubertal children, patients in ketoacidosis, or in patients receiving glucocorticoid therapy

## 1. Twice daily (premixed insulin)

- ▶ 2/3 the amount of the total daily insulin in the morning (before breakfast)  
1/3 before the evening meal
- ▶ Premixed insulin e.g. (Mixtard= intermediate acting insulin+ short acting/rapid acting)
- ▶ Ratio of intermediate acting to short acting insulin  
2:1 or 3:1
- ▶ Less flexible regime in adjusting for BG levels or variability in food intake and activity.

# Cont. how to give insulin

2. **Basal insulin** usually at bedtime+ **Bolus insulin** before meals

- Multiple daily injections of insulin (MDI)
- 40% of total daily dose of insulin is given as basal insulin and 60% bolus insulin
- Example:


Weight: 20 kg

- Total daily insulin:  $20\text{kg} \times 1\text{ u/kg/day} = 20\text{ units/day}$  (including all basal and bolus insulin)
- Give 8 units (40%) as long acting insulin glargine (Lantus) once daily at 10 pm
- Give 12 units as v.short acting insulin or short acting; 4 units before each meal in addition to the correction of the dose according to the amount of CHO and the preprandial blood glucose level ( this has its own calculations)
- Start with the minimal dose (0.5 u/kg/day)



# How to monitor blood glucose levels?

- Before meals and 2 hrs postprandial
- At 12:00 MN
- At 3:00 AM




▶ To prevent the development of diabetic ketoacidosis (DKA), patients must check for urine or blood ketones when blood glucose is persistently  $\geq 250$  mg/dL (13.9 mmol/L), or during acute episodes of increased stress, including intercurrent illnesses.

▶ Patients who have hyperglycemia and positive urine ketones or increased blood ketone concentrations should be treated with additional insulin (with or without additional carbohydrates) and increased fluid intake, combined with meticulous monitoring of blood glucose and ketone concentrations



# Ways of giving insulin

- Syringes
  - Pen
  - pump
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## Insulin syringes



## Insulin pen



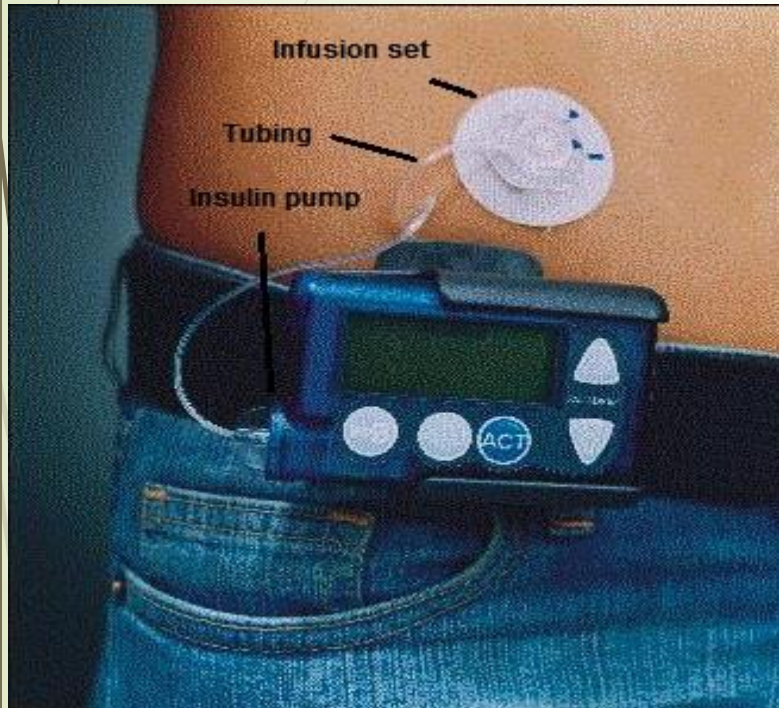




# Continuous glucose monitoring CGM

- ▶ A new technology now available
- ▶ A SC placed glucose sensor measures tissue glucose at frequent intervals.
- ▶ Several different types of CGM devices have been developed.

# Insulin pump therapy



## How a Pump Works

The insulin is housed inside the pump in a little cartridge called a "reservoir."




Insulin travels into your body through a flexible tube that ends with a tiny needle called a "cannula" inserted just under the skin.



The needle is held in place by an "infusion set," a little adhesive patch stuck to your skin.








# Nutrition in patients with T1D


- ▶ No special nutrition
  - ▶ No particular food should be considered forbidden
  - ▶ Dietary recommendations are based on healthy eating principles suitable for all children and families with the aim of improving diabetes outcomes and reducing cardiovascular risk .
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- Healthy eating habits is a key component for healthy children, with or without diabetes.
  - For youth with type 1 diabetes - provide adequate energy to ensure normal growth and development, integrate insulin regimens into usual eating and physical activity habits.



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- International agreement that carbohydrate should not be restricted in children and adolescents with type 1 diabetes as it may result in deleterious effects on growth.
  - Caregivers should encourage healthy sources of carbohydrate foods such as whole grain breads and cereals, legumes (peas, beans, and lentils), fruit, vegetables, and low-fat dairy products (full fat in children under 2 yr).
  - Fresh fruit is preferred over drinking fruit juice.
  - Extra-insulin when necessary.



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- The optimal macronutrient distribution varies depending on an individualized assessment of the young person. As a guide, carbohydrate should approximate 50–55% of energy, fat <35% of energy (saturated fat <10%), and protein 15–20% of energy (C).

- 70% of CHO content from complex CHO as starch

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- Carbohydrate 50–55% (3)
  - Moderate sucrose intake (up to 10% total energy) (6)
  - Fat 25–35%
  - <10% saturated fat + trans fatty acids
  - <10% polyunsaturated fat
  - >10% monounsaturated fat (upto 20% total energy) (5)
  - Protein 15–20% (2, 3)



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- Dietary fat and protein may impact postprandial glycemia.
  - Prevention of overweight and obesity in pediatric type 1 diabetes is a key strategy of care.
  - Weight loss or failure to gain appropriate weight may be a sign of illness (infections, celiac disease, and hyperthyroidism), insulin omission or disordered eating.
  - Achieve a balance between food intake, metabolic requirements, energy expenditure, and insulin action profiles to attain optimum glycemic control.



**“Both children and adults like me who live with **Type 1 Diabetes** need to be mathematicians, physicians, personal trainers, and dietitians all rolled into one. We need to be constantly factoring and adjusting, making frequent finger sticks to check blood sugars, and giving ourselves multiple daily insulin injections just to stay alive.”**

Mary Tyler Moore

[family.ing\\_with\\_t1d](http://family.ing_with_t1d)