



# PHYSIOLOGY



Sheet 11: 2-24-2020

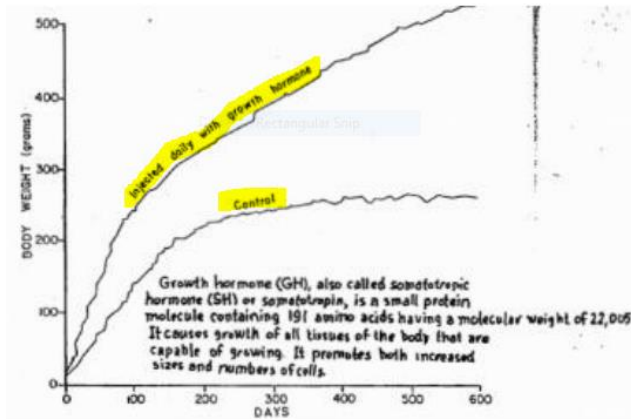
MALAK J ALAMLEH

Correction: Osama Fraij

Dr. SALEEM

## Anterior pituitary gland

- Release growth hormone
- Increases the growth of the cells & the number of cells `which are capable to grow`
- Is established in all body cells



The diagram shows that the weight is increased when injected with growth hormone.

## Hormones functioning with growth hormone

- Many hormones function together, complement each other.
- **Growth hormone** does not function properly unless **insulin** is present. (growth hormone without Insulin ..... no growth).
- Multiple hormones, including growth hormone (GH), insulin – like growth factors (IGF-I and -II), insulin, thyroid hormones, Glucocorticoids, androgens & estrogens contribute to the growth process in humans.
- Among these, GH & IGF-I have been implicated as the major determinants of growth in normal post-uterine life.

## INSULIN AND GROWTH HORMONE

The rat was injected with:

1. Growth hormone only!!! little growth

2. Insulin only!!! Growth is more than when the rat was injected with GH only.

3. A **combination** of GH and insulin

The combination of these hormones causes **dramatic growth**. Thus, it appears that the two hormones function **synergistically** to promote growth.

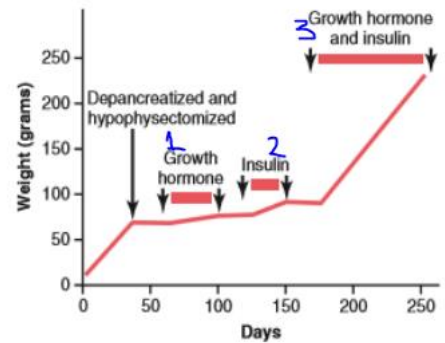
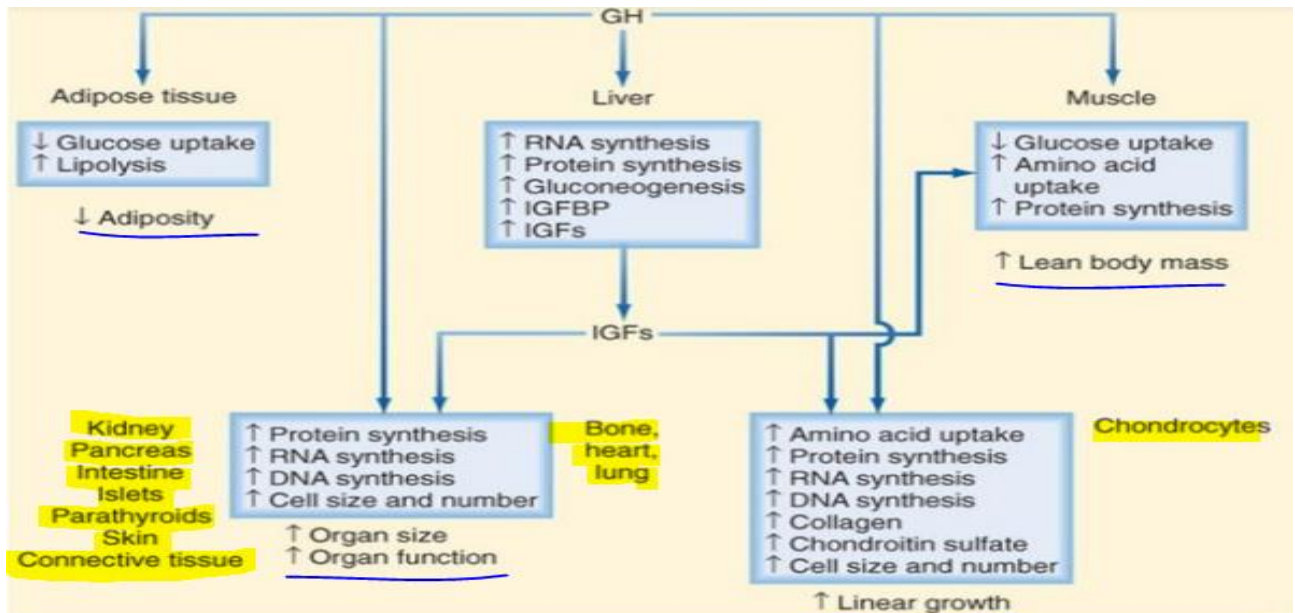


Figure 79-6. The effect of growth hormone, insulin, and growth hormone plus insulin on growth in a depancreatized and hypophysectomized rat.

## GH has direct & indirect effect



**Direct** effect on adipose tissue, liver & muscle.

### 1- Adipose tissue.

**Decrease adiposity**, by increasing lipolysis and decreasing the glucose uptake so that glucose stays in the blood.

### 2- Liver.

- increasing RNA synthesis to increase protein production.
- increasing the rate of protein synthesis.

- c) increasing Gluconeogenesis (production of glucose from noncarbohydrate sources).
  - d) production of Somatomedins “insulin-like growth hormones”.
- 3- muscle cells.**
- a) decrease glucose uptake.
  - b) increase amino acid uptake.
  - c) increase protein synthesis.

✚ By affecting the liver, it produces hormones called somatomedins “insulin-like growth factors”. There are 6 types of somatomedins, they differ in the sequence or number of amino acids. All of them function the same, but with varying potency. القدره

### METABOLIC EFFECTS OF GROWTH HORMONE

1. Increase the rate of **protein synthesis**.
2. Increase **mobilization of fatty acids** from adipose tissue & increased use of it for energy.
3. **Decrease** the rate of **glucose utilization** throughout the body.

Net effect: Growth hormone enhances the body protein, uses up the fatty stores and conserves carbohydrates.

It's probable that the increased rate of growth result mainly from the increased rate of protein synthesis. It is reasonable because as mentioned earlier, insulin plays a major role in growth.

Note: one of the functions of growth hormone is to increase the concentration of glucose in the blood (**normalize the blood glucose level**).

>>> Sometimes there is **abnormality**, in which there is increase in the concentration of growth hormone —> Cause diabetes.

This is called the **diabetogenic effect of growth hormone**.

**G.H. causes diabetes in two ways:**

**1. Increase blood glucose concentration.**

**2. By directly affecting the beta cell (cells in pancreas produce insulin).**

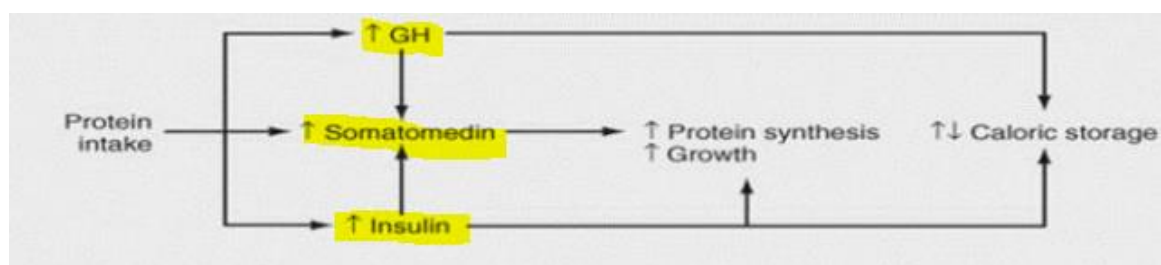
pancreas is over stimulated, and the cells finally burn out. the person develops diabetes mellitus.

### EFFECT OF GH IN ENHANCING FAT UTILIZATION FOR ENERGY by increase lipolysis

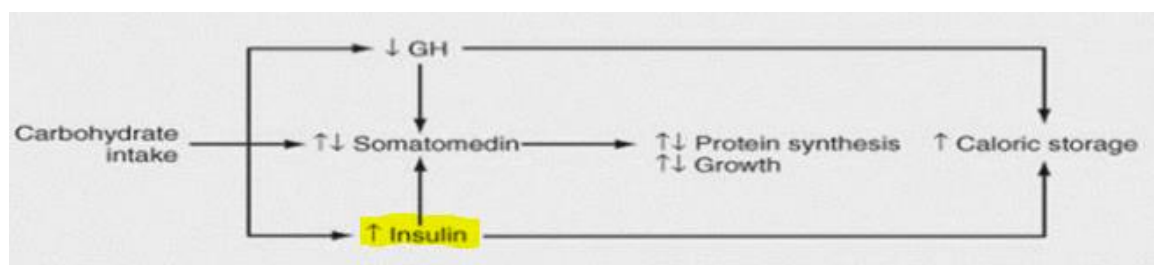
- \* Increases the free fatty acids in the blood by increase the lipolysis.
- \* Fatty acids concentration increases in body fluids.
- \* Under the excessive of GH, great amount of fat is mobilized.

Therefore, a lot of acetoacetic acids are formed by the liver and released into the body fluids, thus causing (ketosis). Which is called "ketogenic effect" of GH.

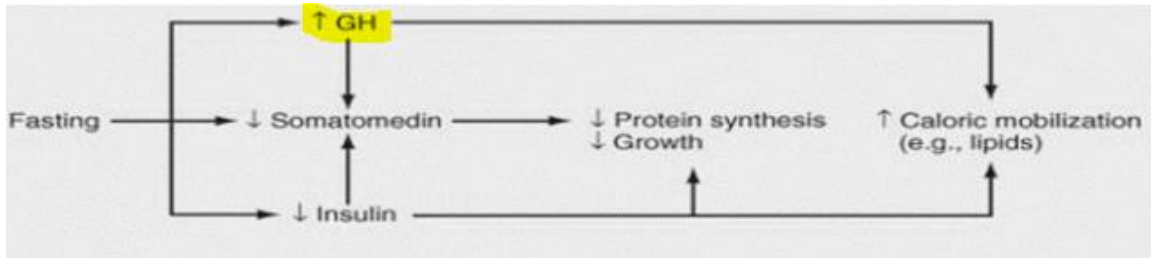
### DIETARY HABITS AND THEIR EFFECT ON GH, SOMATOMEDIN, AND INSULIN



**Protein intake → all of them increase.**



**Carbohydrate intake → insulin only increases.** → to normalize glucose level. (Details please! OK) → as a result of carbohydrate intake, the glucose conc. increases and it has to be transported into cells → we need insulin for that.



**Fasting → GH only increases (for Gluconeogenesis ).**

### FACTORS AFFECTING THE SECRETION OF GROWTH HORMONE

Growth hormone secretion shows a sleep & wake rhythm, diurnal rhythm (level of GH during 24 hour) , and a developmental rhythm.

#### **GH during development.**

Q: What is the significant difference (that means the change excess 10% ) between childhood and adult life (concerning G.H secretion)?

-GH secretion levels are higher in children than adults with a peak period during puberty.

- GH declines with aging.

### FEEDBACK MECHANISMS FOR CONTROL OF FOOD INTAKE

- Eating is a habit, Eating is a habit, ...
- When you feel full “satisfied”, you stop eating. HOW!!

The inside surface of stomach has receptors (**Stretch receptor**).

When it filled .... The **food touch the receptors** ... it become stimulated .... You feel satisfied. ☺

if your stomach is too large, you must eat a lot to let the food touch these receptors ... so, eat normally.

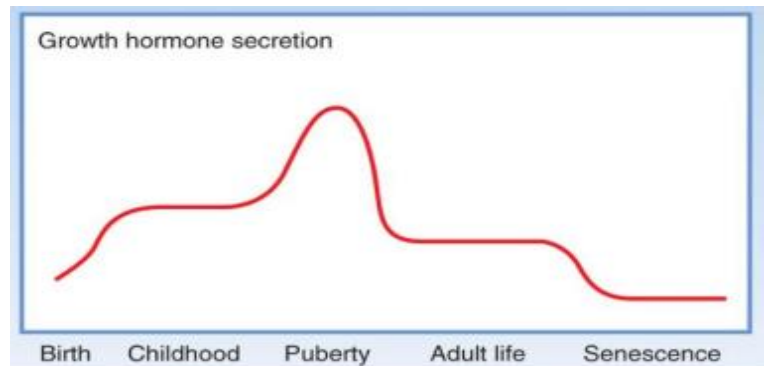
- Stretch receptors in the stomach activate sensory afferent pathway of vagus nerve and inhibit food intake.

📚 **By aging** the metabolism is decreased so, we should decreased amount of eating to have normal Wight.

📚 cholecystokinin (CCK), and insulin are gastrointestinal hormones that are released by the ingestion of food and suppress further feeding.

📚 **Ghrelin** is released by the stomach and the intestines, especially during fasting, and stimulates appetite. شهية

📚 **Leptin** (a hormone produced by the adipose tissue) is produced in increasing amounts by fat cells as they increase in size; it inhibits food intake.



**PANHYPOPITUITARISM** (*hypopituitarism: is the decreased(hypo) secretion of one or more of the eight hormones normally produced by the pituitary gland.*)

\*What happens to the human when there is a problem in pituitary gland?

Deficiency in all pituitary gland hormones (anti. + post. Pituitary)

Kidney will be affected (bec. ADH will decrease ), water will be excreted result in **diabetes insipidus**. (*Is a condition characterized by large amounts of dilute urine and increased thirst*).

Pan  
means  
all.

Diabetes insipidus	Diabetes
due to ADH deficiency.	insulin deficiency.
Urine too much with pall (colorless).	too much urine with color
no taste	sweet taste

Oxytocin is not mentioned because the deficiency of this hormone is not problematic. (The baby takes the milk & delivery occurs (difficult without oxytocin))

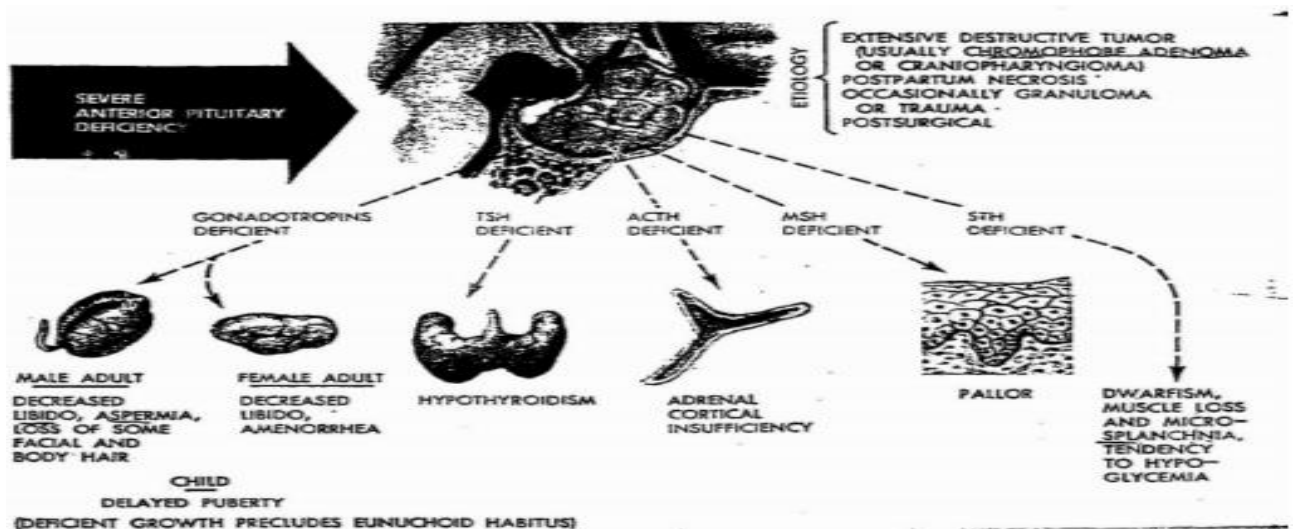
In gonadotropins deficiency, level decreases (such as FSH and LH):

Males will suffer from:

1. Libido Decreased .
2. Aspermia (failure to produce semen).
3. Loss of some facial and body hair.

Females will suffer from:

1. Decreased libido.
2. Amenorrhea (an abnormal absence of menstruation).



-Thyroid stimulating hormone (**TSH**) deficiency leads to hypothyroidism (decreased thyroid hormones levels).

-**ACTH** deficiency leads to adrenal cortex insufficiency.

-**MSH** (melanocyte-stimulating hormone) deficiency leads to Pallor

-**STH** (SOMATOTROPIC HORMON) Growth hormone.



## Growth hormone problems (next page)

### Dwarfism القزامة

Intelligence is normal

### Gigantism التعملق

- **over secretion** (genetic – not tumor) of growth hormone before the beginning of adulthood.
- All body tissues will grow rapidly **ضخامه مع الاطراف تناسق**.
- These people height ranges from 8-9 feet ( 1feet = 30.48cm).
- Giant people suffer from **Hyperglycemia** and if they were not treated, they may suffer from **diabetes mellitus**.



If they were not treated, they will suffer from

**PANHYPOPETUITERISM.**

-In **acromegaly** (tumor after being adult), the person can't grow taller (because the shaft of long bones now is fused), but the soft tissue can continue growing, so the bones get thicker.

-Also many soft tissues in organs like liver, tongue and kidneys become greatly enlarged.

