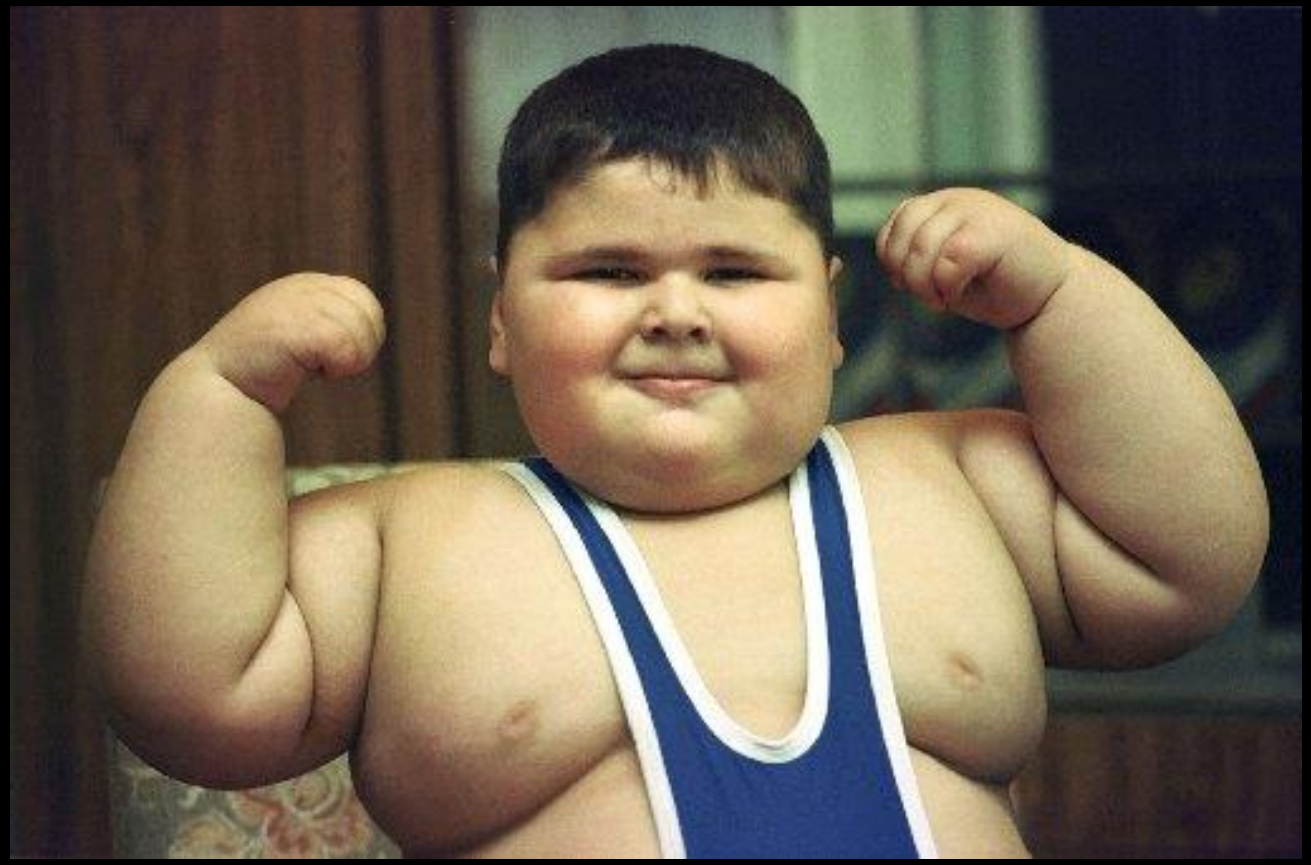
Nafith Abu Tarboush
DDS, MSc, PhD
natarboush@ju.edu.jo
www.facebook.com/natarboush

Obesity



Obesity

- A disorder affecting body weight regulatory systems
- Characterized by an accumulation of excess body fat
- Primitive societies vs. developed ones! (availability & activity)
- Prevalence increases with age

The availability of food nowadays, our new lazy lifestyle and technology made obesity a PANDIMIC disease.
Carbohydrates are the main source of our diet that causes obesity.
The most dangerous and common disease we fear from as a risk from obesity is: Diabetes.

- Risk of associated diseases (diabetes, hypertension, cardiovascular disease)

Obesity

- Childhood obesity: three fold increase in prevalence over the last four decades
- In fact, there are more obese than undernourished individuals worldwide

Obese people today are way more than malnourished people

Statistics

Many huge numbers and statistics show us how serious the problem is.

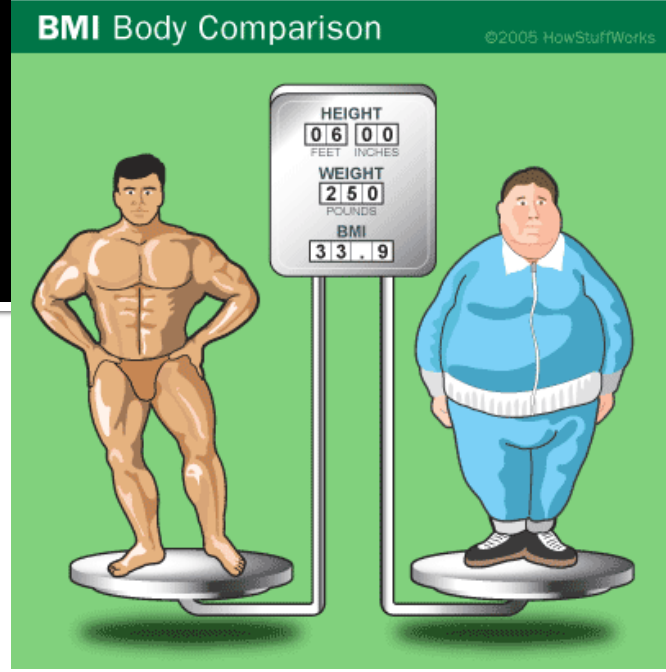
- Approximately 17% of those age 2–19 years are obese
- In USA:

  You have a chance of 50% to become overweight and a chance of 25% to become obese.

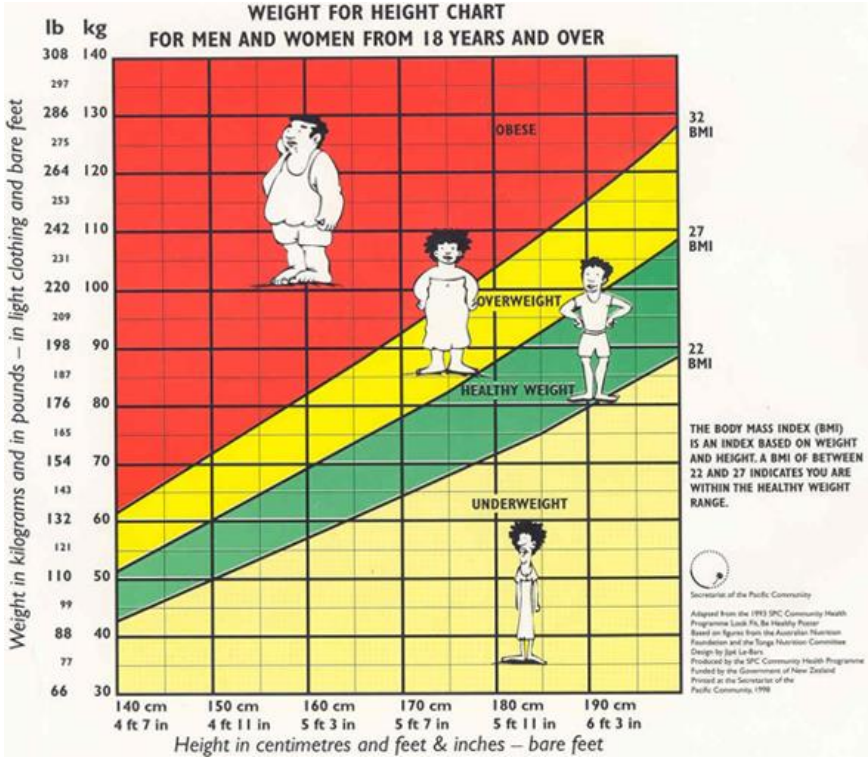
  - Lifetime risk of becoming overweight ~ 50%
  - Lifetime risk of becoming obese is ~ 25%
- Worldwide: 650,000,000 - WHO 2016
- Jordan: 2,800,000 - WHO 2016

Approximately in Jordan 1/3 of the population ARE obese

How do we measure/define obesity?!
Assessment of Obesity



- 1. Body mass index: (exceptions - athletes)
- A measure of relative weight, adjusted for height ⇝ The best indicator for obesity
- Allows comparisons both within & between populations
- BMI = (weight in kg)/(height in meters)2
- Healthy = 18.5-24.9; Overweight = 25-29.9; Obese = ≥30; morbidly obese >40
- ≈ 2/3 of American adults are overweight & > 36% are obese



Assessment of Obesity

-It's how much weight do you have divided by your squared height.

HEALTHY
18.5-24.9

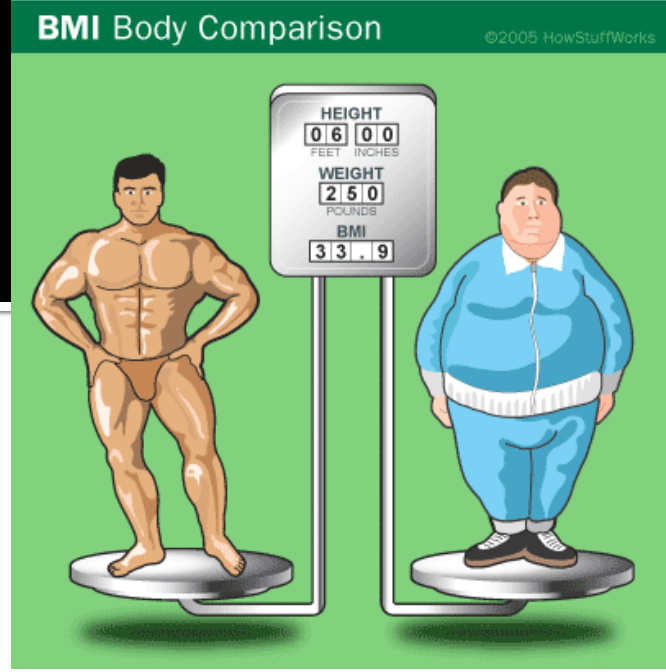
OVERWEIGHT
25-29.9

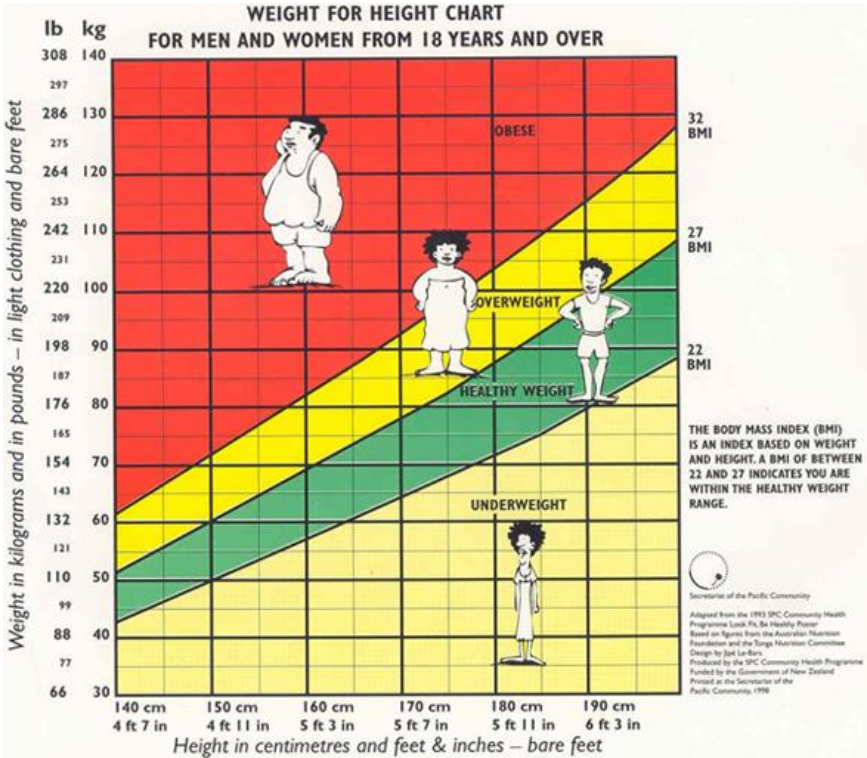
OBESE
=> 30

MORBIDLY OBESE
> 40

$$BMI = \frac{Weight(Kg)}{Height(m^2)}$$

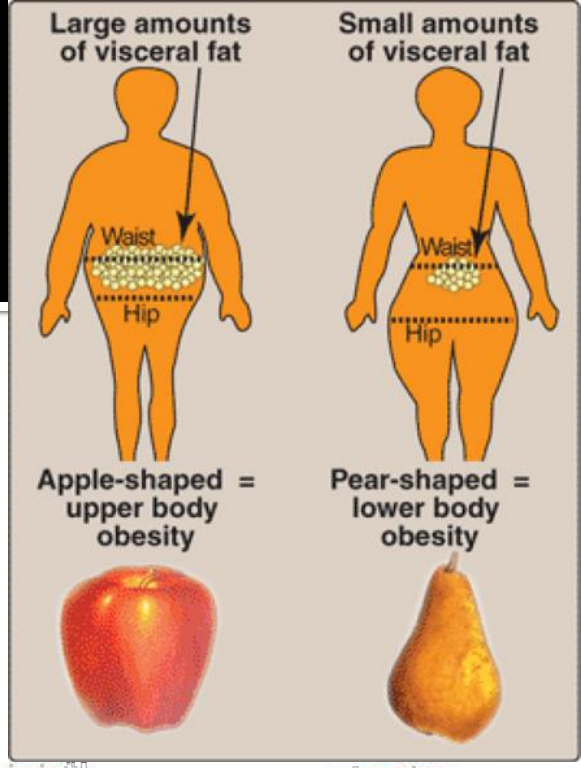
-Morbidly obese leads to surgical and medical intervention, because at this stage obesity **IS** a disease.





Assessment of Obesity

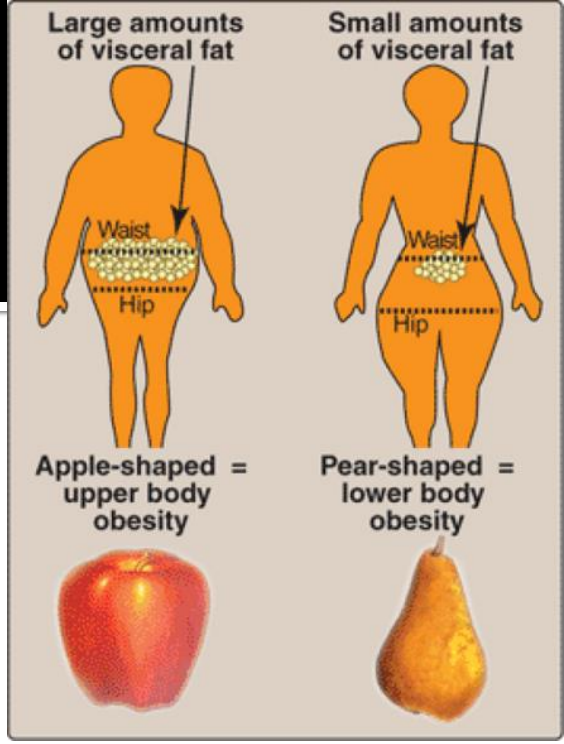
- 2. Waist circumference: ≥40 in (2.54cm) (men) and ≥35 in (women) ** they considered obese which is a risk factor for other diseases.
- 3. Anatomic differences in fat deposition (W/H ratio)
- Android, "apple-shaped," or upper body obesity: excess fat located in the central abdominal area
  - Associated with a greater risk for hypertension, insulin resistance, diabetes, dyslipidemia, & coronary heart disease
  - Waist to hip ratio: >0.8 for women & > 1.0 for men



People are different in fat deposition (males/females) and their body shape between each gender.

Assessment of Obesity

- Gynoid, "pear-shaped," or lower body obesity: fat distributed in the lower extremities around the hips or gluteal region
  - Waist to hip ratio: < 0.8 for women & < 1.0 for men
  - Relatively benign health wise
  - Commonly found in females



then it may become a risk factor, below this ratio it doesn't make any problem otherwise, it tells you that the hip has more accumulation of fats than the abdominal.

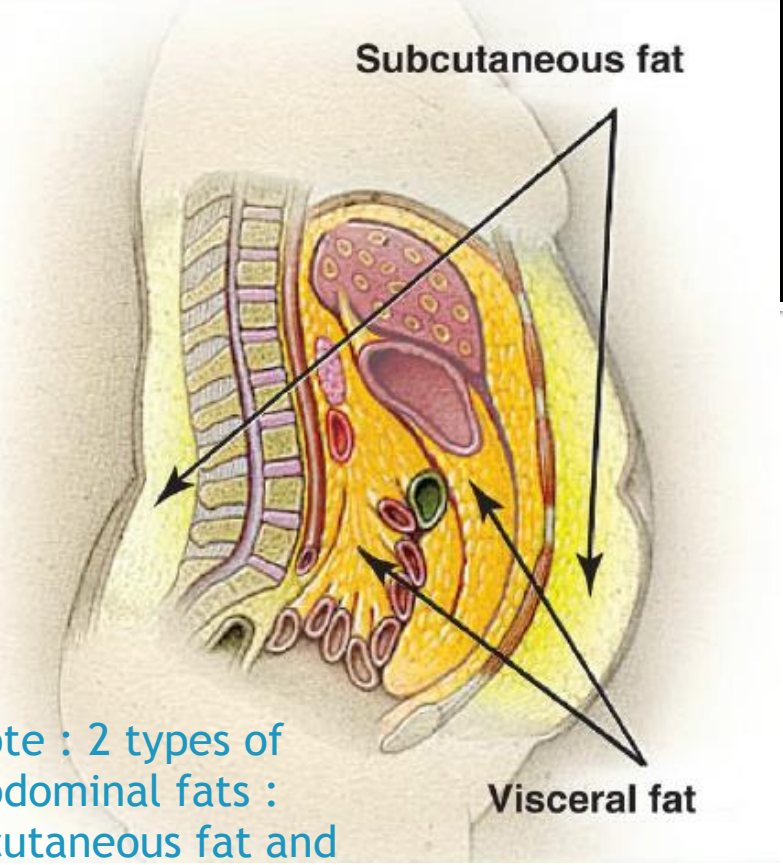
Assessment of Obesity

- Biochemical differences in regional fat depots

Different between abdominal fats and gluteal fats:

A. Abdominal fat:

- Cells are much larger
- Higher rate of fat turnover
- Hormonally more responsive
- Readily mobilizable: men lose weight more readily than women
- Portal vein: fatty acids may lead to insulin resistance & increased synthesis of triacylglycerols, which are released as very-low-density lipoprotein (VLDL)

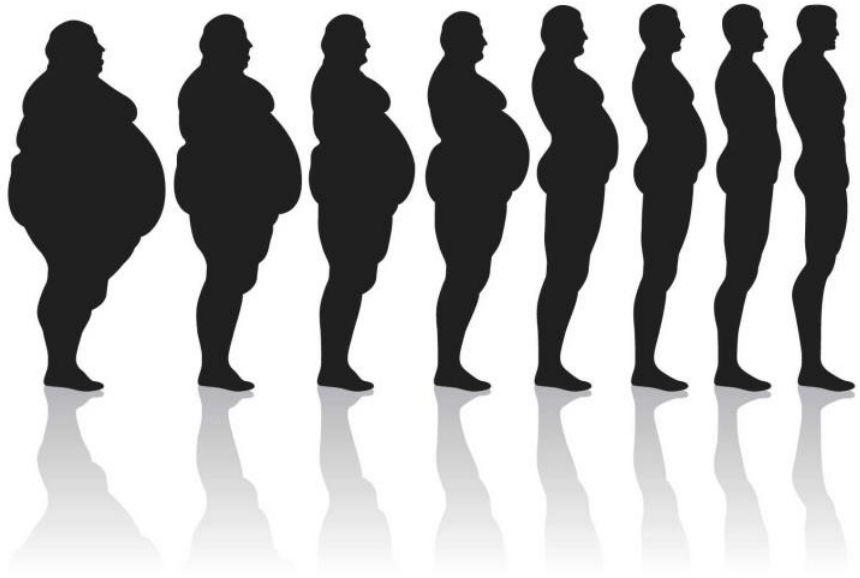


Note : 2 types of abdominal fats : (subcutaneous fat and visceral fat) .

Assessment of Obesity

- Biochemical differences in regional fat depots

B. Gluteal fat: fatty acids from gluteal fat enter the general circulation, & have no preferential action on hepatic metabolism



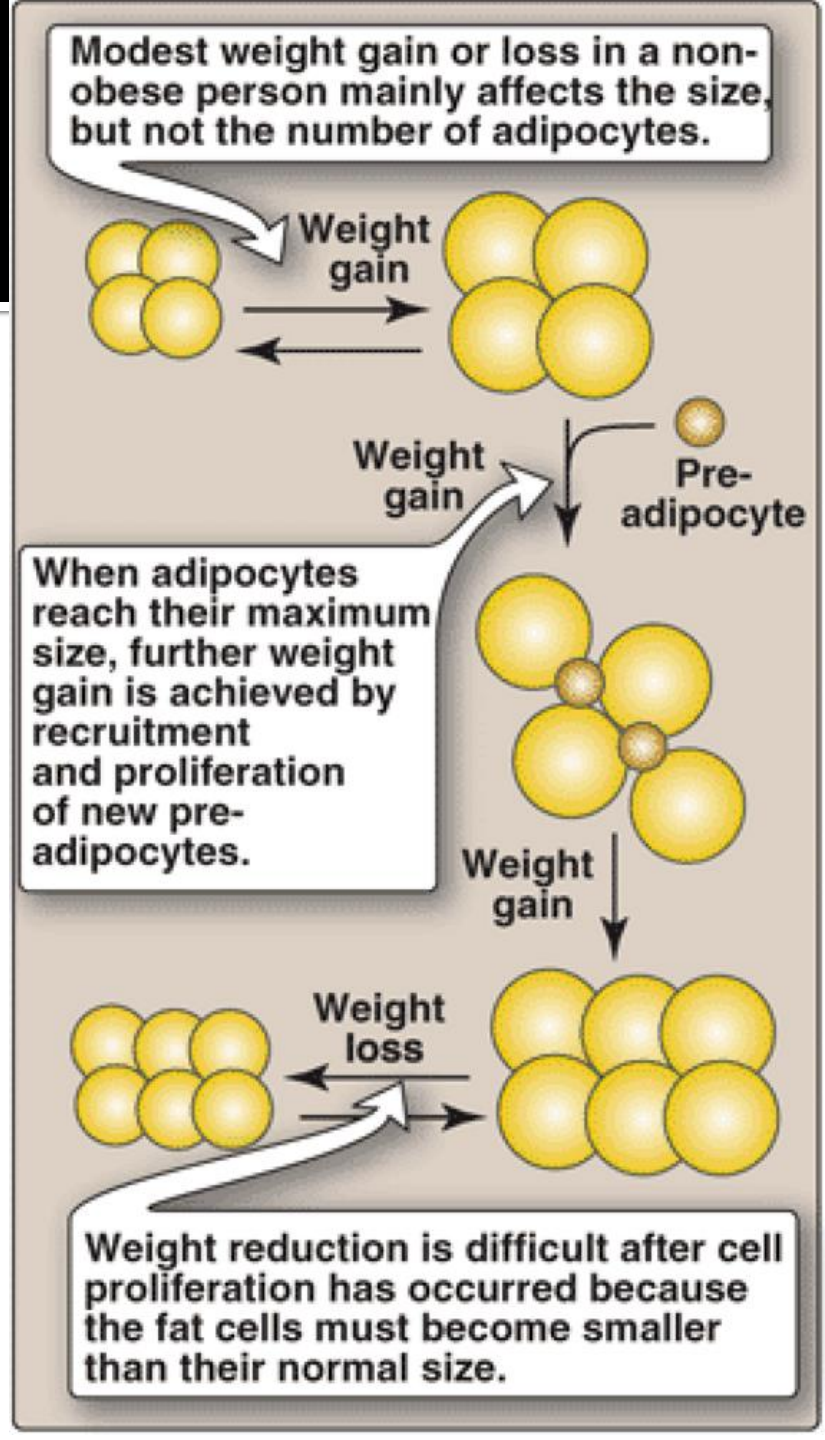
-

Abdominal fat .	Gluteal fat .
Large cells.	Small cells.
Higher rate of fat turnover	
Activity of the enzymes on them is much easier. (visceral fats is also easier than subcutaneous fats).	In other words, mobilization of (FFA) from the TAG in the gluteal region is much harder to occur.
Worsley impact the health. Because it is very close to the liver So FFA go direct to the liver through portal vein and combine them to TAG again. converting them to the VLDL . VLDL is a risk factor for many diseases such as cardiovascular diseases .	FFA from the hip area enter the general circulation, so it decreases the amount of FFA that is converted to VLDL.

Depending on the previous info. it has been noticed that men can lose weight faster then women.

Assessment of Obesity

- Number of fat cells
- The ability of a fat cell to expand is limited (2-3 folds)
- Fat cells, once gained, are never lost! (10 years cycle)
- Formerly obese patients have a particularly difficult time maintaining their reduced body weight



Assessment of Obesity

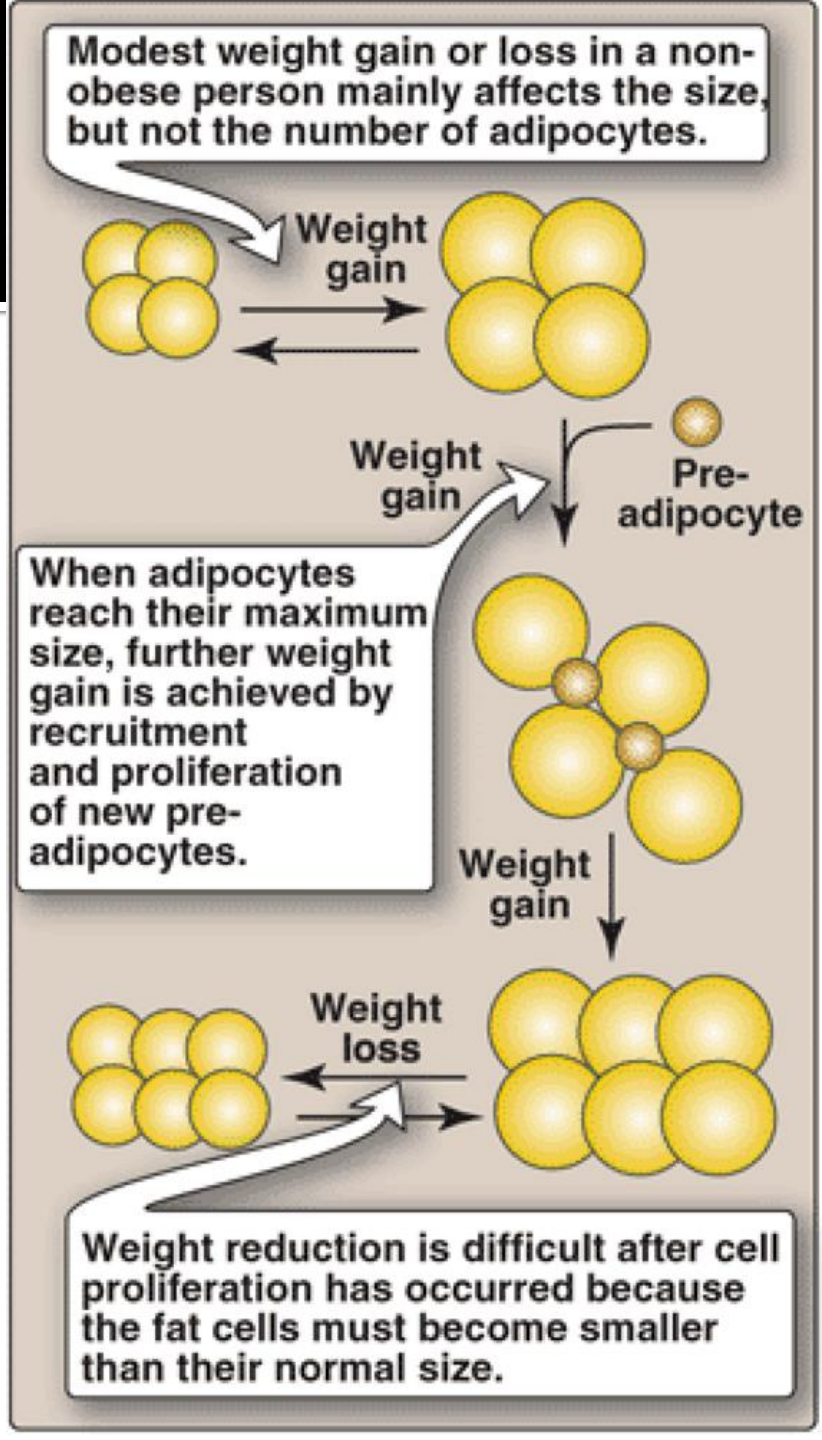
You must take care of your self since you were a child because Fat cells, once gained, may lose them BUT they have a very long cell cycle which can last up to 10 years).

When you over eat, fat cells will expand (hypertrophy) 2 to 3 times of their original size, after this if you have an excess fat your body will store them as a new adipocytes (Hyperplasia).

New adipocytes are formed from a preadipocytes which can NOT divide.

you can not play with the number of cells because their remodeling takes several years, you can just decrease their size.

لهيك عادة الي بعاني من سمنة في طفولته صعب يخسر وزن عند كبره بسبب تكون الخلايا الدهنية

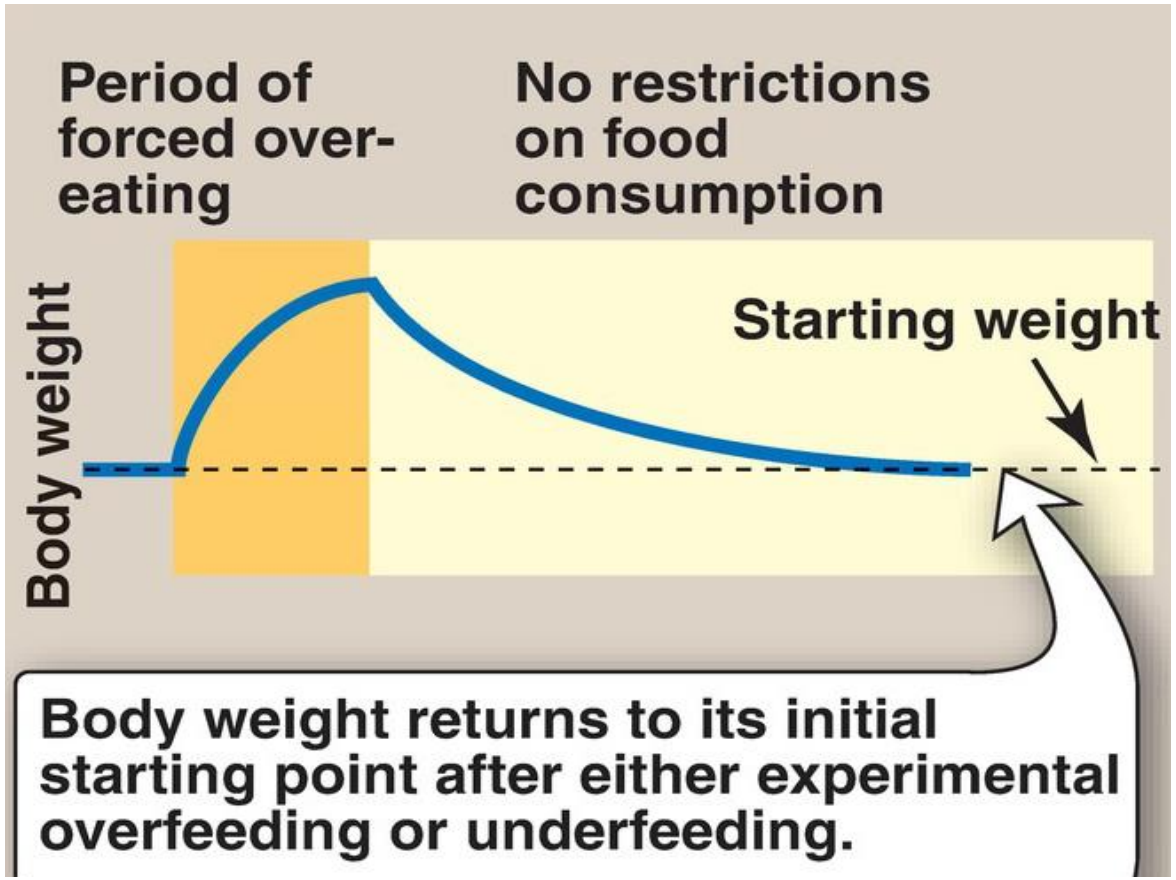


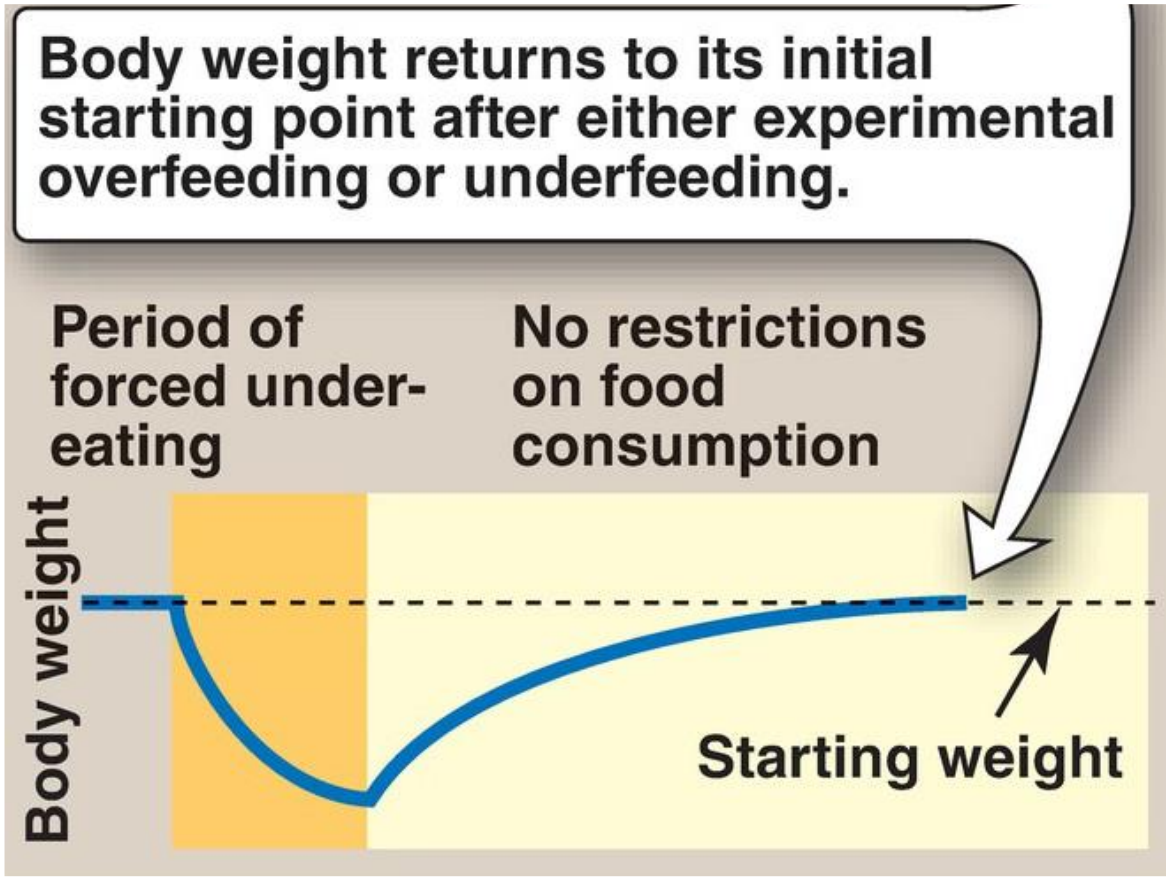
Body Weight Regulation

Body weight is stable as long as the behavioral & environmental factors that influence energy balance are constant

Every one has a set point of his weight and it can't be changed !!
even though this information may hurt a lot of you BUT
unfortunately this is the ugly truth.

The concept of a set point! – not a 100%



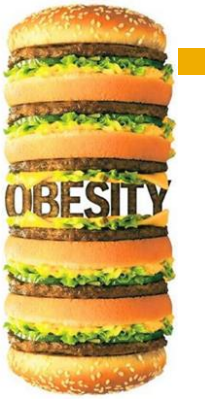


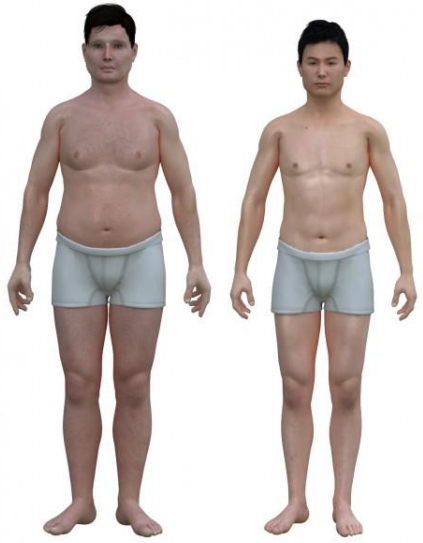
A. Genetic contributions to obesity

- Uncontrolled, greedy eating behavior
- Genetic mechanisms play a major role in body weight (rather than a lack of willpower)
- Often observed clustered in families
- 80% when parents fat, 9% when parents are lean
- Inheritance is not simple mendelian genetics (a complex polygenic disease)
- Adopted children usually correlates with biologic parents
- Identical twins have very similar BMI

B. Environmental & behavioral contributions

- The epidemic of obesity occurring over the last four decades! genetic factors are stable on this short time scale





- Environmental & behavioral:
  - Ready available food
  - Energy-dense food
  - Sedentary lifestyles: TV, cars, computer (energy-sparing)
  - Eating behaviors: snacking, portion size, number of people

- Men in Japan (aged 46–49 years) are lean (BMI = 20), in California (BMI = 24)

Molecules that Influence Obesity

Obesity results when energy intake exceeds energy expenditure

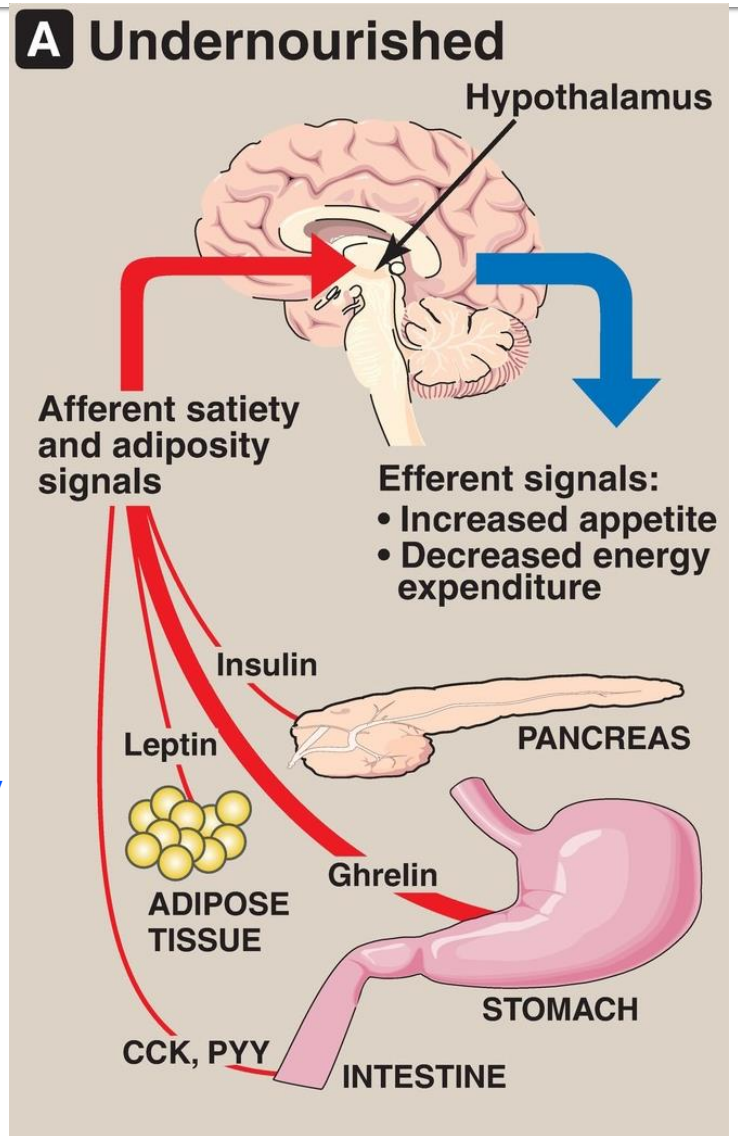
- Can be long term or short term

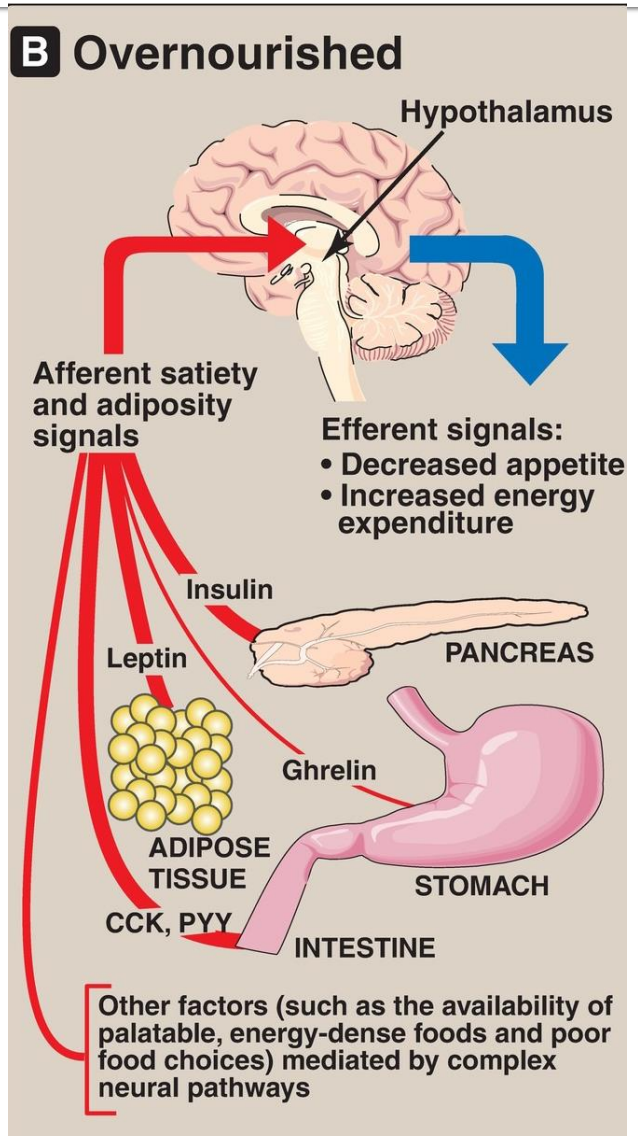
Molecular influences

Gut hormones such as CCK, PYY
Ghrelin suppresses cholecystokinin (CCK), peptide YY (PYY)

Controlling the obesity is very complicated ,so the brain (hypothalamus), pancreas and GI system are the ones who takes the lead.

Molecules from these organs control your appetite and energy expenditures by something called (GOT – BRAIN ACCESS)





IN UNDERNOURISHED:

Insulin	low
Ghrelin (Hungry hormone)	High
Leptin	low
CCK ,PYY	low

Over nourished :

Insulin	High
Ghrelin (Hungry hormone)	Low
Leptin	High
CCK ,PYY	High

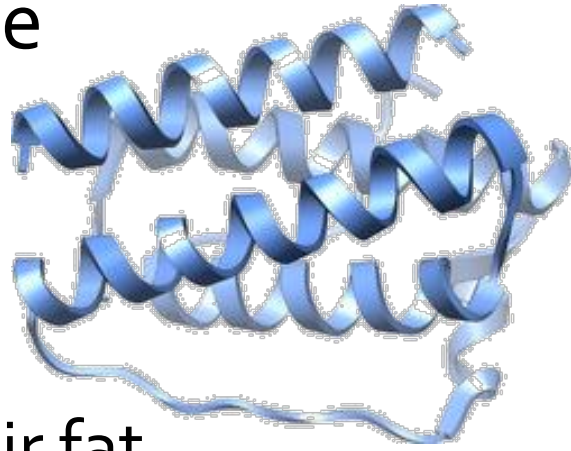
Adipose tissue is a hormonal organ produce many hormones called ADIPOCHINES such as ((leptin))

CCK is Produced to activate trypsine secretion

Long Term Signals

- Reflect the status of fat (TAG) stores
- 1. Leptin: Structure, product of ob gene, Produced proportionally to the adipose mass, Informs the brain of the fat store level, Regulate body fat through the control of appetite & energy expenditure (an anorexigenic effect)
  - Daily injection of leptin in mice
  - Plasma leptin in obese humans is usually normal for their fat mass (resistance to leptin rather than deficiency)

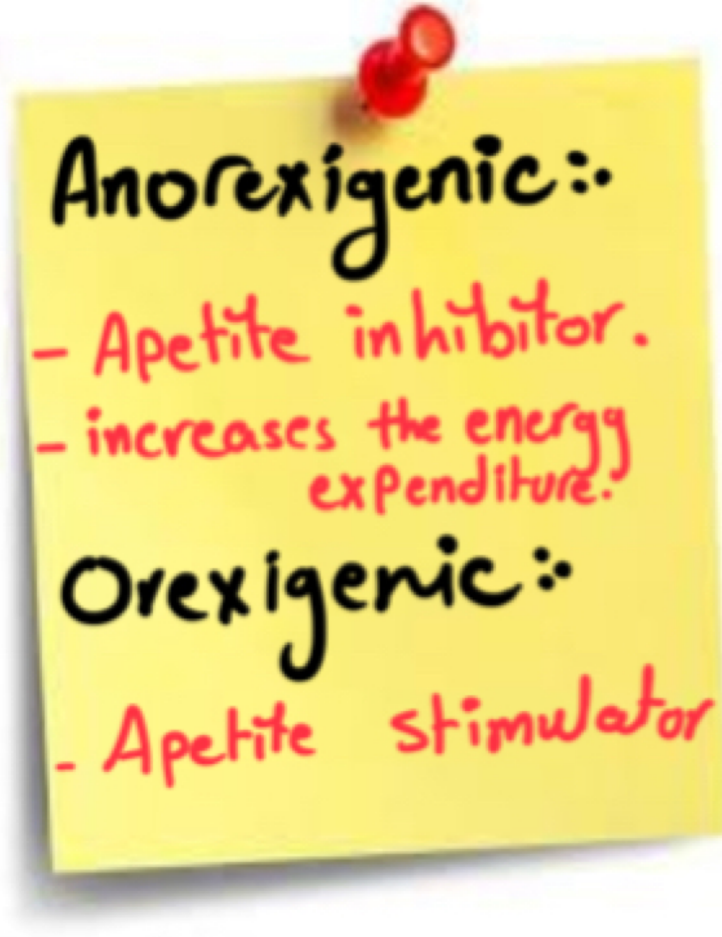
Composed of alpha helices and product of OB gene (with reference to Obesity)

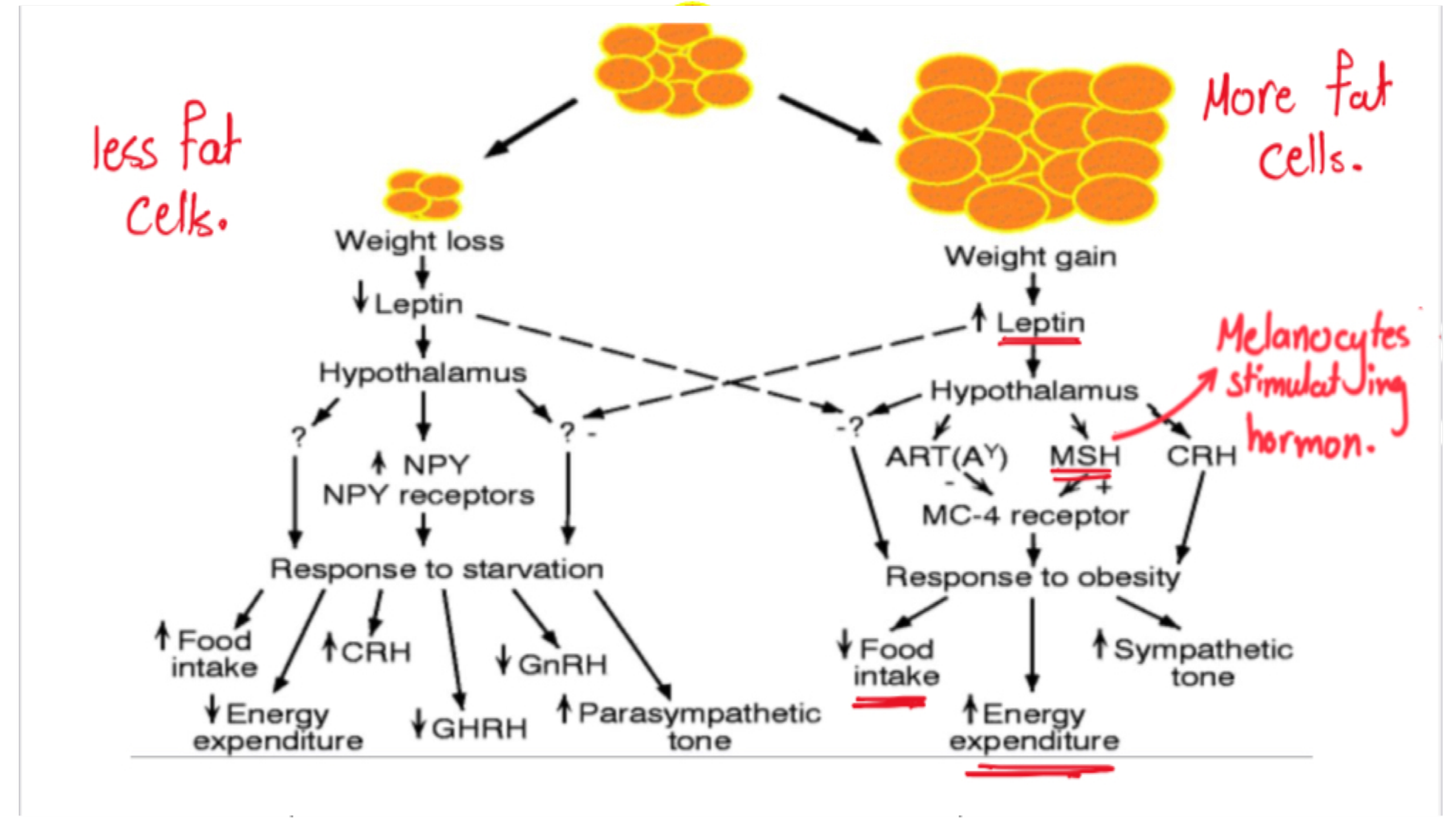


As long as when fat content increase in your body, leptin secretion will increase too.

So why do we have obesity !?
If leptin increases - appetite decreases - energy expenditures increases – no obesity .
Why it doesn't happen here ?

Because receptors of leptin will have resistant against high concentration of leptin . (Same issue of DM with insulin)
Leptin is high but it isn't working (not functional because of resistance)




less fat cells.
More fat cells.
Weight loss
Leptin
Hypothalamus
?
NPY
NPY receptors
?
Response to starvation
Food intake
Energy expenditure
CRH
GHRH
GnRH
Parasympathetic tone
Weight gain
Leptin
Hypothalamus
?
ART(AY)
MSH
CRH
MC-4 receptor
Melanocytes stimulating hormon.
Response to obesity
Food intake
Energy expenditure
Sympathetic tone

Long Term Signals

- 2. Insulin:
  - Obese individuals are also hyperinsulinemic
  - Like leptin, insulin acts on hypothalamic neurons to decrease appetite
  - Obesity is associated with insulin resistance

Short Term Signals

control hunger and satiety.
Affect size (during eating) and number of meals(between the meals)

- From the GI tract (control hunger and satiety)
- Affect size and number of meals (over minutes to hours)

- In the absence of food intake (between meals)
  - Stomach produces ghrelin – orexigenic (appetite-stimulating)

- As food is consumed
  - GI hormones (CCK and peptide YY, …) induce satiety (an anorexigenic effect) → terminating eating

Short Term Signals

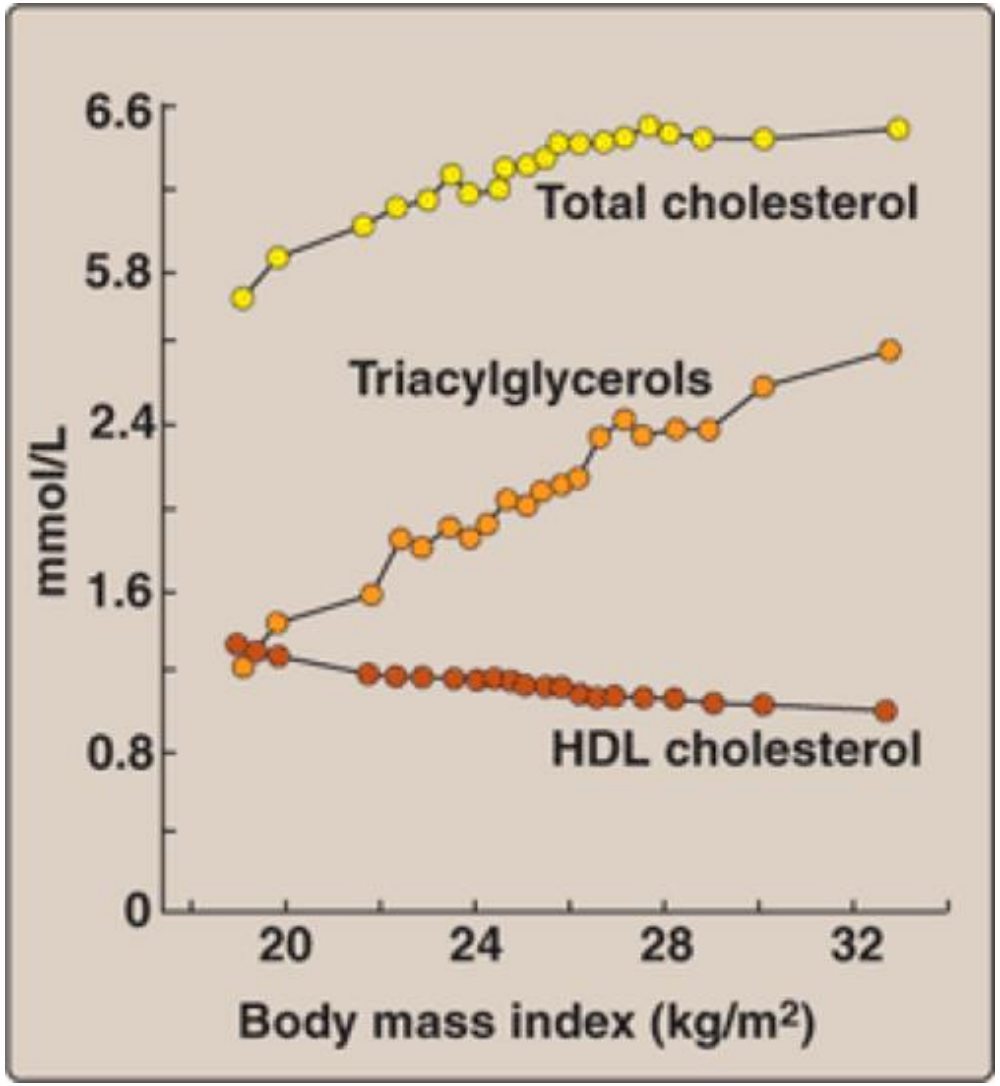
- Within the hypothalamus
  - Neuropeptides (such as orexigenic neuropeptide Y [NPY]) and anorexigenic α-MSH and neurotransmitters (such as serotonin and dopamine) are important in regulating hunger and satiety
- Long-term and short-term signals interact
  - Leptin increases secretion of α-MSH and decreases secretion of NPY
  - There are many complex regulatory loops that control the size and number of meals in relationship to the status of body fat stores
- α-MSH (proopiomelanocortin) → (MC_4R) -(very big protein)
  - Loss-of-function mutations to MC_4R are associated with early-onset obesity

Metabolic Changes Observed in Obesity

- Metabolic syndrome (insulin resistance syndrome, syndrome X)
  - Glucose intolerance, Insulin resistance, Hyperinsulinemia
  - Dyslipidemia (low HDL & high VLDL)
  - Hypertension
- Increased risk for diabetes mellitus & cardiovascular disorders (men: 4 times higher mortality of cardiovascular disease)

Metabolic Changes Observed in Obesity

- Insulin resistance causes increased activity of hormone-sensitive lipase, resulting in increased levels of circulating fatty acids
- In liver converted to triacylglycerol and cholesterol
- Released as VLDL, resulting in elevated serum triacylglycerols
- Concomitantly, HDL levels are decreased (when increasing the BMI)

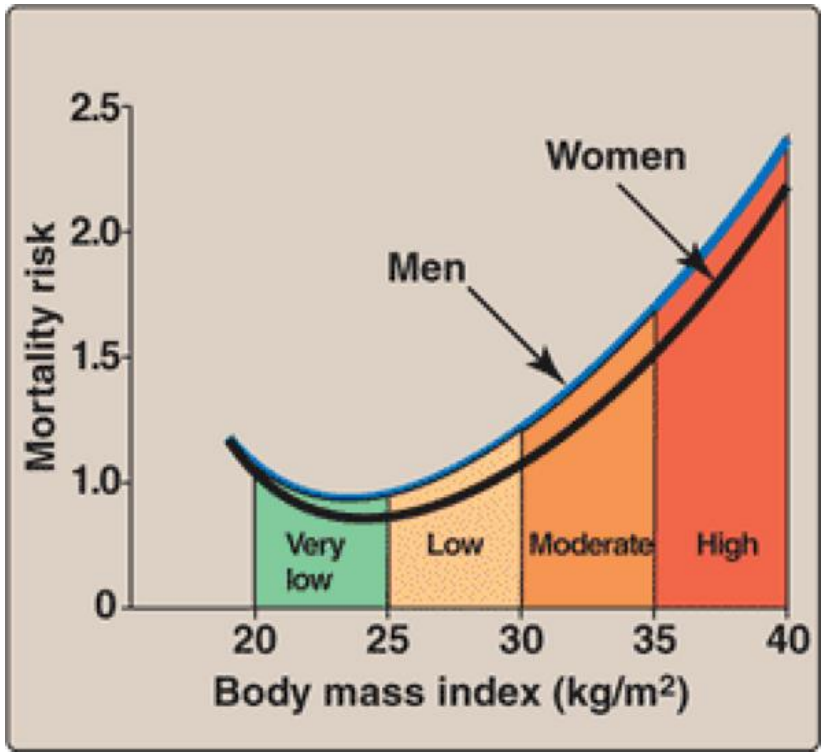


Obesity and Health

- Correlated with increased risk of death
- Risk factor for:
  - Adult onset diabetes; Hypercholesterolemia; High plasma TAGs; Hypertension; Heart disease; some Cancers; Gallstones; Arthritis; Gout

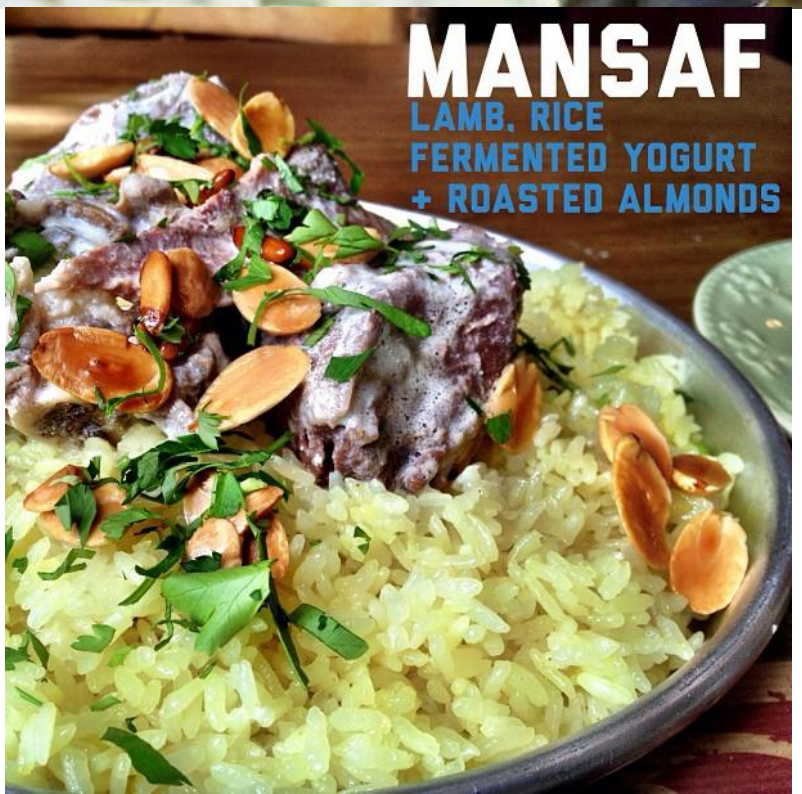
The relationship is weak for >55 and < 74.

- The relationship is stronger for <55 yrs
- After age 74, there is no association between increased BMI & mortality



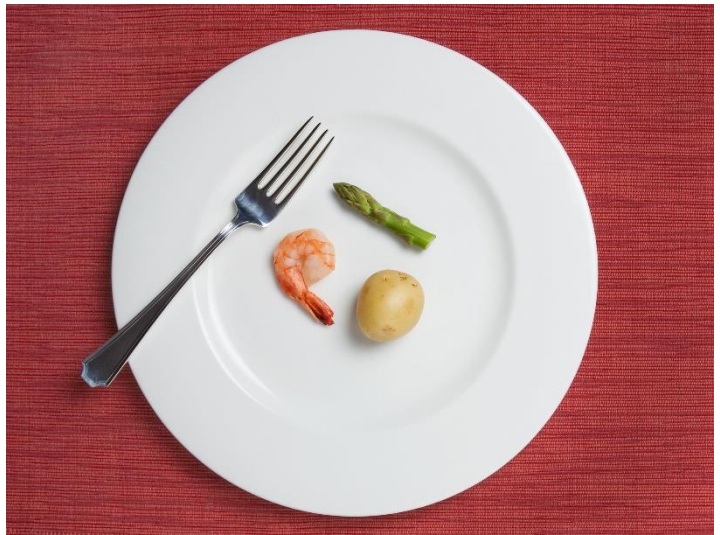
Weight Reduction

1. Physical activity
- Create an energy deficit
- Increases cardiorespiratory fitness
- Combine caloric restriction & exercise with behavioral treatment may lose about 5–10% of body weight over a period of 4–6 months



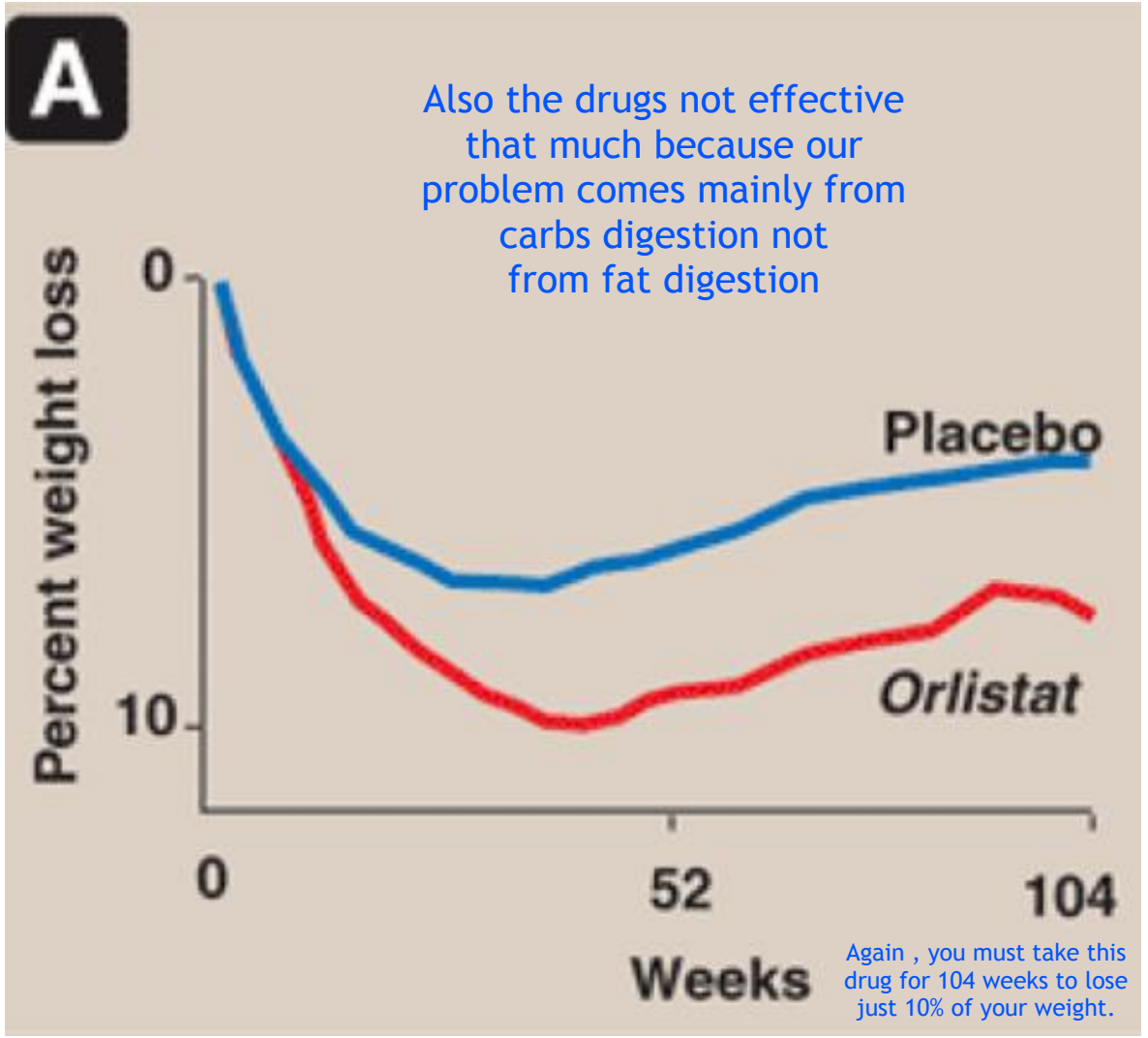
Weight Reduction

- Caloric restriction
- The most common approach
- 1 pound (454 gm) of adipose tissue corresponds to approximately 3,500 kcal
- Ineffective over the long term for many individuals



Weight Reduction

- Pharmacologic & surgical treatment
- Two medications (BMI ≥ 30):
  - Sibutramine: appetite suppressant that inhibits the reuptake of both serotonin & norepinephrine
  - Orlistat: lipase inhibitor that inhibits gastric and pancreatic lipases



Weight Reduction

- Surgical procedures are an option for the severely obese patients

the whole idea is to reduce the size of the stomach and gives the best outcomes (lose 35% from their weight) but not the best lifestyle .

Risk factors :

1- The Stomach is a muscular tissue could be expanded again and every thing back to its normal.
2- Undigested food due to loosing the stomach function .
3- Hormonal increase (Ghrelin mainly) are produced from the stomach which effect the brain .

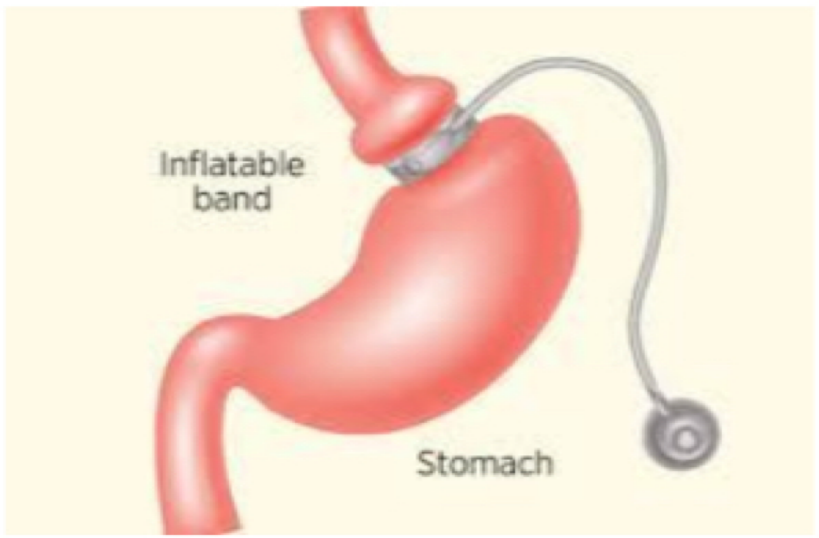
لهيك الأشخاص الي عاملين عمليات قص معدة دائمًا بكونوا جوعانين .

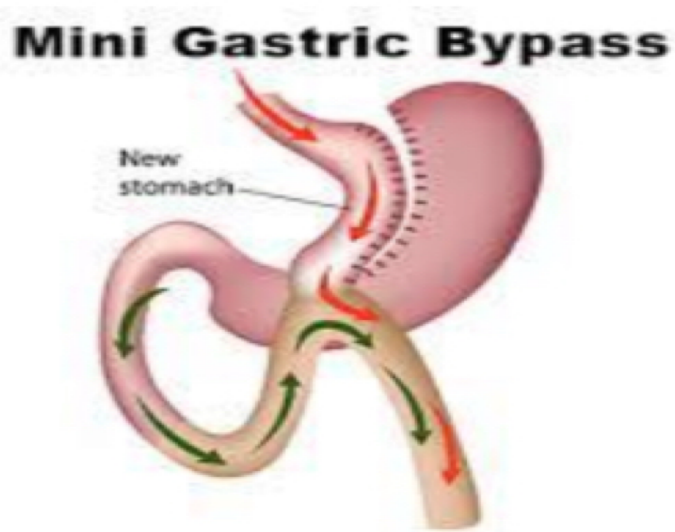
And this depends on the site of removal and how much cells are dead.

Another surgical interventions:

1- **gastric band** to decrease the amount of food that get inside the stomach. (Hormonal secretion and digestion don't change) .

2-**gastric bypass** surgeons link the jejunum to the stomach, so the food doesn't pass by the stomach it passes through the jejunum also, they link the jejunum to the duodenum to receive the pancreatic enzymes.





Weight Reduction

- Surgery produces greater & more sustained weight loss than dietary or pharmacologic therapy, but has substantial risks for complications