Vitamin D Status Among Emirati Students
“Avoidance of Sunlight Causing Vitamin D Deficiency”

Afrozul Haq, Ph.D.
Pathology & Laboratory Medicine,
SKMC, Abu Dhabi

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<table>
<thead>
<tr>
<th>Publication</th>
<th>Authors/Subjects</th>
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<tbody>
<tr>
<td>Abu Dhabi, United Arab Emirates. Dermat Endocrinology (in press).</td>
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<tr>
<td>rickets?. Bone, 45 Suppl.2: S102.</td>
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<tr>
<td>case report of an infant with prolonged QTc interval. Paediatrics. me</td>
<td>Paediatrics. me 14: 71-73.</td>
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<tr>
<td>15. High prevalence of Vitamin D deficiency among young Emiratis in a</td>
<td>Al Anouti F., Thomas J., Ahmad B., Al Hasani S., Abdel-Wareth L., Khalili AD. And Haq A.</td>
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<td>among young Emiratis. 1st WHO Regional Nutritional Conference, Doha(Qatar),</td>
<td>1st WHO Regional Nutritional Conference, Doha(Qatar),……</td>
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<tr>
<td>students. 2nd SEHA Annual Research Conference, Abu Dhabi(UAE), December</td>
<td>2nd SEHA Annual Research Conference, Abu Dhabi(UAE), December 12-13.</td>
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<td>22. Sun, Sea, Sand and Sadness: Exploring the Links between Vitamin D</td>
<td>Sun, Sea, Sand and Sadness: Exploring the Links between Vitamin D deficiency and</td>
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<td>deficiency and depressive illness in the United Arab Emirates. The British</td>
<td>depressive illness in the United Arab Emirates. The British Psychology Society Meeting,</td>
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</table>
Vitamin D and its metabolites have many actions in the body not just those required to prevent rickets and osteomalacia.

These newly discovered actions include cancer prevention and treatment; regulation of hormone secretion; increased resistance to infections; protection against autoimmune diseases; prolonged survival of transplanted organs.

These newly discovered actions require vitamin D levels greater that those found in most people.
10,000 IU of vit D generates in 15-20 minutes exposure. Longer exposure does not induce more vit D because UVB also degrades vit D, preventing too much of it from building up in the skin.
All studies, in virtually all nations, irrespective of latitude, show that the majority of the world’s population has inadequate vitamin D status
**Types & Sources of Vitamin D**

- **Vitamin D2 (Ergocalciferol)**
  - Ergosterol from plants/mushrooms/yeast leads to the formation of Vitamin D2 (calciferol).
  - Biologically inert
  - Conversion (OH) in the liver and then in kidneys produces active form.
  - D2 is less potent than vitamin D3

- **Vitamin D3 (Cholecalciferol)**
  - Naturally occurring form in humans, formed by the action of ultraviolet light (UVB) on Vitamin D precursors in the skin (7-DHC).
  - Lanolin is often used as a raw material for producing vitamin D3.
  - Present in fish (salmon), other sea food.
  - Biologically inert
  - Conversion (OH) in the liver and then in kidneys produces active form.

A. Haq, 2010
PROBLEM: VERY LITTLE VITAMIN D IS FOUND IN NATURAL FOODS
Vitamin D Endocrine, Autocrine / Paracrine Systems

Vitamin D3 & D2

25(OH)D

Prostate, skin, lung, breast, colon, macrophages, monocytes, other cells & tissues

1,25(OH)2D

Calcium homeostasis, muscle health, bone health, neurodevelopment

Immunomodulation, gene transcription, cardiovascular health, & cancer prevention

Vitamin D activation, mechanism of action and biological response
Why does vitamin D affect so many biologic processes?

Vitamin D controls (directly or indirectly) more than 3000 genes that regulate calcium and bone metabolism, modulate innate immunity, control cell growth and maturation, regulate the production of insulin and renin, induce apoptosis and inhibit angiogenesis.

Many tissues are able to make their own 1,25(OH)2D.
When vitamin D is in short supply, the various tissues and cells of our bodies cannot make enough calcitriol to open up their DNA libraries adequately.

Their functioning is thus impaired.
Vitamin D Deficiency in the Gulf Countries


A study conducted on 433 school girls, revealed that VTD deficiency was highly prevalent (81%) among adolescent females.

A study showed that VTD deficiency is common in women of child-bearing age (33 subjects) in Arab communities residing in the UAE.
The D-lemma: To Screen or Not to Screen for 25(OH)D Concentrations?

- With the recognition of widespread vitamin D deficiency/insufficiency in children and adults, there is no need to measure everybody's blood 25(OH)D. It would be much more cost-effective to implement a vitamin D supplementation program for all children and adults until there is higher fortification of vitamin D in foods and drinks.

Three Ways to Obtain Vitamin D

- Sun exposure obtaining 10 to 15 minutes per day, with 40% of the skin exposed without sunscreen, can help prevent vitamin D deficiency.

- Consuming vitamin D rich foods also can help to maintain the beneficial (75 nM) to optimal levels (90 to 150 nM) of 25-hydroxyvitamin D in the blood.

- Vitamin D supplementation with vitamin D3 (Cholecalciferol) or D2 (get blood levels of 25(OH)D tested first).
### Vitamin D Reference Ranges

<table>
<thead>
<tr>
<th>25(OH)D (nmol/L)</th>
<th>Vitamin D status</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25</td>
<td>Severe Deficiency</td>
</tr>
<tr>
<td>25 – 75</td>
<td>Insufficiency</td>
</tr>
<tr>
<td>75 – 200</td>
<td>Sufficiency</td>
</tr>
<tr>
<td>&gt; 250</td>
<td>Toxicity</td>
</tr>
</tbody>
</table>

HPLC Lab at SKMC 2010
## Updated Vitamin D Status

<table>
<thead>
<tr>
<th>Serum 25(OH)D (nmol/L)</th>
<th>Vitamin D Status</th>
<th>Clinical/Biochemical Alterations</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25</td>
<td><strong>Severely Deficient</strong></td>
<td>Rickets, osteomalacia, myopathy, calcium malabsorption, severe hyperparathyroidism, impaired immune and cardiac function.</td>
</tr>
<tr>
<td>25 – 49</td>
<td><strong>Deficient</strong></td>
<td>Reduced bone mineral density, impaired muscle function, low intestinal calcium absorption rate, elevated PTH.</td>
</tr>
<tr>
<td>50 – 74</td>
<td><strong>Insufficient</strong></td>
<td>Low bodily stores of 25(OH)D, elevated PTH</td>
</tr>
<tr>
<td>75 - 374</td>
<td><strong>Sufficient</strong></td>
<td>No disturbances of D-dependent functions</td>
</tr>
<tr>
<td>&gt; 375</td>
<td><strong>Toxic</strong></td>
<td>Soft tissue calcification, hypercalcemia</td>
</tr>
</tbody>
</table>

The Upper Limit of Possible 25(OH)D is 150 - 200 nmol/L

Am J Clin Nutr 80,1645-1649, 2004;
J Clin Endocrinol Metab 87,4952- 4956,2002
Small Scale Study (Target: ZU male/female students) & Larger population based study (Target: Adult Emirati population residing in Abu Dhabi)

Objectives and rationale of the study

- Assess the Prevalence of Vitamin D deficiency among the target population (274/ZU students and 500/general population)
- Evaluate the influence of sun avoidance attitude, diet and life style/depression (psychosocial factors) on Vitamin D status
Methodology

- Vitamin D blood testing by HPLC (modified method)

- Sun Avoidance Inventory/Sun Academic Initiative (SAI) to assess attitude towards sun avoidance in the context of Vitamin D deficiency

- BDI (Beck Depression Inventory)

- FFQ (Food Consumption and Diet)
Choose an assay that measures both 25(OH)D2 and 25(OH)D3

If using an assay that separates 25(OH)D2 and 25(OH)D3 (i.e. HPLC or LC/MS-MS) indicate the sum of the 2 compounds (25(OH)D2+25(OH)D3) as the main results in your results sheet.

Participate to an external quality control scheme that provides materials with a documented commutability with human sera (e.g. the CAP or the UK based DEQAS)

An internal quality control program has to be carried out in every laboratory by using different levels samples and valuable criteria for rejecting or accepting “the analytical run“

Do not use population-based reference values (i.e. the concentrations of an apparently healthy population) in addition to a recommended range for 25(OH)D.

We recommend serum as the sample of choice.
Express results in nmol/L
Vitamin D Status in the UAE

274 UAE STUDENTS FROM ZAYED UNIVERSITY

% of Students

Vitamin D (nmol/L)

<25 25-49 50-75 >75

68 26 5 1

<25 25-49 50-75 >75
Table 1: Baseline characteristics of male and female students that participated in the study

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Males (n = 70)</th>
<th>Females (n = 208)</th>
<th>t-test 95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>21.0 ± 4.6</td>
<td>20.8 ± 4.0</td>
<td>0.211</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.7 ± 4.2</td>
<td>23.2 ± 5.0</td>
<td>0.057</td>
</tr>
<tr>
<td>25 (OH)D(nmol/L)</td>
<td>27.3 ± 15.7</td>
<td>24.2 ± 14.9</td>
<td>0.0025*</td>
</tr>
<tr>
<td>SAI score</td>
<td>34.6 ± 7.0</td>
<td>39.4 ± 7.4</td>
<td>0.000*</td>
</tr>
<tr>
<td>FFQ score</td>
<td>17.4 ± 5.8</td>
<td>12.5 ± 4.9</td>
<td>0.064</td>
</tr>
</tbody>
</table>

*Differences are significant; p<0.05. All values are shown as mean ± SD. BMI, body mass index; SAI, sun avoidance inventory; FFQ, food frequency questionnaire.*
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Females (summer) (n = 138)</th>
<th>Females (winter) (n = 70)</th>
<th>t-test 95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>21.1 ± 4.6</td>
<td>20.3 ± 1.9</td>
<td>0.106</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.6 ± 4.6</td>
<td>24.4 ± 5.6</td>
<td>0.30</td>
</tr>
<tr>
<td>25 (OH)D (nmol/L)</td>
<td>20.9 ± 14.9</td>
<td>31.3 ± 12.3</td>
<td>0.0005*</td>
</tr>
<tr>
<td>SAI score</td>
<td>41.4 ± 7.4</td>
<td>35.1 ± 5.4</td>
<td>0.000*</td>
</tr>
<tr>
<td>FFQ score</td>
<td>13.2 ± 5.4</td>
<td>11.0 ± 3.2</td>
<td>0.003</td>
</tr>
</tbody>
</table>

* Differences are significant; p<0.05. All values are shown as mean ± SD., BMI, body mass index; SAI, sun avoidance inventory; FFQ, food frequency questionnaire.
Effect of Sun Avoidance on Vitamin D Levels
Figure 2.

Body Mass Index

- Severe Underweight: 0.47%
- Underweight: 22.17%
- Normal: 52.83%
- Overweight: 16.04%
- Obese: 7.98%
- Severe Obese: 1.42%
### Correlation Between Vitamin D, SAI, BDI & BMI

<table>
<thead>
<tr>
<th></th>
<th>Vitamin D</th>
<th>SAI Total</th>
<th>BDI-Total</th>
<th>Body Mass Index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vitamin D</strong></td>
<td>1</td>
<td>-0.327**</td>
<td>-0.311**</td>
<td>0.030</td>
</tr>
<tr>
<td><strong>Significance-1 tailed</strong></td>
<td>0.000</td>
<td>0.000</td>
<td>0.332</td>
<td></td>
</tr>
<tr>
<td><strong>n</strong></td>
<td>212</td>
<td>208</td>
<td>211</td>
<td>209</td>
</tr>
<tr>
<td><strong>SAI Total</strong></td>
<td>-0.327**</td>
<td>1</td>
<td>0.178**</td>
<td>0.099</td>
</tr>
<tr>
<td><strong>Significance-1 tailed</strong></td>
<td>0.000</td>
<td>0.005</td>
<td>0.078</td>
<td></td>
</tr>
<tr>
<td><strong>n</strong></td>
<td>208</td>
<td>208</td>
<td>207</td>
<td>205</td>
</tr>
<tr>
<td><strong>BDI Total</strong></td>
<td>-0.311**</td>
<td>0.178**</td>
<td>1</td>
<td>-0.005</td>
</tr>
<tr>
<td><strong>Significance-1 tailed</strong></td>
<td>0.000</td>
<td>0.005</td>
<td>0.471</td>
<td></td>
</tr>
<tr>
<td><strong>n</strong></td>
<td>211</td>
<td>207</td>
<td>211</td>
<td>208</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td>0.030</td>
<td>0.099</td>
<td>-0.005</td>
<td>1</td>
</tr>
<tr>
<td><strong>Significance-1 tailed</strong></td>
<td>0.332</td>
<td>0.078</td>
<td>0.471</td>
<td></td>
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<td><strong>n</strong></td>
<td>209</td>
<td>205</td>
<td>208</td>
<td>209</td>
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</table>

**Correlation is significant at the 0.01 level (1-tailed), Pearson Correlation, Significance (1-tailed)**
Results

- Significant negative correlation between vitamin D status and SAI
- Significant negative correlation between vitamin D status and BDI
- Significant positive correlation between BDI and SAI

X No correlation between vitamin D and FFQ

X No correlation between vitamin D and BMI
Conclusions

- Documents the true picture of Vitamin D deficiency among University students in the UAE

- Guide future intervention studies which would aim at implementing awareness programs to educate people about the beneficial role of Vitamin D (implications from SAI results)

- Vitamin D deficiency and insufficiency can be both corrected/treated and prevented safely through supplementation, fortification and UVB

- Encourage policy makers to implement a policy in the UAE regarding the need for fortification of drinks and some food items with Vitamin D
Recommendation:

I recommend:

400-1000 IU/day for infants
1000-1500 IU/day for Children 1-10 years
1500-2000 IU/day for teenagers and adults

Treatment Recommendations For Vitamin D Deficiency

Vitamin D Deficiency
25(OH)D < 20 ng/mL

50,000 IU/wk D₂ or D₃ for 8 Weeks

Maintenance Therapy (3 Choices)

50,000 IU D₂ every 2 weeks
1,000 to 2,000 IU D₃ daily
Sunlight exposure

Recheck 25(OH)D in 3 to 6 months

1Tab
Vitamin D₃
50,000 IU/month
- Vitamin D₃
- 100,000 IU
- by mouth
- one time

Is Vitamin D Toxic?..

- Excessive exposure to sunlight does not lead to overproduction of vitamin D.
- Supplemental vitamin D in certain clinical settings may have toxicity.
- Symptoms are largely hypercalcaemia, high blood pressure, headache, fatigue, loss of appetite, excessive thrust and polyurea, severe itching, vomiting, diarrhoea, constipation, kidney damage, joints and muscle pain.
1217 Clinical Trials Related to Vitamin D on Jan 20, 2011

- Bone 84
- Calcium 51
- Osteoporosis 51
- Kidney 44
- Renal 28
- Postmenopausal 25
- Hyperparathyroidism 20
- Prostate 19
- Obese 19
- Breast Cancer 16
- Fracture 15
- Diabetes 12
- HIV 10
- Elderly 9
- Tuberculosis 9

- Chronic Obstructive Pulmonary Disease 7
- Colon 6
- Multiple Sclerosis 5
- Blood Pressure 5
- Muscle 5
- Cystic Fibrosis 5
- Hip 5
- Rheumatoid Arthritis 5
- Lung 4
- Psoriasis 4
- Lupus 4
- Crohn's 4
- Knee 3
- Heart 9
- Rickets 7

http://clinicaltrials.gov/
1. What is the optimal level of vitamin D suppl. and or level of D in the blood to achieve maximal benefits?.

2. Is vitamin D suppl. given orally equally effective to D produced endogenously in the skin?.

3. Do low concentrations of D predispose people to malignancy or inflammatory disease?.

Outstanding Questions
Acknowledgements

- Dr. Fatme Al Anouti
- Dr. Laila Abdel-Wareth
- Dr. Jaishen Rajah
- Mr. Nafiz Nimer
Thanks for your Attention