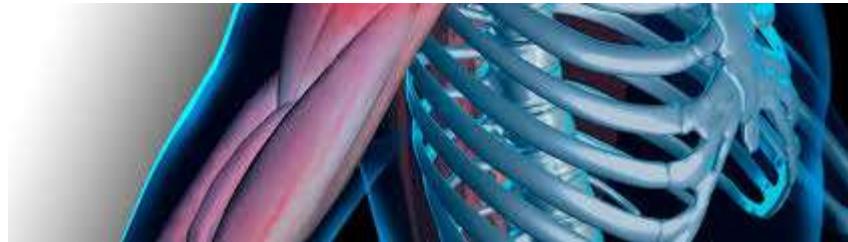


# Boost your Bone Health with Special Focus on Vitamin D

# Musculo – Skeletal Health



Muscles, joints and bones work well together with ease without any pain, stiffness or fatigue

# Why Bone Health is Important?

- Protects & supports the body
- Storehouse of minerals esp calcium, phosphorous, magnesium and zinc
- Produce blood cells ( RBC) that nourish the body
- Produce blood cells ( WBC) that protects the body against infection

# How to Ensure Bone Health

- Proper intake of nutrients – Calcium, Vit D, protein and micronutrients like Magnesium, Vit K, Vit C, Zn etc
- Absorption of nutrients
- Regular Physical Activity

# Calcium & Vit D

## Interdependent Functions

- Vit D increases intestinal absorption of calcium
- Maintains normal blood levels of Ca & P
- In Vit D deficiency, calcium leaches out from bone making them brittle & hollow

## Independent Functions

### Calcium

- Formation of bone and teeth
- Muscle movement
- Blood clotting
- Transmission of nerve impulses
- Normal heart rhythm

### Vit D

- Improves
- Immunity
  - Muscle co-ordination
  - Muscle mass & its strength

# Calcium from Diet

## RDA -1000-1200 mg / day



# 1500 Kcal Vegetarian Diet Plan

## Protein – 70 gm    Calcium -1689 + mg

Food	Quantity	Household Measure	Calcium ( mg)
Dairy Products	930 ml	2 cup milk ( 250 ml each) + 2 katori curd from skim milk ( 200 gm each)	1050 + 596
Pulse	75 gm	2 katori dal + a handful of bhuna chana ( 15 gm) or $\frac{1}{2}$ katori sprouts ( 35 gm)	Variable
Cereal	120 gm	1 slices whole wheat bread + 20 gm Dalia/ Oats/ Suji + 4 chapati or 2 chapati + 1 Katori rice	Less
Vegetable A	200 gm	Spinach/ Sarson ka saag/ Methi/Lettuce/Bathua/Ghia/tinda/ tori	Variable
Vegetable B	400 gm	2 Katori cooked vegetable + 2 plate salad	Variable

Food	Quantity	Household Measure	Calcium ( mg)
Fruit	300 gm	$\frac{1}{2}$ medium apple + 1 orange / $\frac{1}{2}$ banana + 1 small guava / 2 slices pineapple	Variable
Fat	15 gm	3 tsp	-
Sugar	10 gm	2 tsp	-
Sunflower seeds	5 gm	1 tsp	4
Almonds	8 no.	8 no.	18
Prunes	5 no.	5 no.	21

**In case you are lactose intolerant include foods like paneer, tofu, soymilk, dry coconut, methi leaves, broccoli, sesame seeds, poppy seeds, chia seeds, moringa leaves**

# Calcium from Supplement

- **Types**

**Calcium carbonate** - to be taken with food.

**Calcium citrate** – can be taken with or without food

- **Don't take more than 500 mg at a time**



# Maximizing Ca Absorption from Supplements

- Avoid Ca supplements with
  - Very high fiber meals -as it can bind with calcium
  - High salt and caffeine rich foods as they can interfere with Ca absorption
- If taking both calcium & iron supplement, keep a gap of 2-3 hrs between them
- Hypothyroids - avoid taking Calcium supplement at the same time with thyroxine to avoid negative interaction

# Absorption of Calcium from Foods



# Vit D - Sources

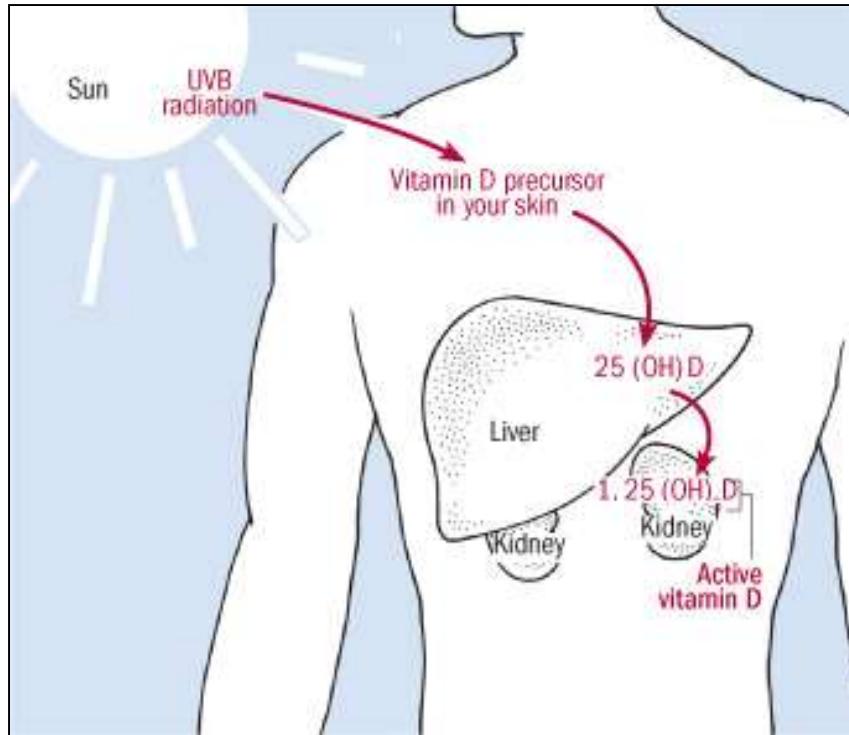
- Made in the skin by exposure to UVB rays from sunlight – D3
- Food source
  - Animal sources ( fatty fish – mackerel, salmon , sardine, fish liver oil, egg)– Vit D3
  - Plant source ( mushroom exposed to sunlight / UV light, yeast)– Vit D2
  - Fortified foods ( breakfast cereals, milk, soymilk, tofu, orange juice)

Both D3 and D2 are inactive forms of Vit D

**Requirement**– 800 - 1000 IU/day



# How The Body Makes Vit D



The sun's energy turns a chemical in the skin into vitamin D<sub>3</sub>, which is carried to liver and then to kidneys to transform it to an active form of vitamin D ( calcitriol)

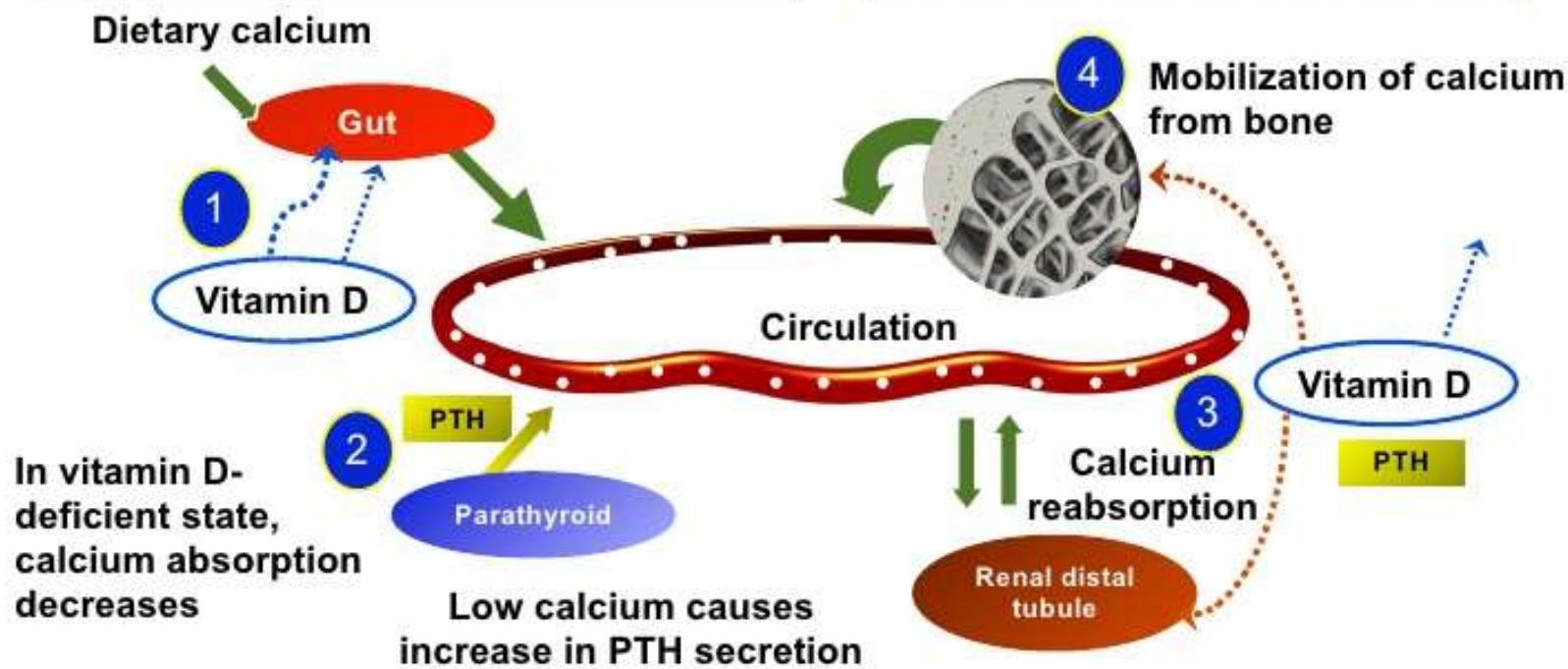
# Vitamin D and Bone Metabolism

## Balanced System

Calcium absorption meets metabolic demands  
Normal bone mineralization is maintained

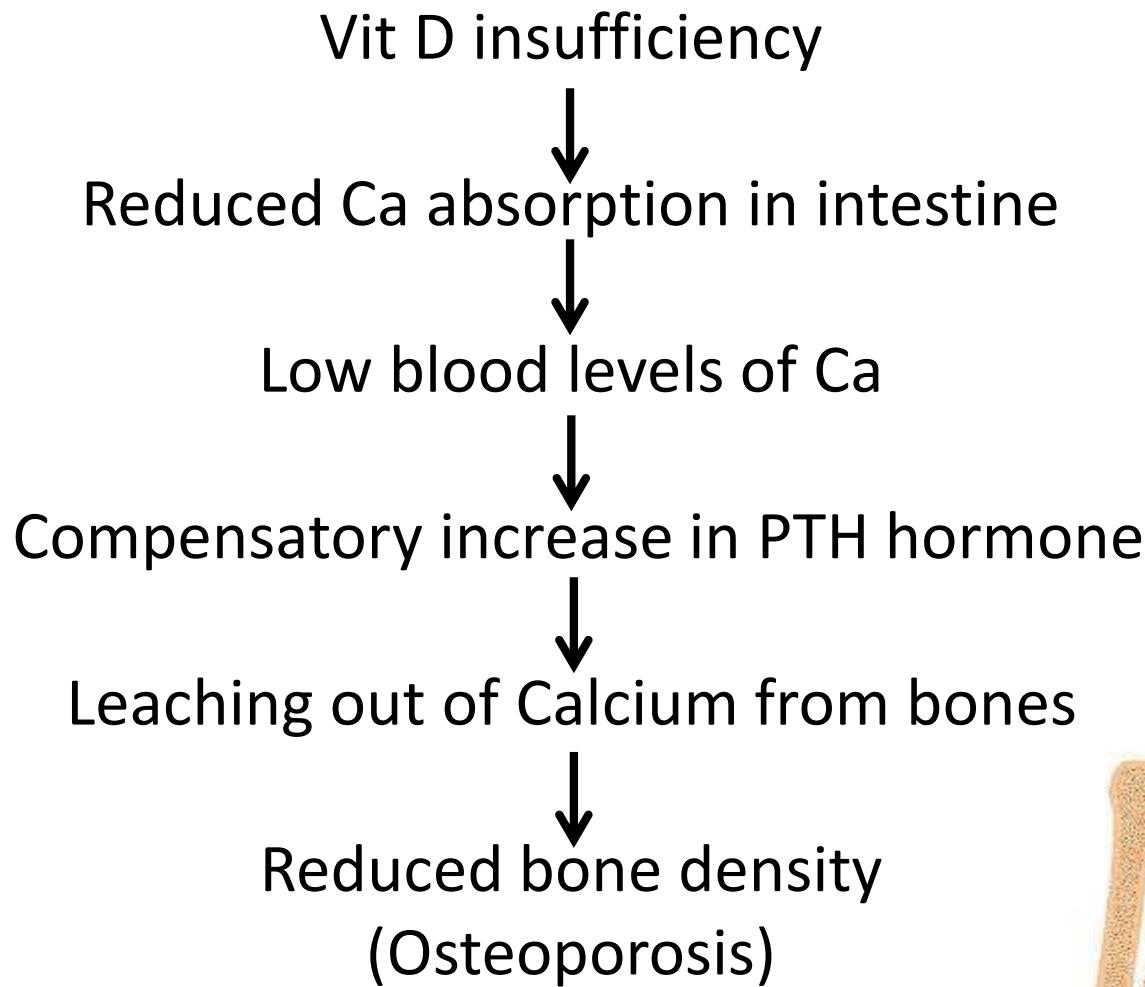
## Low Levels of Vitamin D

Calcium reservoir of bone is depleted to correct for low calcium absorption in gut



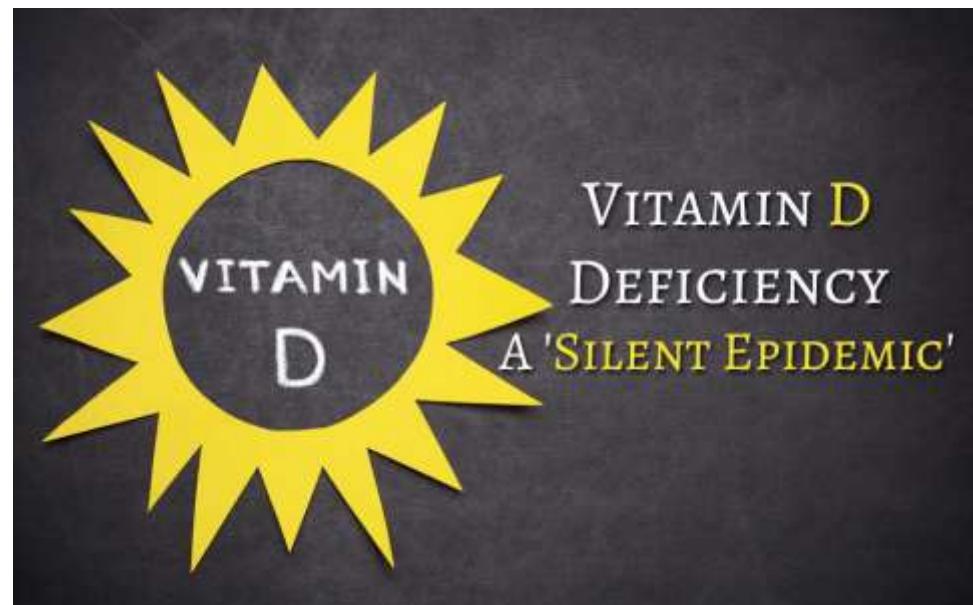
Adapted from: Holick M. *Curr Opin Endocrinol Diabetes*. 2002;9:87–98; DeLuca HF. *Am J Clin Nutr*. 2004;80(suppl 1):1689S–1696S; Lips P. *Endocr Rev*. 2001;22:477–501; Holick MF. *J Nutr*. 2005;135:2739S–2748S.

# Effect of Inadequate Vit D



# Vit D Deficiency - Prevalence

- Most prevalent and underdiagnosed medical condition in the world
- 70 – 90 % of healthy Indian population is Vit D deficient



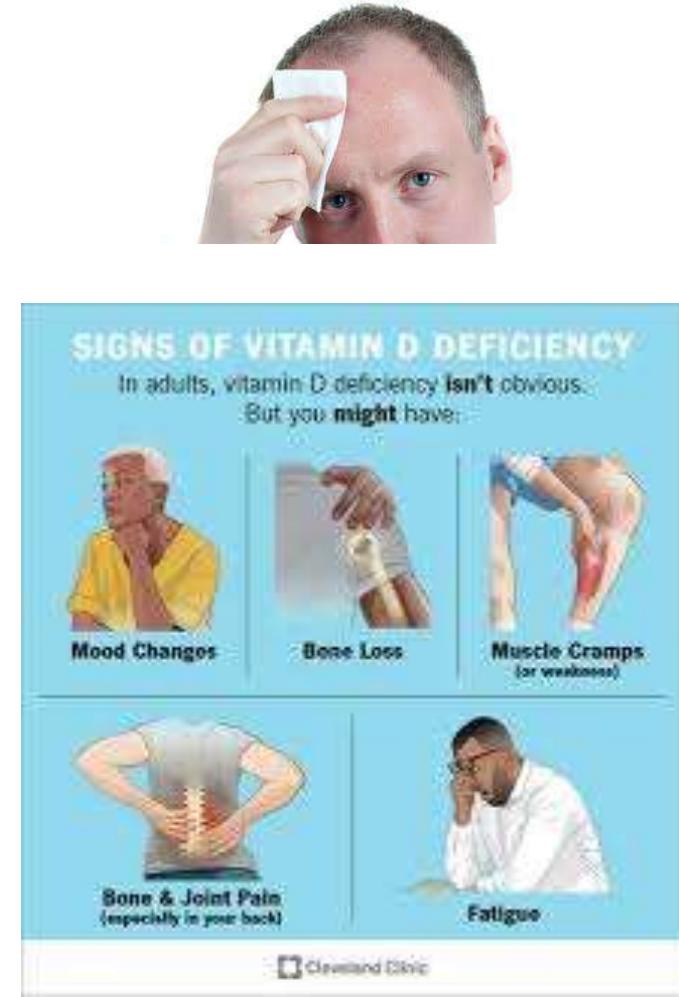
# Why Don't We Get Enough Vit D?

- Difficult to measure how much we get from food & sunlight
- Lack of adequate sun exposure
  - Latitude, season
  - Skin colour
  - Use of sunscreen
  - Clothing cover
- Few natural foods rich in Vit D
- Lack of availability / cost of Vit D fortified foods

**Supplement is the only choice**

# Symptoms of Vit D deficiency

- Sweaty forehead, but not the rest of the body
- Pain in bones
- Chronic fatigue
- Large waist circumference
- Fracture due to little force
- Frequent viral infections
- Low / depressed mood
- Slow wound healing
- Muscle ache
- Loss of hair



# Diagnosis of Vit D Deficiency

- Low Blood Vit D level
- Increased PTH Level

Blood Vit D - 25 ( OH ) D Levels

Normal - 20-100 ng / ml

Toxicity - > 100 ng / mL

**Maintain serum Vit D levels around 50 ng/ ml**

# How To Get Vit D From Sun

- **Time of day** – 11 am – 2 pm
- **Amount of skin exposed** -forearms, hands or lower legs should be exposed to sun without sunscreen
- **Duration** 15 min for light skin , 30 min for dark skin. Can vary with season and based on skin sensitivity
- **Frequency** – 3-4 times / week



Sitting indoors by a sunny window does not produce Vit D as UVB rays can't penetrate through the glass.

# Vit D Supplements

## D2

- **Ergocalciferol** - Inactive form

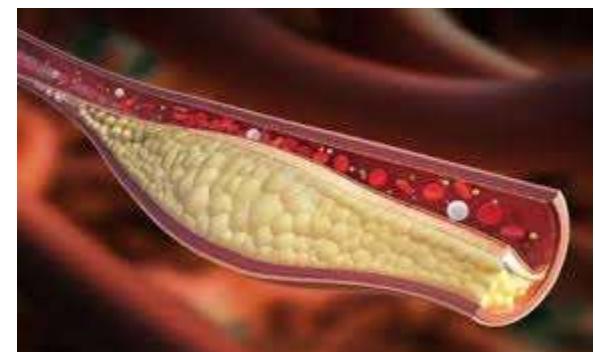
## D3

- **Cholecalciferol** - Inactive form. Granules / capsule
  - Superior than Vit D2 in potency
  - Increases and maintains blood levels of Vit D
  - **Preferred form of treatment for Vit D deficiency**
- **Alphacalcidiol** - Active form
  - Prescribed for patients with liver disease
  - Not preferred for treatment of Vit D deficiency
- **Calcitriol** – Active form
  - Prescribed for patients with chronic kidney disease
  - Not preferred for treatment of Vit D deficiency
  - Requires regular blood Ca monitoring as may increase Ca levels.
  - Does not build Vit D stores in body.

# Dosage

Immediate deficiency has to be followed by maintenance dose \*

- Toxicity of Vit D
  - Increased blood Ca and phosphate levels
  - Calcium stones
  - Calcium deposit in arteries & other soft tissue



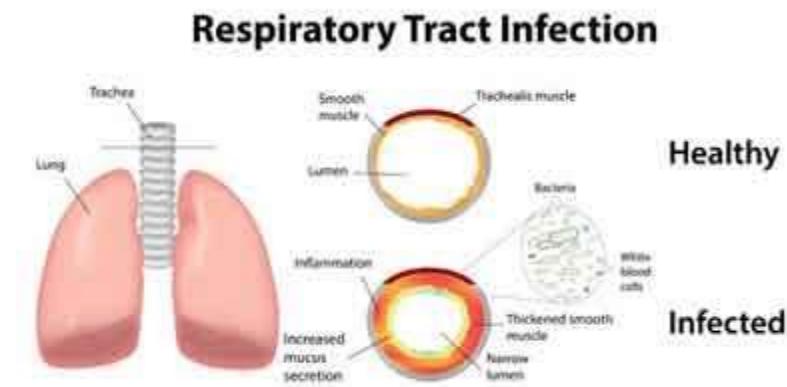
# Vit D and Belly Fat

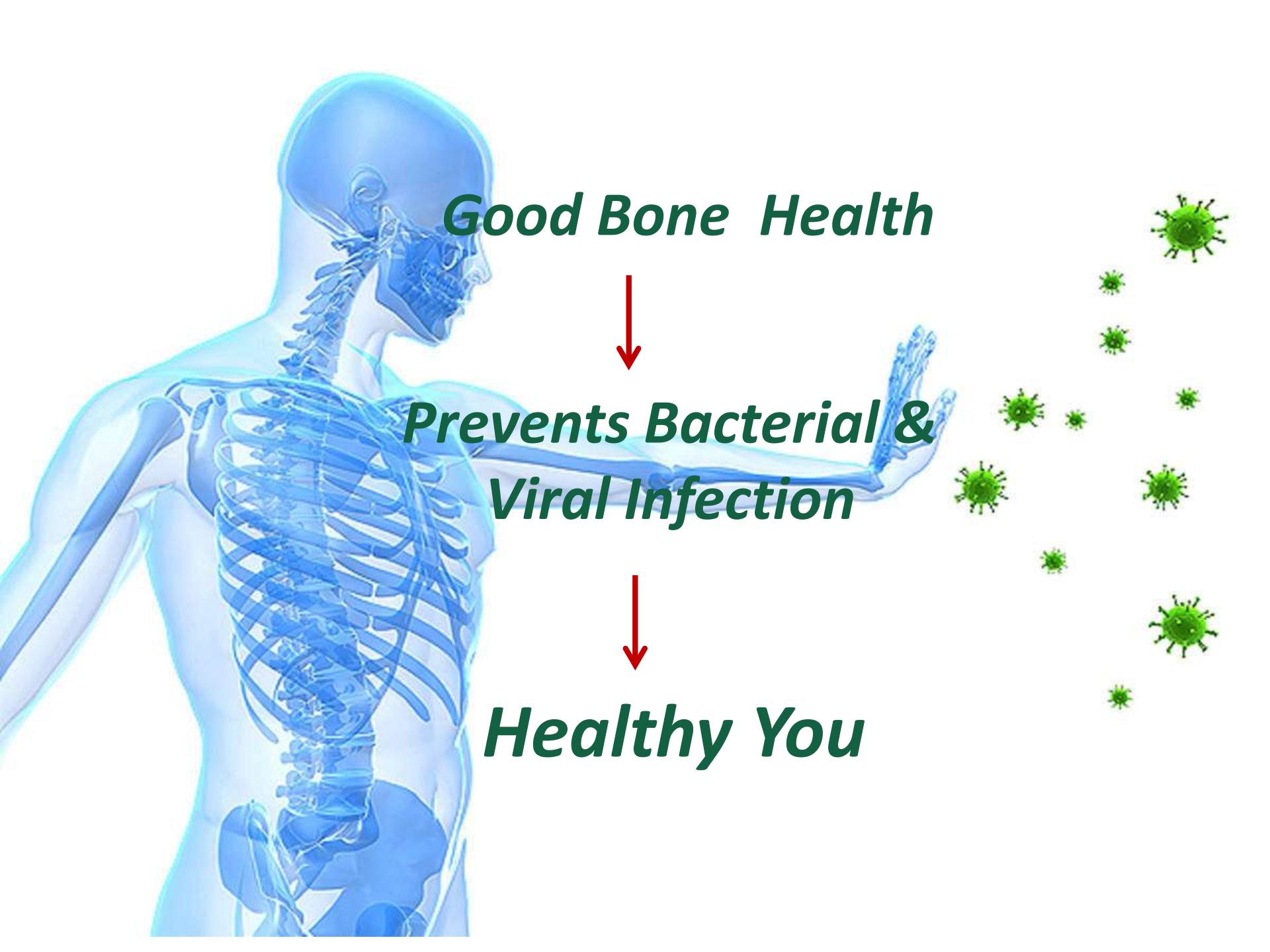
- If Waist circumference is
  - > 94 cm in Men
  - > 80 cm in womenpossibility of Vit D deficiency
- High waist circumference reduces the secretion of growth hormone which is essential for bone health



# Vit D and Immunity

- Vit D superior than Vit C for enhancing immunity
- Vit D activates WBC ( T & B cells) important for immune system & reduces inflammation in body
- Vit D deficiency - linked to respiratory infections such as asthma, pneumonia and bronchiolitis
- Vit D supplementation can decrease the frequency and severity of respiratory infections

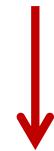




***Good Bone Health***



***Prevents Bacterial &  
Viral Infection***



***Healthy You***

