

*Remember that:

-Posterior pituitary hormones :- ADH (Antidiuretic Hormone) & Oxytocin

-Anterior pituitary hormones :- GH, ACTH, TSH, FSH, LH & Prolactin

*First, we'll discuss the GH, because ALL the cells of the body are considered as target cells for this hormone.

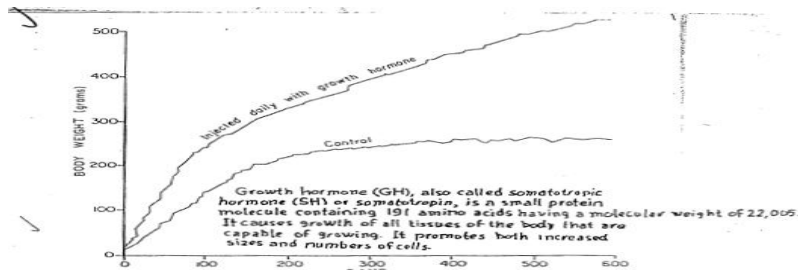


Figure 75-4. Comparison of weight gain of a rat injected daily with growth hormone with that of a normal rat.

*Referring to the figure above, there're two curves, the lower one represents the normal growth of a rat while the upper one represents the growth of the same rat injected with the GH. This indicates the effect of the GH.

-Again, GH causes the growth of ALL tissues of the body, that are capable of growing.

-It increases the sizes & numbers of cells.

*Growth process is affected by many hormones, which function synergistically "they synergize with each other"

*These hormones, beside the GH, insulin, insulin-like growth factors 1&2, thyroid hormones, cortisol, estrogen, androgen.

-All these hormones "the previous 7 hormones" function together "they complement each other"

-They cause the growth.

-The most important in a normal post uterine life "after born" is the:

- 1)GH
- 2)Insulin-like growth factor 1

*It doesn't mean that the others are not important, if they're deficient, it'll cause serious problems.

*Especially, GH & insulin synergize with each other and there's a relationship between these two hormones, so as to cause growth.

*If we've a rat, without pancreas & pituitary gland, injected with GH, the result will be: little increase in the growth.

-the same result will be observed if the rat was injected ONLY with insulin "there'll be a little increase in the growth".

-But if the rat was injected with both, GH & insulin, there'll be faster increase in the growth. "remember that these two hormones function synergistically".

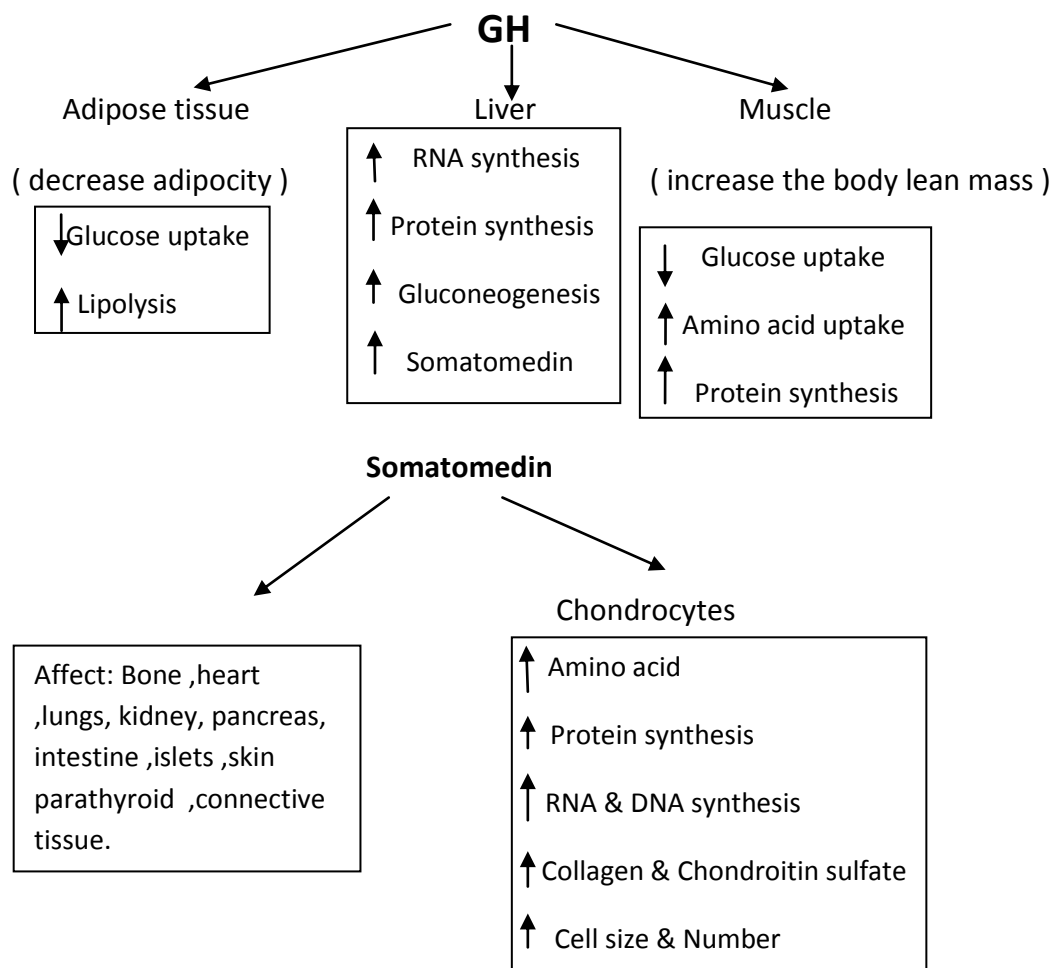
*GH affects the cells of the body in two ways:

- 1) Directly
- 2) Indirectly

-Directly by affecting the adipose tissue ,liver & muscle cells.

-When the GH affects the liver ,it'll produce proteins ,which are hormones called ((somatomedin)) OR ((Insulin-like growth factors)).

-Somatomedin are many hormones "about 6 hormones" that have a similarity in their structure ,also in their function ,but the vary in their potencies.



-Somatomedin are the indirect effects produced by GH.

*So, the GH exerts its effect either directly, which is the Main way for the GH, or indirectly.

*From the functions of the GH, the metabolic ones are important because they're essential for the human beings minute by minute and hour by hour.

***Metabolic Effects of GH :-**

1) Increased rate of protein synthesis (increase rates of GH is probably resulted by increased rate of protein synthesis)

2) Increased mobilization of fatty acids or energy.

3) decreased rate of glucose utilization.

-GH enhances the body protein, uses up "utilizes" the free fatty acids for energy & conserves carbohydrate.

(It spares the glucose to be available at any minute for energy, because glucose is for Fast energy)

***Hypersecretion of GH :-**

(There's an excess "NOT normal" in the secretion of GH)

A)Diabetogenic effect of GH

-GH increases blood glucose concentration.

-It may affect the Beta-cells of pancreas directly , causing over exhaustion of beta cells

-Finally, the result is a diabetes mellitus.

*Direct & indirect effects by production of insulin as well as affecting Beta-cells.

B)Ketogenic effect of GH

***Effects of GH in enhancing fat utilization, for energy:-**

1) Increases the release of fatty acids from the adipose tissue.

2) Fatty acids concentration increases in body fluids.

3) It enhances the conversion of fatty acids into Acetyl-CoA, with the subsequent utilization for energy.

4) In this case spare the protein.

5) Under the effect of GH ,the mobilization of fat requires minutes to hours, where as protein synthesis can be in minutes, because protein synthesis is performed by many hormones NOT only GH.

6) Under the excessive of GH ,great amount of fat mobilized, therefore a lot of acetoacetic acids are formed by the liver, causing ***Ketogenic effect***.

***Diabetogenic effects of other anterior pituitary hormones:-**

1)TSH 2)Prolactin 3)ACTH

*The most important hormones ,which are functioning together, are GH &Insulin in:-

1)Protein intake

2)Carbohydrate intake

3)Fasting

-In protein intake--->Both GH & Insulin increase including somatomedin

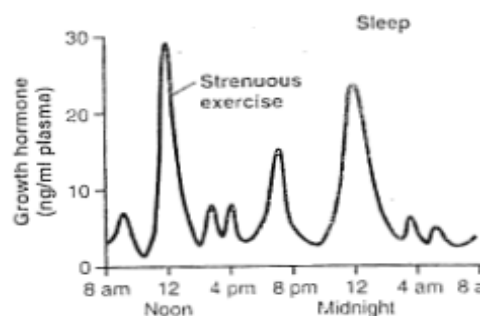
-In carbohydrates intake---> JUST insulin increases ,because it leads to the entering of glucose into the cells, but GH is NOT needed in this condition.

-In fasting---> JUST GH increases ,here we don't need insulin, we need glucose from non-carbohydrate sources.

*The secretion of the GH shows a diurnal rhythm as well as pulses or oscillation rhythms & developmental rhythm.

*The level of GH during the 24 hrs.. the highest at 12 noon and at 12 midnight

the probable explanation of high GH at midnight is the escape of the cells which secrete GH from their control by nerves ,so body becomes out of control of the nerves ,so death is mostly at 3-5 a.m



***Factors that stimulate or inhibit secretion of GH :-**

-The most important in **stimulating** GH is the metabolic, especially the Glucose.

-Also, the Ghrelin, which is a hormone produced by the stomach as well as in the intestines .

"They're saying now that it might be produced by the pancreas"

-Ghrelin can stimulate the appetite.

Stimulate Growth Hormone Secretion

Decreased blood glucose
Decreased blood free fatty acids
Increased blood amino acids
(arginine)
Starvation or fasting, protein deficiency
Trauma, stress, excitement
Exercise
Testosterone, estrogen
Deep sleep (stages II and IV)
Growth hormone-releasing hormone
Ghrelin

-The most important factors that **inhibit** GH secretion are: Obesity, Aging & somatomedin. Others are increased blood glucose and free fatty acids, GH inhibitory hormone (somatostatin) and Somatomedins

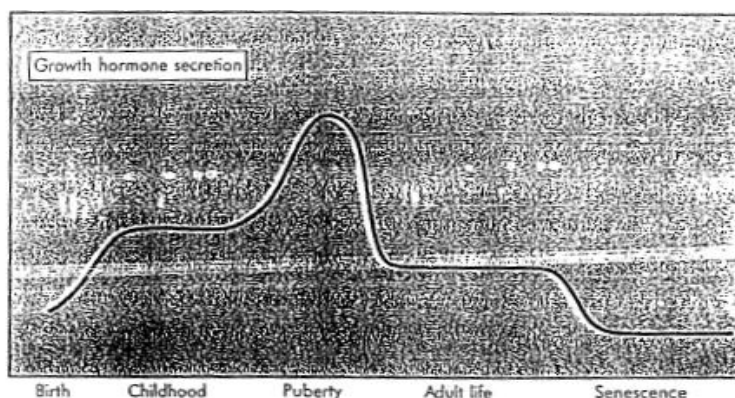
-Stretch receptors in the stomach, as well as hormones along with these receptors, inhibit food intake.

-Peptide YY(PYY), cholecystokinin(CCK)& insulin are gastrointestinal hormones, that are released by the ingestion of food & suppress further food intake

-Obese individuals have large stomach, stretch receptors are away from the food, so they take a lot of food in order to touch the receptors.

Therefore, they've to accommodate gradually to decrease their food, so the stretch receptors to become closer to the food.

*The level of GH during the life:-



■ Fig. 48-19 Lifetime pattern of growth hormone (GH) secretion. GH levels are higher children than adults with a peak period during puberty. GH secretion declines with aging.

-From birth till death."Developmental rhythm".

-There's NO significant difference between adult & childhood."Little bit higher in the childhood".

*ALL types of stresses can lead to increase the secretion of GH.

***The pituitary gland deficiency:**

The **hyopsecretion** of the pituitary gland is NOT a pathologic, it's a physiologic case.

The results of deficiency of pituitary hormones(both post. & ant. pituitary hormones):-

A)Panhypopituitarism

*"pan = all " ,the deficiency of ALL pituitary hormones

*Oxytocin is NOT mentioned here, meaning that it's NOT so important. "its deficiency is NOT very serious".

1)ADH deficiency: water is NOT reabsorbed probably back into blood, it's excreted ,so there'll be a lot of urination (about 20 liter per a day).
If the patient is not treated ,then he'll die. This disease is called ((Diabetes insipidus)).

2)Gonadotropin deficiency: (LH & FSH)

In male: Decreased lipido (There's NO testosterone), asperemia (NO sperms),loss of some facial and body hair.

*note : LH affects leydig cells leading to testosterone synthesis

In female: Also decreased lipido_& amenorrhea(NO menstrual cycle).

3)TSH deficiency: Hypothyroidism.

4)ACTH deficiency: "adrenal cortex hormones are affected"

5)MSH deficiency: pallor color.

6)GH deficiency: causes dwarfism but mentally is normal.

B)Severe anterior pituitary deficiency

*It's similar to Panhypopituitarism except those of the post. pituitary hormones are **normal**.

C)Moderate anterior pituitary deficiency

*Gonadotropins& TSH are deficient, ACTH & MSH are partially deficient, GH is normal.

D)Mild anterior pituitary deficiency

*JUST Gonadotropins are deficient ,the others are normal.

we can notice that in ALL conditions "A-->D" Gonadotropins are deficient

-Hypersecretion of GH:

a) Giantism or gigantism

*If the over-secretion occurs before being adult(during the childhood),almost all the organs will be affected & become larger than normal.

*These individuals will:

-Be 8-9 feet height.

-The giants have hyperglycemia,10% develop diabetes mellitus.

-If the giants remain without treatment ,they'll develop panhypopituitarism.

*All parts of the body develop in appropriate proportion.

-Also the organs will be enlarged .

b) Acromegaly

*If the over-secretion occurs after being adult, after the fusion of the long bones ,the person cannot grow taller (bones cannot grow) ,but the soft tissues can continue growing and the bones can grow in thickness.

***These individuals will :**

-Suffer from enlargement of the small bones of hands ,feet, cranium ,nose ,forehead ,supraorbital ridges , the lower jaw bone and portions of the vertebrae.

-Many soft tissues or organs like : liver ,tongue ,kidneys are enlarged. "also the heart but it's a little bit enlargement".

*There's NO appropriate proportion in the development.

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