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Faculty of medicine

Hypovitaminosis D
Asilent Epidemic

Essay

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List of Abbreviations

Abbreviation	Meaning
ADHR	Autosomal dominant hypophosphataemic rickets/OM
BMC	Bone mineral content
BMD	Bone mineral density
BMUs	Bone multicellular units
CVD	Cardiovascular disease
CYP27B1	The enzyme that produces 1-25(OH)2D3
DBP	Vitamin D binding protein
DXA	Dual energy X ray absorptiometry
FGF-23	Fibroblast growth factor-23
GC	Glucocorticoids
GIO	Glucocorticoids induced osteoporosis
HHRH	Hereditary hypophosphataemic rickets with hypercalciuria
HVDRR	Hereditary1-25Dihydroxyvitamin D-Resistant Rickets
IL	Interleukins
LBD	Ligand-binding domain
NT	Neurotrophins
25(OH)D	25-hydroxyvitamin D
1-25(OH)2 D3	1-25 dihydroxyvitamin D3
OHOM	Oncogenic hypophosphataemic OM
OM	Osteomalacia
OPG	Osteoprotegerin

List of Abbreviations:

Abbreviation	Meaning
PHEX	Phosphate regulating gene with homologies to Endopeptidases on the X-chromossome
PPIs	Proton pump inhibitors
PTH	parathyroid hormone
RANK	Receptor activator of nuclear factor κB
RANKL	Receptor activator of nuclear factor (NF)-κB ligan
RR	Relative risk
RXR	Retinoid X receptors
2ryHPT	Secondary hyperparathyroidism
pQCT	Peripheral Quantitative computed tomography
QCT	Quantitative computed tomography
QUS	Quantitative ultrasound
SD	Speed of sound
SERMS	Selective Estrogen Receptor Modulators
TGF	Transforming growth factor
TH	T helper
TLRs	Toll-like receptors
TNF	Tumour necrosis factor α
TPN	Total parenteral nutrition
UVB	Ultraviolet B
VDDR1	Vitamin D-dependent rickets type1
VDDR11	Vitamin D-dependent rickets type11
VDR	Vitamin D receptor
VDREs	Vitamin D-responsive elements
VDRR	Vitamin D resistant rickets
XLH	X linked hypophosphataemic rickets

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Introduction

Vitamin D : Is agroup of fat soluble prohormones There are 2 major forms of vitamin D. Cholecalciferol (vitamin D-3) is produced in the skin after sun exposure. It is produced commercially by extracting 7-dehydrocholesterol from wool fat followed by ultraviolet B (UVB) radiation and purification. The other one is Ergocalciferol (vitamin D-2) which has a different side chain than cholecalciferol (i.e.,a C24 methyl group and a double bond betweenC22 and C23) (figure 1) and is commercially made by the action of UVB radiation on the plant and then purifying the ergosterol extracted from yeast. ***(Holick, 2005) .***

The precursor provitamin D (either ergostrol or 7-dehydrocholesterol), Which is relatively rigid, 4-ringed structure, is incorporated into the lipid bilayer of the plasma membrane. During the production of previtamin D during exposure to solar UVB radiation, the B ring opens and becomes a less-rigid open structure (figure 1), which may provide the membrane with increased permeability to various ions, including calcium. ***(Holick, 2004(b)).***

During exposure to sunlight, UVB photons (290-315nm) penetrate in to the viable epidermis and dermis where they are absorbed by 7-dehydrocholesterol that is present in the plasma membrane of these cells. The absorption of UVB radiation cause 7-dehydrocholesterol to open its B ring, forming precholecalciferol. Precholecalciferol is inherently unstable and rapidly undergoes rearrangement of its double bonds to form cholecalciferol (figure 1). As cholecalciferol is being formed, it is ejected out of the plasma membrane in to the extracellular space, where it enters into the dermal capillary bed, drawn in by the vitamin D binding protein (DBP). ***(Bouillon, 2001).***

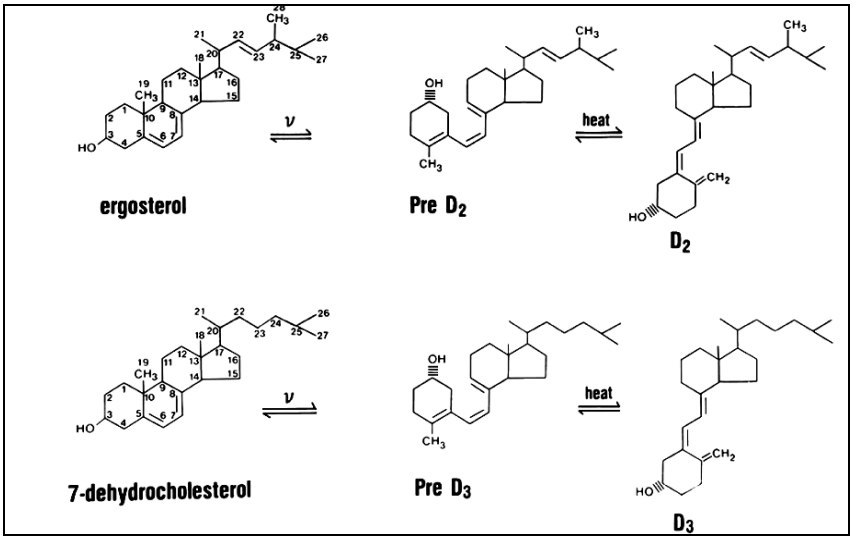

Figure (1) : Production of vitamin D2 and vitamin D3. ***(Adapted from Bikle, 2009)*** **.**

Sources of vitamin D :

Synthesis of vitamin D in the skin by sun light :

Solar UVB irradiation is the primary source of vitamin D (other than diet supplements). For most people, When atmospheric conditions are ideal and skin is clear, 30 minutes of whole-body exposure of pale skin to sunlight without clothing or sun screen can result in the synthesis of between 10,000 and 20,000 IU of vitamin D. These quantities of vitamin D are large, and therefore capable of supplying the body's full needs. ***(Adams and Hollis, 2002).***

At the same time, the body has two mechanisms to prevent an excess of vitamin D from developing : first, further irradiation converts excess vitamin D in the skin to a variety of inactive metabolites; second, the pigment melanin begins to accumulate in skin tissues after the first exposure, which decreases the production of vitamin D. ***(Hollis, 2005).***

Dietary sources of vitamin D :

Fortified foods are the major dietary sources of vitamin D. The foods that require fortification with vitamin D are milk and margarine. ***(Stene et al., 2003).***

In the case of milk, fluid milk contain added vitamin D in such an amount that a reasonable daily intake of the milk contains not less than 300 IU and not more than 400 IU of vitamin D. ***(Calvo et al., 2004).***

Fortification of milk with vitamin D may not be adequate for satisfying the vitamin D requirement because of variability in vitamin D content after fortification and because many persons have milk allergy or lactose intolerance. Additional foods need to be fortified with vitamin D. ***(Zeiger, 2000).***

Fluid milk is labeled as providing 44% of the recommended daily intake (of 400 IU) per 250-mL serving. Other milk products that require vitamin D fortification are evaporated milk, powdered milk, and goat's milk. The proliferation of milks of plant origin (particularly soy) made it necessary to require calcium-fortified, plant-based milks to be fortified with vitamin D. ***(Calvo et al., 2004).***

All margarines are fortified with vitamin D (530 IU/100 g) Other foods for which vitamin D addition is permitted are meal replacements, nutrational supplements, and formulated liquid diets. ***(Tangpricha, 2003).***

Fortification of orange juice with calcium was introduced, making orange juice a potential good source of calcium for children and adults who do not drink milk . ***(Tangpricha, 2003).***