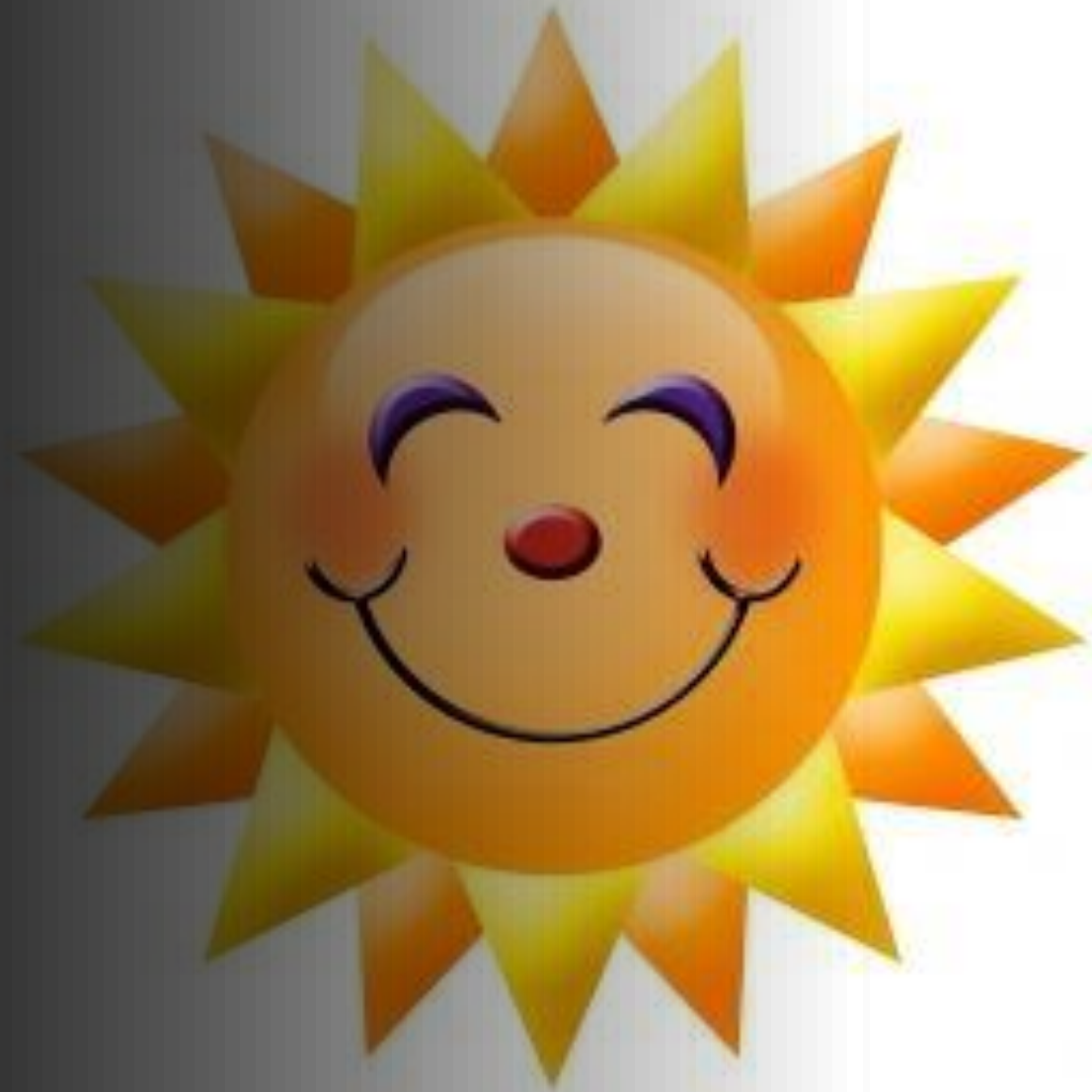




Vitamin D

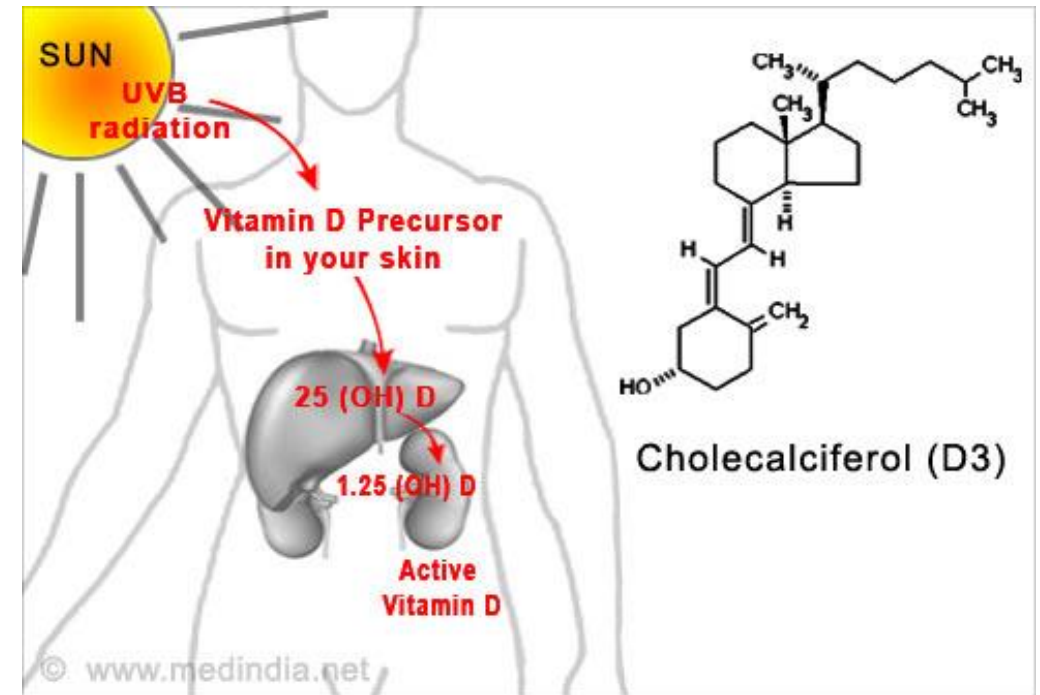
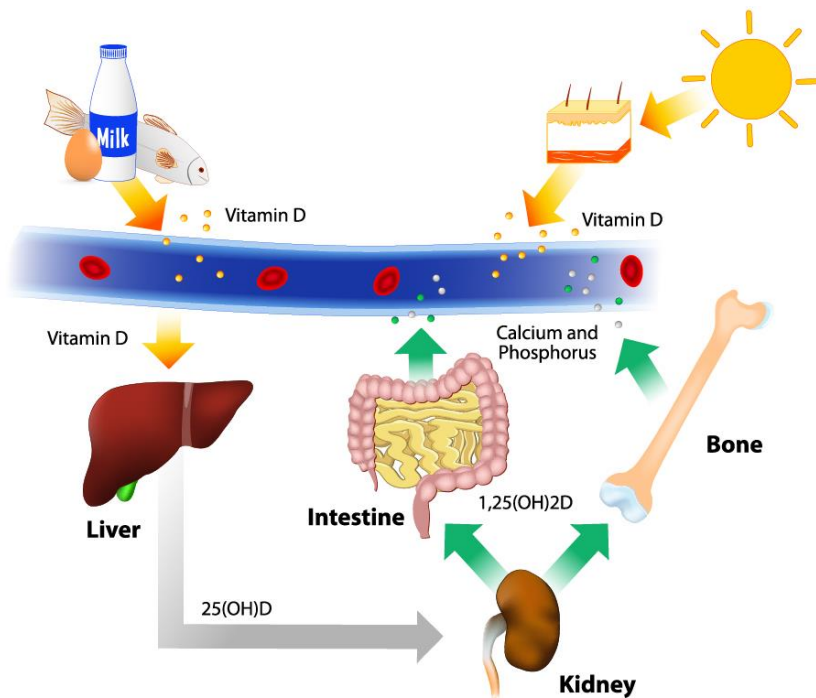
DR. YIN YIN WIN



Sunshine vitamin

Vitamin D

- Vitamin D is a fat-soluble vitamin involved in the regulation of **calcium homeostasis and bone health**.
- It is synthesized in the body when ultraviolet rays (UVB) from sunlight strike the skin and trigger vitamin D synthesis.



Functions of Vitamin D

Active vitamin D (1, 25 DHCC or Calcitriol) regulates calcium levels in the body (calcium homeostasis)

Through:

- **Increasing absorption of calcium by the intestine**
- **Minimizing loss of calcium by kidney**
- Stimulating resorption of bone (*when necessary*)

Deficiency of Active Vitamin D (1, 25-DHCC or Calcitriol)



Defective Bone Mineralization (poor calcification)

BENEFITS OF VITAMIN D

- ✓ Reduces Inflammation
- ✓ Reduces Auto-Immunity
- ✓ Improves Brain Function
- ✓ Reduces Cancer Cell Growth
- ✓ Improves Immunity
- ✓ Enhances Mood & Sleep
- ✓ Reduces Risk of Heart Disease



Bone & Muscle

Extra

How much skin are you exposing?

The more skin you expose to the sun, the more vitamin D you can make. So, how much skin are you exposing?



*Percentages based on common body surface area rule of thumbs

What does the Council recommend? Expose as much skin as you can

Applying sunscreen to your face and hands isn't a bad idea, as there isn't much skin there and they're exposed the most

Vitamin D production is influenced by the time of year and where you live.

*You can make the most vitamin D during summer months.
*Those who live closest to the equator make the most vitamin D year round.

Don't burn. We recommend spending half the time it takes for you skin to become pink, and then cover up with clothing, sunscreen, or shade.

VITAMIN  COUNCIL

Exposing ???

SUNLIGHT > FOOD



- The major source of vitamin D for both children and adults is exposure to natural sunlight.
- The major cause of vitamin D deficiency is lack of sun exposure.
- 10 am to 3 pm (15- 30 mins)

Light > Dark

Zenith angle

THROWING SOME LIGHT ON DARKER SKIN

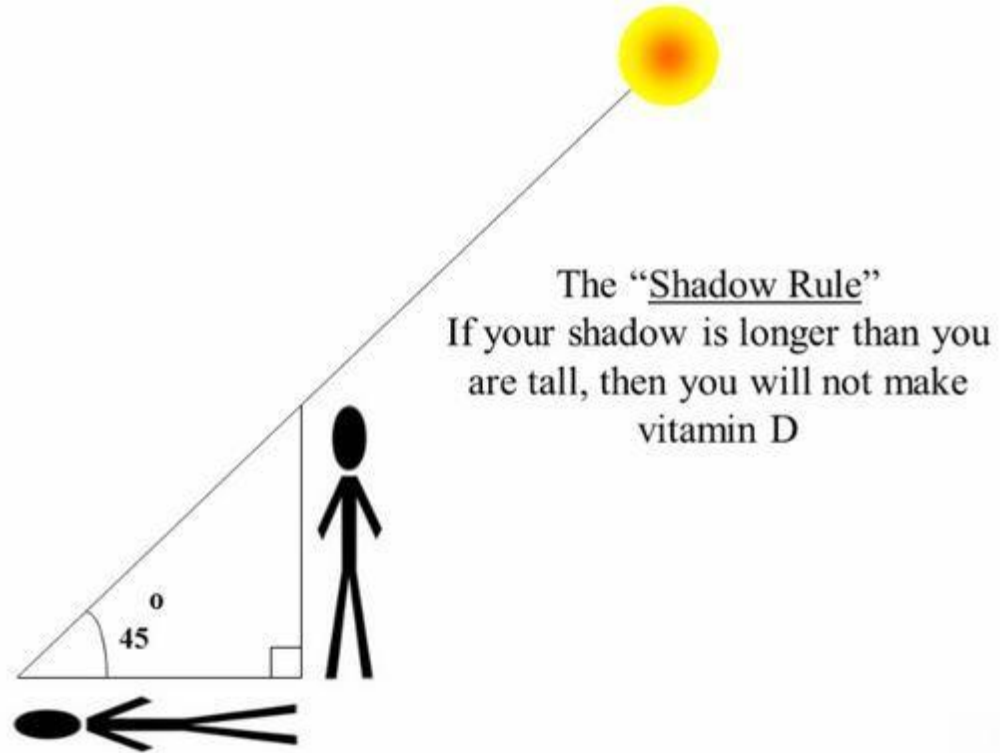
DARKER SKIN NEEDS MORE OF IT

LIGHT	MEDIUM	DARK
50%	75%	90% ← Not enough vitamin D

SYMPTOMS

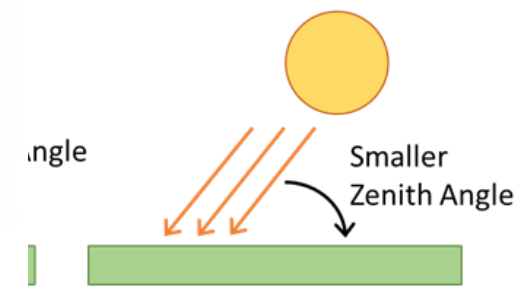
Mild deficiency	Severe deficiency
•Diarrhoea	•Severe pains
•Headaches	•Joint pains
•General malaise	•Muscle weakness
•Vague pains	•Pain in bones

KT GRAPHIC • SOURCE: VITAMINDFOODS.ORG



Graphic prepared by Edward Gorham, Ph.D.

sun is impacted by latitude, The larger the angle, the can produce with sunlight.

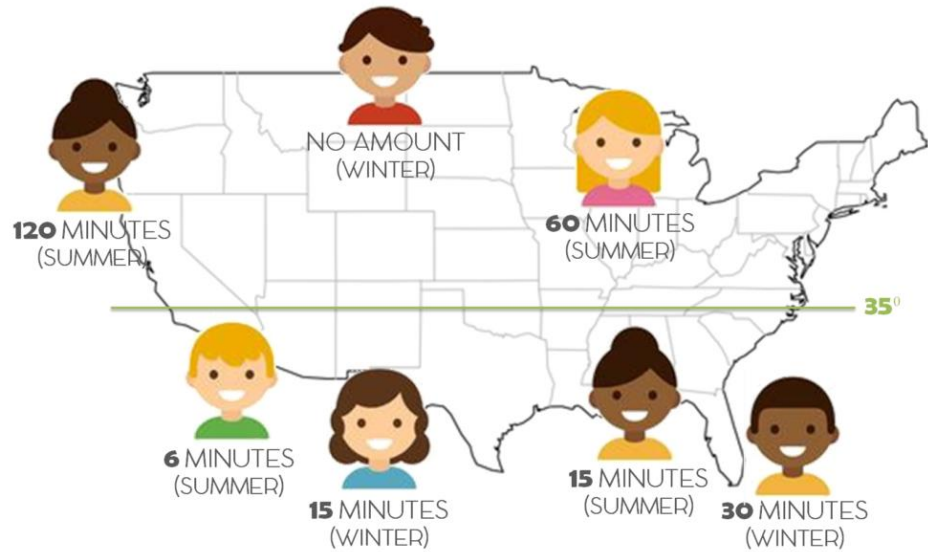


Summer at Midday

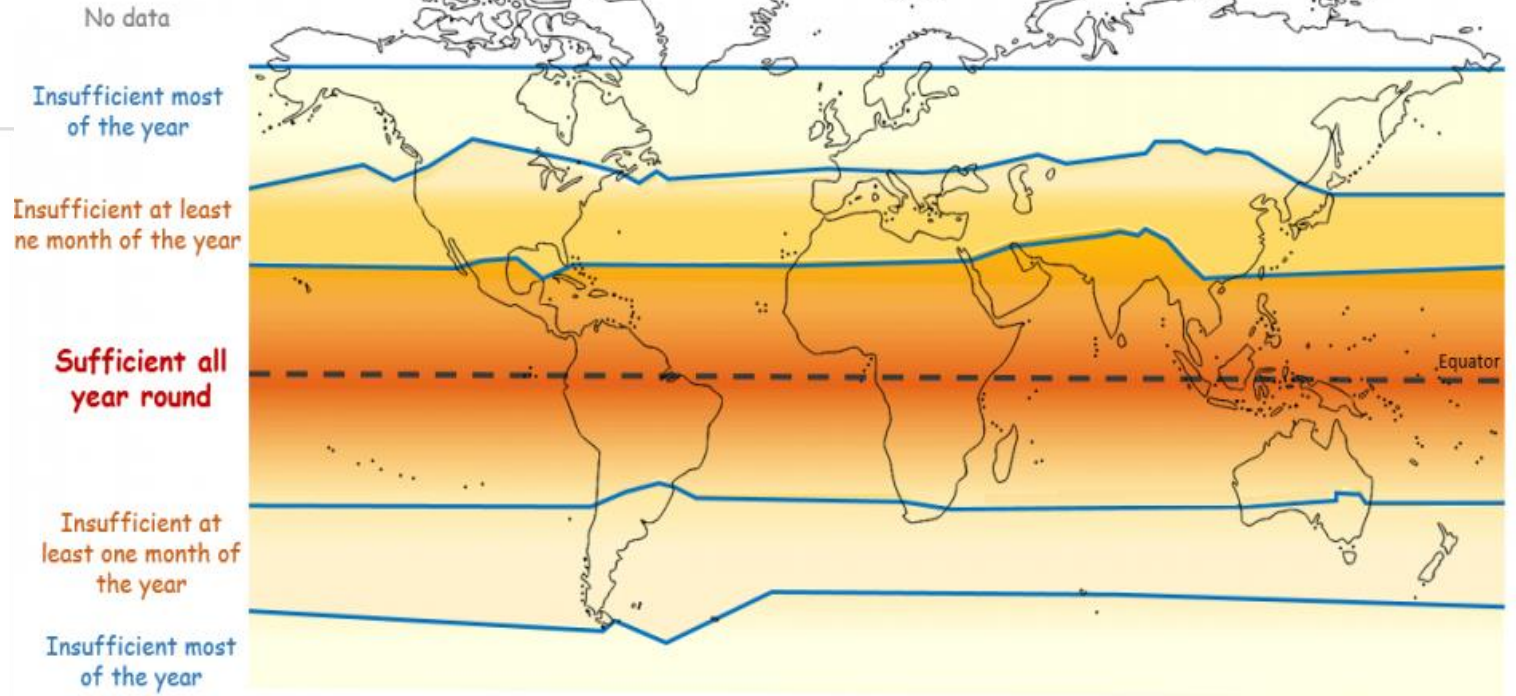
Winter or Sunset

Latitude

VITAMIN D SUN EXPOSURE ESTIMATED TIME TO GET **1,000IU**



UV Intensity Required For Vitamin D Synthesis In The Skin



SPENDING TIME IN THE SUN HAS **HARMS** AND **BENEFITS**



UV rays from the sun help us make vitamin D, which we need for **healthy bones**.

But...




Too much UV from the sun (or sunbeds) causes **sunburn, skin cancer** and **premature ageing**.



The NHS recommends people think about taking a vitamin D supplement.

LET'S BEAT CANCER **SOONER**
cruk.org



The amount of time to spend in the sun to get a healthy balance is different for everyone.



In summer, **white people** only need a little time in the UK sun each day to make enough vitamin D. You don't need to sunbathe.



People with darker skin may need longer in the sun but also have a lower risk of burning and skin cancer.



What does vitamin D production depend on?

Skin Type: The lighter, the more Vitamin D



Time of day: More Vitamin D at noon



Time of year: Most Vitamin D in summer



Latitude: The closer to the equator, the more vitamin D



There are few foods that naturally contain vitamin D or are fortified with it

Lack of Sun Exposure

The major cause of vitamin D deficiency is inadequate exposure to sunlight.^{14,40-43}

Winter Season

During the winter, little if any vitamin D is produced at latitudes above and below 35°.^{13,44-46}

Age

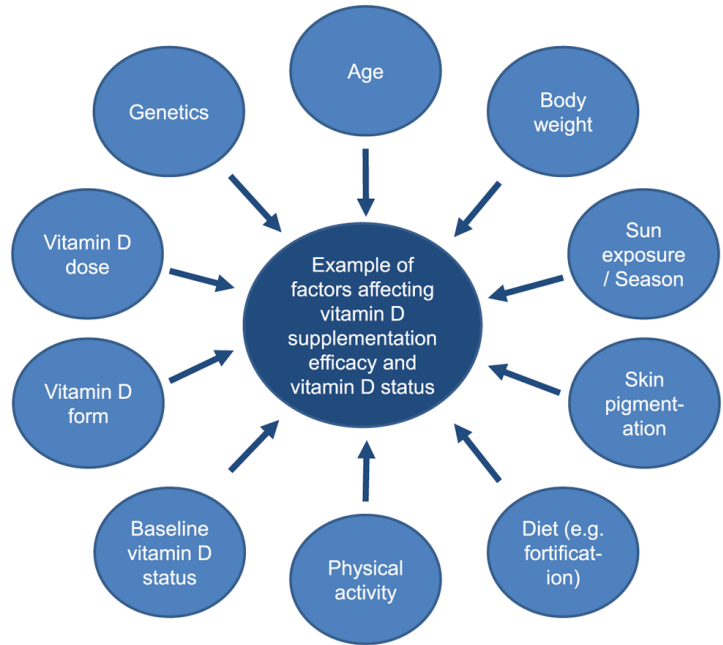
Aging can dramatically decrease the precursor levels of vitamin D₃ (7-dehydrocholesterol) in the skin.^{13,47-50}

Body Mass Index (BMI)

There is an inverse association between vitamin D levels and BMI. Therefore, overweight patients are often vitamin D deficient.^{13,14,54,55}

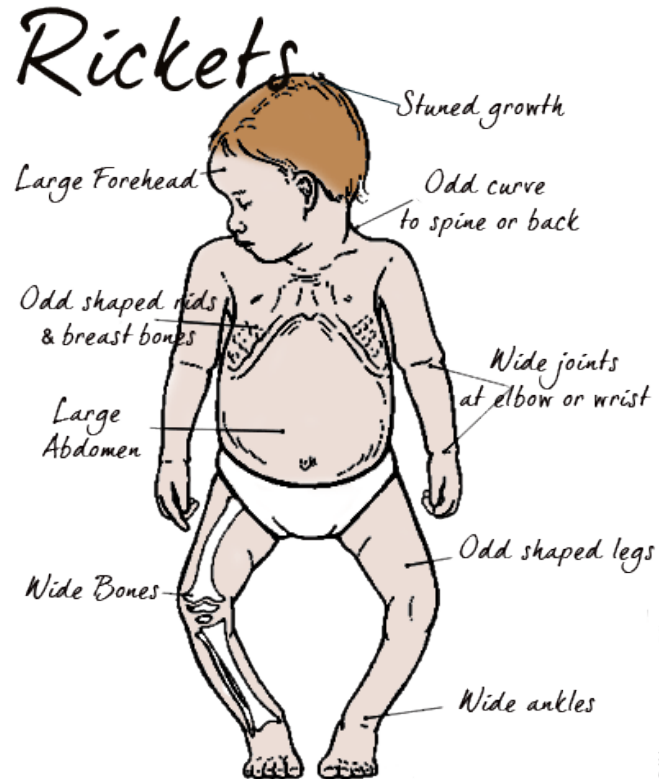
Skin Tone

People with naturally dark skin tones have natural sunscreen and require longer exposure to make adequate vitamin D.^{20,21,62,63}



Vitamin D & Our Body

- Vitamin D deficiency results in abnormalities in calcium, phosphorous, and bone metabolism.
- Severe and prolonged deficiency can cause bone mineralization diseases, such as **rickets in children and osteomalacia in adults**.
- Vitamin D deficiency has also been associated with fractures, falls, functional limitations, some types of cancer, diabetes, cardiovascular disease, and depression



SIGNS OF VITAMIN D DEFICIENCY

In adults, vitamin D deficiency **isn't** obvious.
But you **might** have:

The infographic is divided into five panels, each illustrating a sign of vitamin D deficiency in adults:

- Mood Changes**: An illustration of an elderly man sitting at a table, looking thoughtful with his hand on his chin.
- Bone Loss**: An illustration of a hand holding a bone, with a yellow arrow pointing to a hole in the bone, indicating bone loss.
- Muscle Cramps (or weakness)**: An illustration of a person's leg, with a red area on the calf indicating muscle cramps or weakness.
- Bone & Joint Pain (especially in your back)**: An illustration of a person's back, with a red area on the spine indicating pain.
- Fatigue**: An illustration of a man sitting at a desk, looking tired with his hand on his face.

Cleveland Clinic

VITAMIN D DEFICIENCY

Vitamin D is important for bone and muscle health, but it affects many other aspects of our health.

If these symptoms sound familiar, talk to your doc about testing your D levels and adding a supplement to your routine.



you're constantly sick

research suggests vitamin D may affect our immune function



you're exhausted

vitamin D's involvement in the immune system may impact our sleep-wake cycle



your bone density is declining

vitamin D helps our bones absorb calcium, which they need to grow and stay strong



you have back pain

D may be involved in age-related muscle and strength loss (called 'sarcopenia')



you're feeling blue

vitamin D deficiency has been linked to an increased risk of depression later in life



your muscles are always sore

D deficiency can deprive our muscles of calcium, which they need to function properly



Clinical Features of Vitamin D Deficiency

Vitamin D deficiency is often asymptomatic.

Severe or prolonged deficiency may cause the following symptoms:

- ✓ Bone discomfort or pain in the lower back, pelvis, or lower extremities
- ✓ Falls and impaired physical function
- ✓ Muscle aches
- ✓ Proximal muscle weakness
- ✓ Symmetric low back pain (in women)

Screening of Vitamin D deficiency

- Neither the Endocrine Society, the Mayo Clinic, the U.S. Preventive Services Task Force, nor the American Association of Clinical Endocrinologists recommends universal screening for vitamin D deficiency among the general population or asymptomatic individuals.
- They **do recommend** screening in individuals with risk factors for vitamin D deficiency.

Risk factors for Vitamin D deficiency

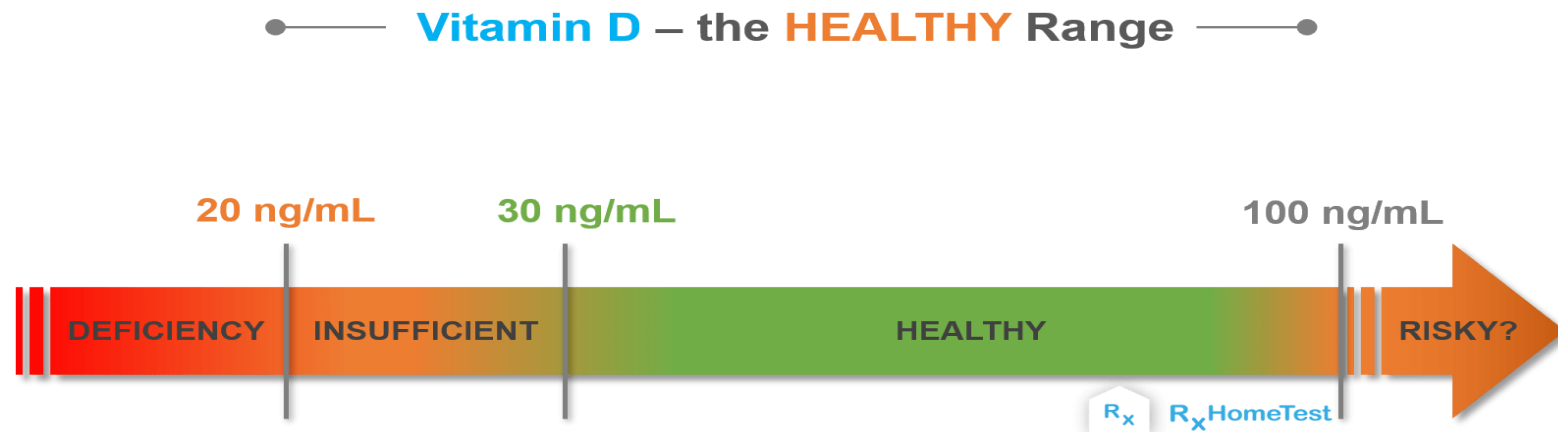
- Malnutrition
- Sedentary Lifestyle
- Limited sun exposure
- Obesity (BMI > 30kg/m²)
- Dark skin
- Age ≥ 65
- Conditions causing gastrointestinal malabsorption, including short bowel syndrome, pancreatitis, inflammatory bowel disease, amyloidosis, celiac sprue, and bariatric surgery.
- Liver disease or failure
- Renal insufficiency or nephrotic syndrome
- Cystic Fibrosis
- Medications that alter vitamin D metabolism, including anticonvulsants and glucocorticoids

Assessing the patient

Patient characteristics	Advice and management
Healthy, no risk factors, symptom free	No investigations required Lifestyle advice
Risk factors only	Lifestyle advice Consider long term preventative therapies
Risk factors AND clinical features	Lifestyle advice Investigations Therapeutic intervention Long term preventative treatment

Diagnosis

- We recommend using the serum circulating **25-hydroxyvitamin D [25(OH)D] level**, measured by a reliable assay, to evaluate vitamin D status in patients who are at risk for vitamin D deficiency.
- Testing for serum 1,25-dihydroxyvitamin D is not recommended.



Definition of Vitamin Deficiency

- There is not yet broad consensus on what constitutes vitamin D deficiency. Different organizations have slightly different definitions, based on serum levels of 25-hydroxyvitamin D, or 25 (OH)D.

The Endocrine Society	The Institute of Medicine (Health and Medicine Division of the National Academies)	The Mayo Clinic	The American Association of Clinical Endocrinologists
Deficiency: ≤ 20 ng/ml	Deficiency: < 12 ng/ml	Severe deficiency: <10 ng/ml	Deficiency: < 30 ng/ml
Insufficiency: 21-29 ng/ml	Insufficiency: 12-20 ng/ml	Mild to moderate Deficiency: 10-24 ng/ml	Optimal: 30-50 ng/ml
Optimal: ≥ 30 ng/ml	Optimal: ≥ 20 ng/ml	Optimal: 25-80 ng/ml	

Kennel KA et al. Vitamin D deficiency in adults: When to test and how to treat. *Mayo Clin Proc* 2010; 85:752-758.

IOM (Institute of Medicine). 2011 Dietary Reference Intakes for Calcium and Vitamin D. Washington DC: The National Academies Press.

Holick MF et al. Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab* 2011; 96:1911-30

Camacho PM, Petak SM, Binkley N et al. American Association of Clinical Endocrinologists and American College of Endocrinology Clinical Practice Guidelines for the Diagnosis and Treatment of Postmenopausal Osteoporosis - 2016. *Endocr Pract.* 2016;22(Suppl 4):1-42.

Investigations

Test	Reason
Renal function tests (U&E, eGFR)	To exclude renal failure.
Liver function tests (including ALP)	To exclude hepatic failure.
FBC	Anaemia may be present if there is malabsorption.
PTH	To exclude primary hyperparathyroidism.
Calcium	To exclude hypercalcaemia and provide a baseline for monitoring. Hypocalcaemia may indicate long standing vitamin D deficiency.
Phosphate	Hypophosphataemia may indicate long standing vitamin D deficiency.
25-OH Vitamin D levels*	To determine vitamin D status

Prevention:

Endocrine Society Recommendations

- The Endocrine Society recommends the following daily intakes of vitamin D to prevent deficiency and maximize bone health.
 - **Children age 0-1:** at least 400 IU/day. May require 1,000 IU/day to achieve > 30ng/ml
 - **Children age 1-18:** at least 600 IU/day. May require 1,000 IU/day to achieve > 30ng/ml
 - **Adults age 19-70:** at least 600 IU/day. May require 1,500-2,000 IU/day to achieve > 30ng/ml
 - **Adults older than 70:** at least 800 IU/day. May require 1,500-2,000 IU/day to achieve > 30ng/ml
- Obese children and adults; those on anticonvulsant medications, glucocorticoids, and antifungals such as ketoconazole; and those taking medications for AIDS should be given at least two to three times more vitamin D for their age group to satisfy their body's requirement.

We suggest that pregnant and lactating women require at least 600 IU/d of vitamin D and recognize that at least 1500–2000 IU/d of vitamin D may be needed to maintain a blood level of 25(OH)D above 30 ng/ml

Prevention:

AACE Recommendations

- Daily supplementation with vitamin D3 at a dose of 1,000 to 2,000 IU is typically needed to maintain an optimal serum 25(OH)D level.
- Higher doses may be necessary in the presence of certain factors including obesity, malabsorption, and certain ethnicities.
- Transplant patients and older individuals may also need higher doses.

Treatment:

Endocrine Society Recommendations

We suggest using either vitamin D2 or vitamin D3 for the treatment and prevention of vitamin D deficiency

- **Age 0-1**

2,000 IU per day for infants and Toddlers or 50,000 IU once weekly for 6 weeks to achieve a blood level 25(OH)D above 30 ng/ml. Followed by maintenance therapy of 400-1,000 IU/day.

- **Children Age 1-18**

2,000 IU per day for at least 6 weeks or 50,000 IU once weekly for at least 6 weeks to achieve a blood level 25(OH)D above 30 ng/ml. Followed by maintenance therapy of 600-1,000 IU/day.

- **Adults**

6,000 IU per day or 50,000 IU per week for 8 weeks to achieve a blood level 25(OH)D above 30 ng/ml. Followed by maintenance therapy of 1,500-2,000 IU/day.

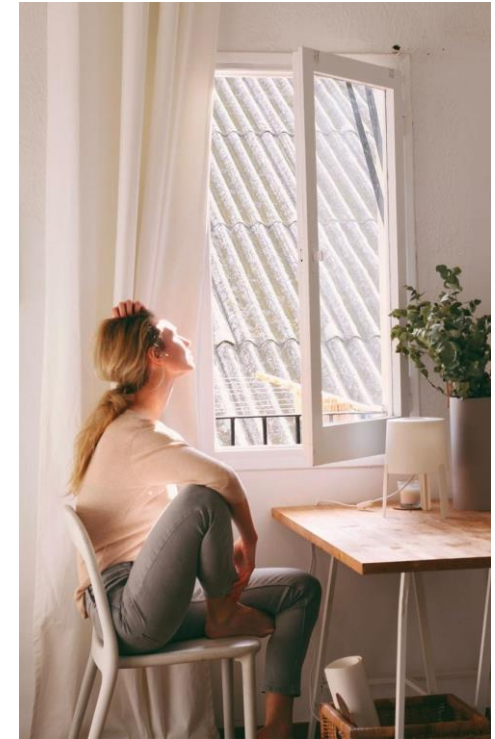
- **Special Cases**

Obese patients, those with malabsorption syndromes, and those on medications affecting vitamin D metabolism should receive a higher dose of 6,000 to 10,000 IU/day to achieve levels above 30 ng/ml. Followed by a maintenance dose of 3,000-6,000 IU/day.

Daily doses of vitamin D are recommended during pregnancy and weekly or monthly higher doses should be avoided, because the placental production of calcitriol is substrate-dependant

Obesity

In obese patients, patients with malabsorption syndromes, and patients on medications affecting vitamin D metabolism, we suggest a higher dose (**two to three times higher**; at least 6000–10,000 IU/d) of vitamin D to treat vitamin D deficiency to maintain a 25(OH)D level above 30 ng/ml, followed by maintenance therapy of at least 3000–6000 IU/d





We recommend prescribing vitamin D supplementation for fall prevention.



We **do not recommend** prescribing vitamin D supplementation **beyond recommended daily needs** for the purpose of preventing cardiovascular disease or death or improving quality of life



Vitamin D active forms, such as **calcitriol or alfacalcidol**, should **not** be used when the objective is supplementation, or in the treatment of vitamin D deficiency, because of their higher risk of side effects

Monitoring

Routine monitoring of vitamin D levels is generally unnecessary for patients on long term **maintenance** vitamin D doses of up to 2,000 International Units/day.

If there is a need to monitor vitamin D levels repeat after **3-6 months** on recommended **replacement** therapy.

For **malabsorption** patients adjusted serum calcium may need to be checked initially **every two weeks**.

Vitamin D can unmask previously undiagnosed **primary hyperparathyroidism**.

This is usually done by measuring adjusted serum calcium which should be checked 1 month after completing the loading regimen or after starting vitamin D supplementation (or if symptoms of hypercalcaemia occur).

Whilst on maintenance vitamin D doses recheck bone profile and vitamin D levels **if symptoms suggestive of vitamin D toxicosis or hypercalcaemia** (confusion, polyuria, polydipsia, anorexia, vomiting or muscle weakness) are present.

For patients on **potent antiresorptive agent** (e.g., denosumab or zoledronic acid) check vitamin D levels.

When to refer to secondary care

- Atypical biochemistry
- Atypical clinical manifestations or biochemistry
- Deficiency due to malabsorption
- Failure to respond to treatment after 3 months
- Focal bone pain
- Liver disease
- Metastatic cancer , Lymphoma
- Renal Stone
- Sarcoidosis
- Short Stature & Skeletal deformity
- Tuberculosis
- Unexplained deficiency
- Unexplained weight loss
- Parathyroid disorders

Vitamin D + K ?

- The administration of vitamin D as a combination containing calcium or vitamin K2 (MK7) or in conjunction is **not recommended presently**.
- Efficacy of simultaneous intake of the vitamins K2 and D, as a factor preventing calcification of vessels and soft tissues, as well as enhancing bone mineralization, has not been proven.

Vitamin D + Calcium

- **Generally** (apart from elderly patients) clinicians **should avoid** giving combined calcium and vitamin D preparations in the long term because the calcium component is unnecessary and unpalatable, reducing concordance.
- **Osteoporosis** - calcium and vitamin D supplements routinely for mobile frail, elderly individuals who are housebound or care home patients.
- The recommended daily dose is Calcium 1 – 1.2g and vitamin D3 800 International Units.

Vitamin D & Osteoporosis

AACE

- Measure serum 25-hydroxyvitamin D (25[OH]D) in patients who are at risk for vitamin D insufficiency
- Maintain serum 25-hydroxyvitamin D (25[OH] D) **≥30 ng/mL** in patients with osteoporosis
- Supplement with vitamin D3 if needed; **1,000 to 2,000 international units (IU)** of daily maintenance therapy is typically needed

“for the prevention of secondary hyperparathyroidism, decreased risk of fall and improvement of BMD”

Vitamin D & Intestinal malabsorption

- Vitamin D deficiency caused by intestinal malabsorption or chronic liver disease usually requires vitamin D in pharmacological doses.
- A suggested regime for adult patients would be to use Ergocalciferol 300,000 IU by **intramuscular injection**, rechecking levels again after 3 months and repeating if required.

Overdose

- Excess vitamin D supplementation can lead to hypercalcemia, but vitamin D toxicity is **extremely rare**.
- (>10,000 IU/day) for prolonged periods in patients with normal gut absorption or those ingesting excessive amounts of calcium.
- Most patients with vitamin D toxicity have levels **greater than 150 ng/ml**.

clinical symptoms:

- Hypercalcemia
- Nausea
- Dehydration
- Constipation
- symptoms of hypercalciuria such as polyuria and kidney stones.

Signs of hypervitaminosis D

Anorexia	Gastrointestinal distress	Nausea and vomiting
Headache	Weakness, lameness	Polyuria, polydipsia
Nervousness	Hypercalcemia	Calcinosis

April 10, 2018

Combs GF The Vitar
Nutrition and H



Vitamin D deficiency < 20 ng/ml

	Test	Treatment Dose			Maintenance Dose		
Healthy , No Risk	-	-			-		
Risk (+)	-	-			0-1 year	400 IU	1000 IU
					1-18 year	600 IU	1000 IU
					19-70 year	600 IU	2000 IU
					> 70 year	800 IU	2000 IU
					Pregnancy	600 IU	2000IU
Risk (+) & Symptoms (+)	+	0-1 year	2000 IU	50000 IU	Same		
		1-18 year	2000 IU	50000 IU			
		19-70 year	6000 IU	50000IU			
		> 70 year	6000 IU	50000 Iu			
		Pregnancy	6000 IU	No			
			Daily	Weekly			
			6 weeks	6 weeks			



Thank You All

