

1-Pancreas

- Pancreatic enzymes are the most important enzymes in the digestive system as they are the only enzymes that have an effect on all food elements.
- Pancreas is a mixed organ (has both exocrine and endocrine functions)
- The pancreas consists of two types of cells: 1- the acini >> enzymes 2- the islet of Langerhans >> hormones
- The most important hormones are insulin and glucagon. Both hormones are connected in an antagonistic type of connection.
- Both hormones affect the metabolism of food elements: lipid, protein, and carbs in the liver. *بعضی عملی بعضی*
- Langerhans islets occupy 2% of the whole pancreas. If these 2% are absent or non-effective then you will be **dead**.

Cell Types	Percentage	Hormones secreted
A alpha cells	20%	Glucagon+ proglucagon
B beta cells	75%	Insulin and amylin, c-peptide, proinsulin
D delta cells	3-5 %	Somatostatin
F cells (pp cells)	<2%	Pancreatic polypeptide
Epsilon cells	<1%	Ghrelin

*Ghrelin>>> appetite

*Proinsulin has 10% potency of insulin

- Amylin acts as a neuroendocrine hormone that is complementary to the action of insulin "synergisms"
- Insulin is composed of two chains: 1- A chain 2- b chain (the active one). Proinsulin is composed of a, b, and c peptide.

↓
21 amino acid

↓
30 amino acid
- A and b chains are connected via disulfide bridges
- The amount of insulin secreted equals the amount of c peptide (c peptide reflects the endogenous insulin)
- C peptide is not extracted by the liver while the insulin is extracted by the liver.

Insulin and glucagon

- 1- Both for short term of regulation and the other hormones for long term of regulation.
- 2- insulin is only hypoglycemic hormone while glucagon is the most potent hyperglycemic hormone.
- 3- cortisol has a permissive action on glucagon facilitating the function of it (action on gluconeogenesis)
- 4- cortisol does not stimulate glycogenolysis
- 5- tyrosine kinase is the second messenger of insulin and if the tyrosine kinase is not activated insulin loses its function

Insulin functions :

- 1- transactivation of glucose transporter
- 2- stimulates protein synthesis as the growth hormone cannot function without insulin
- 3- stimulates fat synthesis
- 4- promotes growth and gene expression

→ The most important stimulator of insulin is glucose

Calcium is present >> secretion of insulin
no calcium no secretion of insulin

Many tissues need insulin to take in glucose (skeletal muscle, adipose tissue and aorta).

But there are exceptions: brain, kidney, intestinal mucosa, RBCs.

When the blood glucose exceeds 160/180 mg/dl the proximal kidney becomes overwhelmed and begins to excrete the glucose in the urine. This renal threshold. Also excess glucose is transferred into fat.

The maximal level of insulin occurs when glucose level is about 300 mg/dl **hyperglycemia**

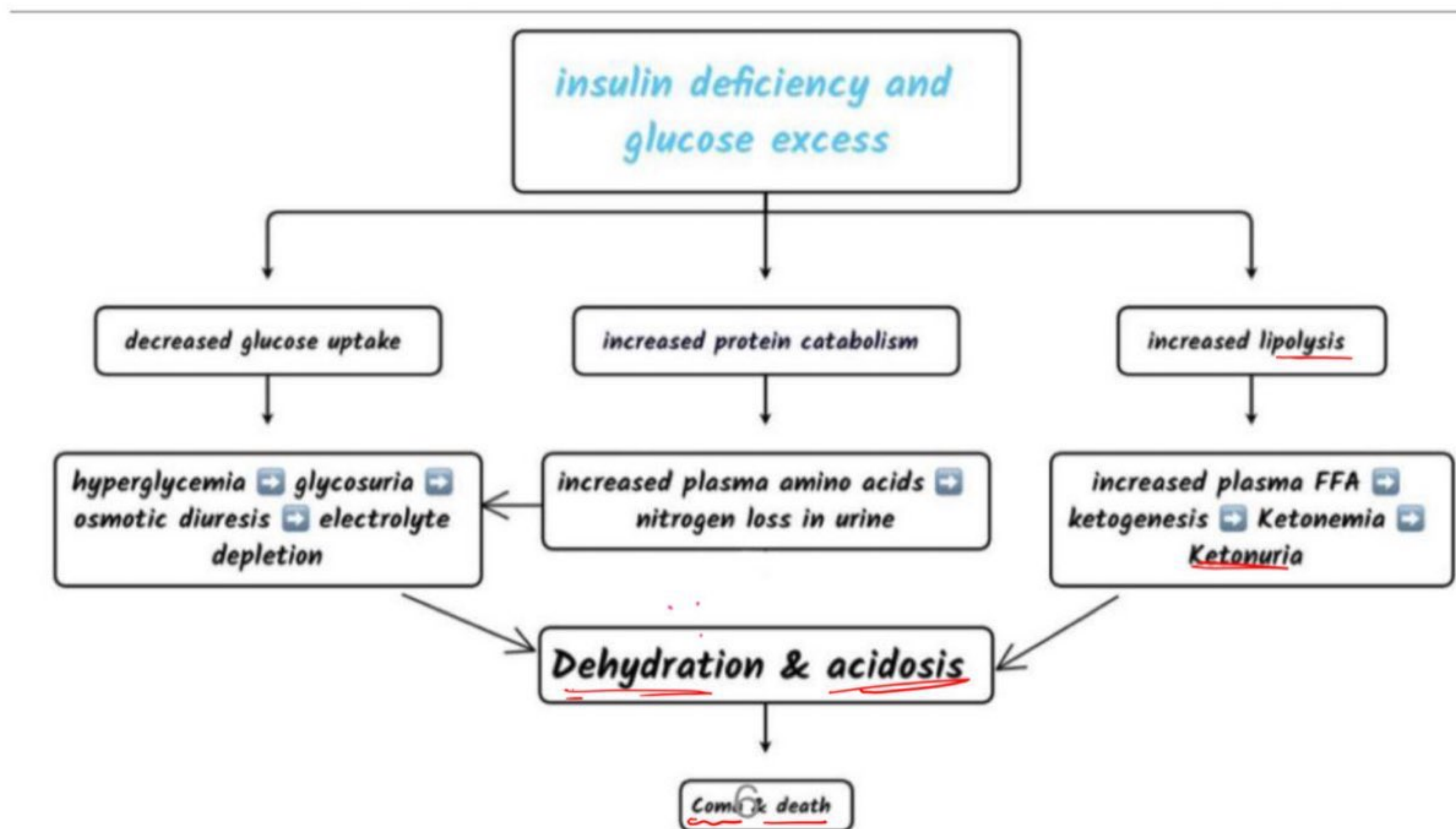
After 500mg/dl no increase in insulin levels

→ Insulin also effects potassium entry, phosphate and magnesium.
(Ion transport)
→ also play a role in the entry of amino acid by activation DAG + IP3.

Diabetic patients have a deficiency in insulin lipolysis occurs because the insulin deficiency activates enzyme hormone sensitive lipases .

Hydrolysis of lipids occurs free fatty acids are produced and few of them used for energy , the remaining fatty acids are used to produce ketone bodies which cause acidosis

No protein synthesis without insulin (catabolism of proteins into amino acid , few amino acids are used for energy and the remaining amino acids produce glucose "hyperglycemia"



What are the causes of acidosis?

- 1- lipolysis (ketone bodies)
- 2- replaced the sodium by hydrogen

What are the causes of hyperglycemia?

- 1- problem in carbohydrate metabolism decrease the glucose uptake by the cell >> glycosuria
- 2- Protein catabolism

What are the causes of coma?

- 1- hyperglycemia (acidosis)
- 2- hypoglycemia
- 3- hyperosmolar
- 4- lactic acidosis
- 5- brain edema

Two types of diabetes mellitus
DM1 occurs usually in children >> lack of insulin secretion (genetic) and its insulin dependent insulin low or absent

DM2 (old age) >> reduced sensitivity of target tissues its not insulin dependent insulin is normal or high

Type 2 usually obese patient while type 1 low body mass

Type 2 diabetes

Early on or in mild cases, diet, weight loss and exercise can be extremely effective. But if none of these mentioned treatments worked, the patient will take drugs:

- 1- insulin sensitizer with primary action in the liver (biguanides)
- 2- insulin sensitizers in peripheral tissues (glitazones)
- 3- insulin secretagogues which stimulate beta cells to secrete more insulin (sulfonylureas)
- 4- agents that slow absorption of carbohydrate (alpha glucosidase inhibitors)

Glucagon

The major stimulus of glucagon is the protein ingestion

mainly affects the liver as well as other tissue

Glucagon is particularly important in glycogenolysis, gluconeogenesis and ketogenesis

Obesity is not included here go and check sheets.

Best of luck

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