



Ain shams university
Faculty of medicine

Hypovitaminosis D Asilent Epidemic

Essay

*Submitted to the Faculty of Medicine Ain Shams University in Partial
Fulfillment for the Requirements of the Master Degree*

in
Internal Medicine

By

Shimaa Mohamed Abd Elattif

M.B.B.Ch. Tanta University

Supervised by

Prof. Dr.

MOHAMED SALAH ELDIN ABDEL BAKY

Prof. of Internal Medicine

Faculty of Medicine

Ain Shams University

Prof. Dr.

DALIA FAYEZ MOHAMED

Prof. of Internal Medicine

Faculty of Medicine

Ain Shams University

Dr.

SAMAH ABD EL RAHMAN MAHMOUD

Ass. Prof. of Internal Medicine

Faculty of Medicine

Ain Shams University

**Faculty of Medicine
Ain Shams University**

2010

Acknowledgement

Thanks to Allah

It is a pleasure to express my deepest gratitude to Prof. Dr. **MOHAMED SALAH ELDIN ABDEL BAKY** Professor of Internal Medicine, Faculty of Medicine, Ain Shams University, who very kindly and generously gave me much of his time and experience in helping, guiding and advising me.

I am deeply indebted and grateful to Prof. Dr. **DALIA FAYEZ MOHAMED** Professor of Internal Medicine, Faculty of Medicine, Ain Shams University, for her enthusiastic help, kind supervision, endless support, critical review and encouragements throughout this work.

Sincere thanks to Dr. **SAMAH ABD EL RAHMAN MAHMOUD** Ass. Prof. of Internal Medicine, Faculty of Medicine, Ain Shams University, for her continuous interest and advice.

Finally, I would like to express my gratitude to **all members** of the department of Internal Medicine, Faculty of Medicine, Ain Shams University, for their encouragement, help and support all through this work.

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List of Abbreviations:

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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	Hereditary 1-25Dihydroxyvitamin 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 κ B
RANKL	Receptor activator of nuclear factor (NF)- κ B ligand
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

Introduction

Vitamin D : Is a group 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 between C₂₂ 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 ergosterol or 7-dehydrocholesterol), which is relatively rigid, 4-ringed structure, is incorporated into the lipid bilayer of the plasma membrane. During the production of provitamin 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 into 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 causes 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 into the extracellular space, where it enters into the dermal capillary bed, drawn in by the vitamin D binding protein (DBP). (*Bouillon, 2001*).

Introduction

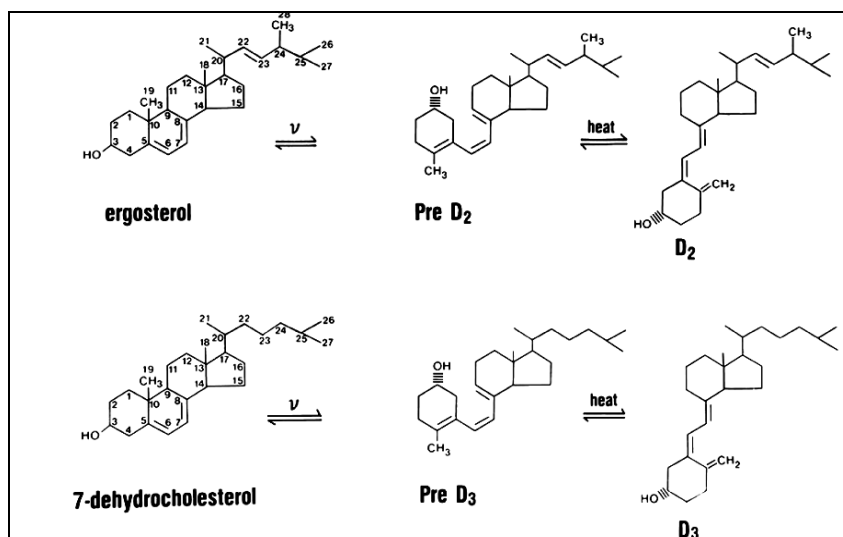


Figure (1) : Production of vitamin D₂ and vitamin D₃. (*Adapted from Bikle, 2009*).

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*).

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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*).