# Prevalence of Hypovitaminosis D in Adult Iraqi People Including Postmenopausal Women

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**Abstract: Background: Vitamin D is a fat–soluble vitamin highly important for skeletal health. Its deficiency is very common and a worldwide metabolic disorder.**

**Objective: To study the prevalence of vitamin D deficiency in adult Iraqi people including postmenopausal women.**

**Methods: The sample studied included 300 participants who accepted to participate in the study. They were in fact companions of patients visiting private specialist medical clinics in Karbala city. The study was completed within 15 months. Participants were divided in to four groups:**
**A - Postmenopausal women**
**B - Women of child-bearing age (25-49) years**
**C - Young men (25-49) years**
**D - Men aged (50-70) years**
**The data were collected according to a format, which was then analyzed statistically and registered.**

**Results:**
**Group (A): Number of participants (120). Severe vitamin D deficiency, i.e. serum level <10ng /ml occurred in 48 participants (40%) of the total, with a mean serum level of (8.5) ng/ml. Fifty four individuals (45%) had serum level of (10-20) ng/ml with a mean of (13.2) ng/ml.**
**Group (B): Sixty women of child-bearing age (25-40) years. Severe vitamin deficiency occurred in (9) persons (15%), with a mean serum level of (7.6) ng/ml and (30) persons (50%) had vitamin deficiency, the mean serum level was (14.2) ng/ml.**
**Group (C): Sixty men. Severe vitamin D deficiency occurred in (7) men (12%), mean serum level (7.8) ng/ml .Vitamin deficiency in (29) men (48%), with a mean serum level of (14.5) ng/ml.**
**Group (D): Sixty men. Severe vitamin D deficiency occurred in (14) men (23.3%) with a mean serum level of (7.3) ng/ml .Vitamin deficiency in (35) men (58.3%), the mean serum level was (14.0) ng/ml.**

**Conclusion: Hypovitaminosis D occurred in more than (85%) of postmenopausal women, more than (65%) of women of child-bearing age, more than (60%) of young men aged (25-49) years and about (82%) of men aged (50-70) years.**

**Key words: Hypovitaminosis D; vitamin D serum level (ng/ml); prevalence; participants.**

## I. INTRODUCTION

Vitamin 25- (OH) D (Vitamin D) has been appreciated for its role in calcium homeostasis and bone health since its identification in 1921[1]. In practice there are two forms of vitamin D: Vitamin D2 called ergocalciferol found in vegetable sources e.g. mushroom and as oral supplements, and Vitamin D3 cholecalceferol which is manufactured in the skin by the effect of sun light ultraviolet which changes the vitamin precursor 7- dehydrocholesterol into vitamin D3. Other sources of Vitamin D3 are animal food, e.g. fatty fish such as salmon, tuna, also cod-liver oil, milk and its products. Vitamin D dietary sources are limited and unaffordable to most postmenopausal women [2]. . .

Vitamin D (D2+D3) is a prohormone which requires two hydroxylations, one in the liver and the second in the kidney before it becomes the active form (1, 25$(OH)_2$ D). The most well recognized function of the active Vitamin D is regulation of calcium and phosphorus balance for bone mineralization and remodeling [2, 3].

Vitamin D deficiency leads to decreased absorption of calcium and phosphorus from the intestine leading in turn to hypocalcemia and ultimately to hyperparathyroidism which in turn results in resorption of bone. Overt signs of Vitamin D deficiency are relatively rare, though Vitamin D insufficiency is remarkably common [4].

There are many diseases that are associated with Vitamin D deficiency and improved when the Vitamin is administered, e.g. cardiovascular diseases, cancer, tuberculosis, respiratory tract infection, coronary heart diseases, hypertension, diabetes and obesity [2, 5]. There are studies investigating whether Vitamin D is helpful or effective for Crohns disease through the role of immunity [6]. Weight gain usually occurs during menopause and there is a link between obesity and Vitamin D. Studies have shown an association between Vitamin D and prevention of colon, breast and prostate cancer [7].

The amount of Vitamin D manufactured by the skin depends on day time, season, latitude, altitude, clothing, veiling, sunscreen use, old age and skin color [8]. Even in sunny climates Vitamin D deficiency is found because of cultural and social habits [9]. Elderly skin produces 75% less Vitamin D [10]. During public health campaigns sunscreen is used which prevents sunlight ultraviolet to do its action [11]. Daily intake of Vitamin D is commonly insufficient if sunlight exposure is limited [12].

The most reliable marker of Vitamin D status is its serum concentration. There are variable cutoffs for normal range of serum Vitamin D, community levels between 30-50 ng/ml is regarded as sufficient and 10-20 ng/ml as deficiency [13]. Adequate daily intake of Vitamin D is variable but as low as 800 i.u. /day or 50.000 units monthly is considered adequate [14, 15]. Opinions differ in whether D2 or D3 is better to be used [15, 16].

## II. METHODS

The total sample included 300 participants. They were companions of patients visiting specialist private clinics in Karbala City from first of January 2015 till first of April 2016 when the study was ended.

The sample was divided into four groups:

Group A: 120 postmenopausal women,

Group B: women of child-bearing age (25-49) years,

Group C: young men aged (25-49) years (nearly aged matched with Group B).

Group D: Men aged (50-70) years.

Full history and physical examination were done to all participants, then they were sent for investigations such as serum level of Vitamin D by immunoassay method (Cobas instrument), serum calcium, serum phosphorus and alkaline phosphatase. Serum parathyroid hormone was not determined because of its very high cost and frequently unavailable. The data were then grouped and results analyzed using SPSS method of statistical analysis and then tabulated.

## III. RESULTS

The total number of participants was 300, divided into four groups:

Group A: Postmenopausal women, their number was 120, mean age (62 ± 8.25), those with severe Vitamin D deficiency (level <10 ng/ml) were 48 participants (40%) and the mean serum level was 8.5 ng/ml. Fifty four participants (45%) had vitamin deficiency with a serum level of Vitamin D (13.2 ng/ml). Refer to table III for other details.

Group B: Sixty women of child bearing age. Their ages ranged from 25-49 years (mean 37.48 ±7.32). Women with severe serum vitamin deficiency were 9 (15%), with a mean serum level (7.6 ng/ml). Thirty women (50%) had vitamin deficiency with serum level of (14.2) ng/ml. Refer to table IV for other details.

Group C: Sixty men aged (25-49) years mean (36.13 ± 6.75) nearly aged matched with group B. Men with severe Vitamin D deficiency were (7) i.e. (12%) with serum level of (7.8) ng/ml, 29 individuals (48%) had Vitamin D deficiency with mean serum level of (14.5) ng/ml other details are in table V.

Group D: Sixty persons aged (50-70) years mean age (58.03 ± 9.16). Men with severe Vitamin D deficiency were (14) i.e. (23.3%), with mean serum level of (7.3) ng/ml . Men with Vitamin D deficiency were 35 (58.3%), with a mean level of (14.0) ng/ml. Full details are in table VI.

## IV. DISCUSSION

It is well known that the main source of Vitamin D is the skin when exposed to sun light. Consequently, the most common cause of Vitamin D deficiency is lack of sun light exposure [17] when dietary sources are limited. Therefore, the insufficiency is remarkably common [18] and prevalent especially in developing countries, varying widely by and within regions between 30 – 90% [19].

The American College Of Cardiology classifies levels of Vitamin D into: severe deficiency when the serum level is below (10 ng/ml), deficiency when the level is (10-20 ng/ml), insufficiency (inadequate or suboptimal, when the level is 21 – 29 ng/ml), optimal or adequate when the level is (30 ng/ml) or over as seen in table I.

The four groups of the study sample differ in terms of sex, age, number of participants (table II) and in the mean of serum level of vitamin D in each group (tables III, IV, V and VI). The postmenopausal group (A) and group (D) carry the least serum level of Vitamin D with means of (13.5) and (14.6), respectively, compared with other groups (tables VII and VIII).

Comparison between Iraqi Postmenopausal women in this study with those in other countries, e.g. in Saudi Arabia, a study of ((321) participants with conservative dress (i.e. veiling), their serum level of Vitamin D was (11.0 ng/ml) [18]. Similarly a study of (245) Postmenopausal Iranian Women showed that in (5%) of them serum Vitamin D level was (<10 ng/ml) and in (37%) the serum Vitamin level was (10-20 ng/ml) [18]. In Morocco a study was carried out in 2012 on postmenopausal women with their serum level of Vitamin D was (15.8 ± 11.6 ng/ml) [20]. These studies show some similarity with Iraqi figures. The serum level of Vitamin D of postmenopausal women of these countries, show low figures, which may be due to many factors including clothing of the body plus veiling .

In some countries, indoor life, senility and diet poor in Vitamin D and unavailability of Vitamin D fortified diet are substantial factors. In china the mean level of serum Vitamin D in participants of a multi center survey study was (19.4 ± 4.6 ng/ml): as follows ( 5.9%) of participants had severe deficiency (serum level <10 ng/ml) , (50%) had deficiency (serum level 10-20 ng/ml) , (38.7%) had Vitamin D insufficiency (20-30 ng/ml) and (5.4%) had a level of (>30 ng/ml) [21]. In India the prevalence of Vitamin D deficiency: generally (70-100%) of Indians especially among postmenopausal women because of socioreligious practices don't facilitate adequate sun exposure together with absence of Vitamin D fortified food. In middle east and Africa, hypo-Vitaminosis D is prevalent in these countries with very low serum level of Vitamin D which ranges between (4.0-15.8 ± 11.6 ng/ml) with a mean level of (<10 ng/ml) [22, 23, 24 and 25]. Other details are seen in table (X). In Australia the majority of adults had sufficient level of serum Vitamin D (>20 ng/ml) in 2011-2012, only (23%) of adults had serum level of Vitamin D of (12-19.6 ng/ml) [26].

The mean serum level of Vitamin D status in Europe differs from one country to another depending on season, latitude and other common factors. Vitamin D in European adults has been reported to be (<10 ng/ml) in (2-30%) of people increasing in the institutional elderly to (80%) in some studies. A study, in 2014, showed that Sweden among Europe had the highest level (26.8 ng/ml), then came France (25.7 ng/ml) and Denmark (24.8 ng/ml), table (XI) shows more details [27]. According to another report, in 2009, from archive of internal medicine, as many as (77%) of Americans are Vitamin D deficient, considering Vitamin D level below (30 ng/ml) as indicator of deficiency [28].

New Bridge Pharmaceutical (a drug company) has published a nice histogram on one of its leaflets revealing the global prevalence of Vitamin D deficiency in different countries (Figure I). Unfortunately, no study was available for Vitamin D status in Iraq for comparison with the above studies.

In regards with relation of Vitamin D and serum calcium, serum phosphorus and alkaline phosphatase of the study sample (table (XII), sixty participants from the whole sample, i.e.(20%), showed mild – moderate decrease in both serum calcium and serum phosphorus. Fifty persons (16.7%) had increased alkaline phosphatase and only (12) participants (4%) had symptoms e.g. aches and pains, low backache and difficulty in rising from a low chair.

The above reported figures of the present investigation are expected, except for alkaline phosphatase. It would be expected to be higher because of suspected massive demineralization of bone in these patients. It would have been of great benefit if the study had involved the estimation of Parathyroid Hormone (PTH) which would give further information about the relationship between Vitamin D level and PTH, but its high cost and unavailability in most laboratories were the limitations of the study.

TABLE I. SERUM 25-HYDROXY VITAMIN D IN NG/ML ACCEPTED BY AMERICAN COLLEGE OF CARDIOLOGY, JAM COLL. CARDIOL., 2011;58(15):1547-1556 DOI:10. 1016/J.J.ACC.2011.07.008.

| **Serum 25-Hydroxy Vitamin D in ng/ml** | **Vitamin D Status** |
|---|---|
| **≤ 10** | Severe Deficiency |
| **10-20** | Deficiency |
| **20-30** | Mild – Moderate Deficiency |
| **≥ 30** | Sufficient |
| **40-50** | Ideal |
| **50-150** | Indeterminate |
| **>150** | Toxicity |

TABLE II. AGE AND SEX DISTRIBUTION IN THE WHOLE SAMPLE.

| Age in years | Age Mean ± SD | Sex | | Total |
|---|---|---|---|---|
| | | No. of Males | No. of Females | |
| **Group (A) (50-70)Years Postmenopausal** | 62 ± 8.25 | | 120 | 120 |
| **Group (B) (25-49)Years Childbearing** | 37.48 ± 7.32 | | 60 | 60 |
| **Group (C) (25-49)Years Young Males** | 36.13 ± 6.75 | 60 | | 60 |
| **Group (D) (50-70)Years Males** | 58.03 ± 9.16 | 60 | | 60 |
| **Total Number** | | | | 300 |

TABLE III. VITAMIN 25(OH)D LEVEL IN POSTMENOPAUSAL WOMEN (GROUP A), N= 120.

| State Level Of Vitamin 25 (OH)D in Serum | Number Of Participants | Percentage of the Total | Mean Serum Level in ng/ml |
|---|---|---|---|
| **Severe Deficiency <10 ng/ml** | 48 | 40 | 8.5 |
| **Deficiency 10-20 ng/ml** | 54 | 45 | 13.2 |
| **Suboptimal (Insufficient) 20 - 30 ng/ml** | 13 | 10.8 | 25 |
| **Optimal (Sufficient) ≥ 30 ng/ml** | 5 | 4.2 | 35 |
| **Total** | 120 | | Average mean 13.5 |

TABLE IV. THE RESULTS OF THE SERUM LEVEL OF VITAMIN 25(OH)D IN CHILDBEARING WOMEN (GROUP B), N= 60, AGE (25 – 49) YEARS.

| State level of Vitamin 25(OH)D in ng/ml | Number Of Participants | % | Mean Level Of Vitamin 25(OH)D |
|---|---|---|---|
| **Severe Deficiency <10 ng/ml** | 9 | 15 | 7.6 |
| **Deficiency 10-20 ng/ml** | 30 | 50 | 14.2 |
| **Suboptimal (Insufficient) 20-30 ng/ml** | 15 | 25 | 23.0 |
| **Optimal level (Sufficient) ≥ 30 ng/ml** | 6 | 10 | 32.6 |
| **Total** | 60 | 100 | Average mean 17.3 |

TABLE V. SERUM VITAMIN 25(OH)D
IN YOUNG MEN (25 – 49) YEARS, (GROUP C).

| State Level of Serum Vitamin 25(OH)D in ng/ml | Number of Participants | Percentage of the Total | Mean in ng/ml |
|---|---|---|---|
| **Severe Deficiency <10 ng/ml** | 7 | 12 | 7.8 |
| **Deficiency 10-20 ng/ml** | 29 | 48 | 14.5 |
| **Suboptimal (Insufficient) 20-30 ng/ml** | 17 | 28 | 23.8 |
| **Optimal (Sufficient) ≥ 30** | 7 | 12 | 33.0 |
| **Total** | 60 | 100 | Average mean 18.5 |

TABLE VI. SERUM VITAMIN 25(OH) D IN 60 MEN (50-70 YEARS),
(GROUP D).

| State Level of Serum Vitamin 25(OH)D in ng/ml | Number Of participants | % | Mean ng/ml |
|---|---|---|---|
| **Severe deficiency < 10 ng/ml** | 14 | 23.3 | 7.3 |
| **Deficiency 10-20 ng/ml** | 35 | 58.3 | 14.0 |
| **Suboptimal (Insufficient) 20-30 ng/ml** | 7 | 11.7 | 21.8 |
| **Optimal (Sufficient) ≥ 30 ng/ml** | 4 | 6.7 | 32.1 |
| **Total** | 60 | 100.0 | Average mean 14.6 |

TABLE VII. STATE LEVEL OF SERUM VITAMIN 25(OH)D IN THE
WHOLE SAMPLE IN ng/ml (N= 300).

| Serum Status of Vitamin (OH)D | Group A Post-menopausal Women | | | Group B Childbearing Women Age (25-49) | | |
|---|---|---|---|---|---|---|
| | Mean | Number | % | Mean | Number | % |
| **Severe Deficiency < 10 ng/ml** | **8.5** | **48** | **40** | **7.6** | **9** | **15** |
| **Deficiency 10-20 ng/ml** | **13.2** | **54** | **45** | **14.2** | **30** | **50** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Suboptimal (20-30) ng/ml** | **25** | **13** | **10.8** | **23.0** | **15** | **25** |
| **Optimal >30 ng/ml** | **35** | **5** | **4.2** | **32.6** | **6** | **10** |

TABLE VII- continued. STATE LEVEL OF SERUM VITAMIN 25(OH)D IN THE WHOLE SAMPLE IN ng/ml (N= 300).

| **Serum Status of vitamin (OH)D** | **Group C Men (25-49) years** | | | **Group D Men (50-70) years** | | |
|---|---|---|---|---|---|---|
| | **Mean** | **Number** | **%** | **Mean** | **Number** | **%** |
| **Severe Deficiency < 10 ng/ml** | **7.8** | **7** | **12** | **7.3** | **14** | **23.3** |
| **Deficiency 10-20 ng/ml** | **14.5** | **29** | **48** | **14.0** | **35** | **58.3** |
| **Suboptimal (20-30) ng/ml** | **23.8** | **17** | **28** | **21.8** | **7** | **11.7** |
| **Optimal >30 ng/ml** | **33.0** | **7** | **12** | **32.1** | **4** | **6.7** |

TABLE VIII. COMPARISON OF MEANS IN DIFFERENT GROUPS OF THE SAMPLE.

| **Group** | **Mean Serum Level of Vitamin 25(OH)D** |
|---|---|
| **Group A Postmenopausal Women** | 13.5 |
| **Group B Childbearing Women** | 17.3 |
| **Group C Men Aged 25-49 years** | 18.5 |
| **Group D Men Aged 50-70 years** | 14.6 |
| **Mean of the Total Sample** | 15.5 |

TABLE IX. PERCENTAGES OF VITAMIN D DEFICIENCY WITHIN DIFFERENT GROUPS OF THE STUDY.

| Group | No. of individuals with Vitamin D deficiency | Percentage of deficiency |
|---|---|---|
| **A n= 120** | 102 | 85 |
| **B n= 060** | 39 | 65 |
| **C n= 060** | 36 | 60 |
| **D n= 060** | 49 | 82 |

N.B.: Deficiency and severe deficiency were considered.

TABLE X. SERUM LEVELS OF VITAMIN 25(OH) D IN COUNTRIES OF THE MIDDLE EAST AND NORTH AFRICA [22, 23, 24 and 25].

| Country | Year | Age | Sex | Number of Individuals | Serum level ng/ml |
|---|---|---|---|---|---|
| **Saudi Arabia** | | University Students Elderly | | | 4.0-12.0 |
| **Saudi Arabia** | | | Females | | Near 10.0 |
| **Saudi Arabia** | | Students | Males | | 12.8 ± 6.3 |
| **Saudi Arabia** | | Post-menopausal Women | | 321 | 11.0 |
| **Saudi Arabia** | 2012 | 20 – 70 | | | 11.6 ± 6.45 |
| **Saudi Arabia** | | Adolescent | Girls | 80% | <10.0 |
| **Lebanon** | | | females | | 10.0 |
| **Lebanon** | | | females | 32% | <10.0 |
| **Lebanon** | | Elderly | Males | 37% | <10.0 |
| **Lebanon** | | Elderly | females | 56% | <10.0 |
| **Tunisia** | | | | | <15.0 |
| **Iran** | | Post-menopausal Women | | 245 | 5%: 10.0<br>37%: 10-20.0 |
| **Iran** | | Adolescent | Girls | 70% | <10.0 |
| **Morocco** | 2012 | Post-menopausal Women | | | 15.8 ± 11.6 |
| **Emirates** | | | Women | 259 | 10.0 |

TABLE XI. SERUM LEVELS OF VITAMIN 25(OH)D IN EUROPEAN COUNTRIES. ADAPTED FROM WAHL *et al*., 2012 and HILGE *et al*., 2014,
ADULT PEOPLE NUT. BULL., 39(4): 322 – 350, 2014.

| Country | Year of Study | Age and Sex | Number of Individuals | Serum Vitamin D ng/ml (+season) |
|---|---|---|---|---|
| **Austria** | 2003 | 21-76 | 1048 | 20.9 |
| **Belgium** | 2011 | 20+ | 542 | 28.6(M), 29.4(F) |
| **Denmark** | 2001 | 17-87(F) | | 24.8 |
| **Finland** | 2001 | 31-43 | 328 | 8.0 (M), 18.8(F) |
| **France** | 2009 | 18-76(F) | 248 | 25.7 |
| **Germany** | 2008 | 18-79 | 4030 | 18.1(M), 17.9(F) |
| **Italy** | 2001 | 36.9 | 90 | 17.1 |
| **Norway** | 2004 | 44.59(F) | 300 | 22.8 |
| **Spain** | 2004 | 15-70 | 253 | 21.1(M), 20.0(F) |
| **Switzerland** | 1992 | 25-74 | 3276 | 20.0 |
| **Ireland** | 2005 | 65.1(F) | 43 | 17.5 winter |

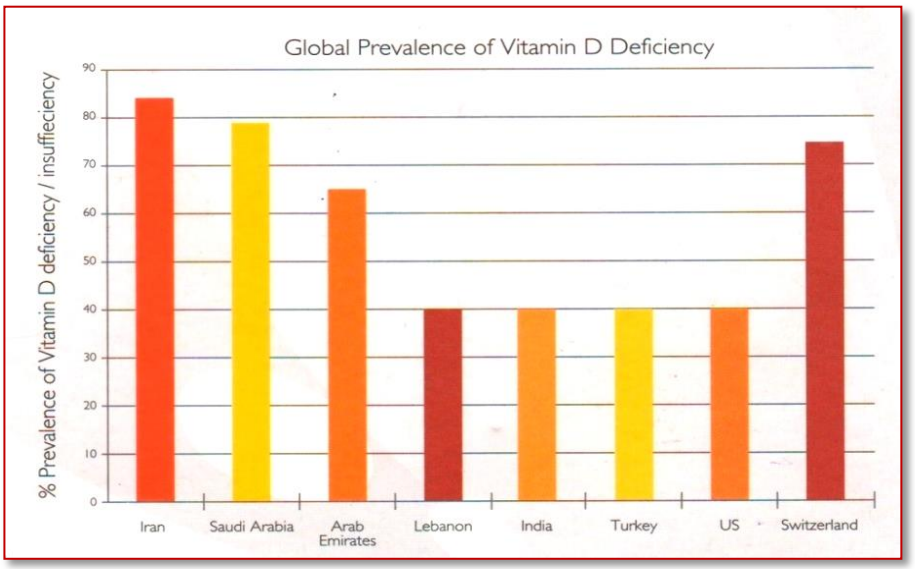
| | | | | |
|---|---|---|---|---|
| **Poland** | 2009 | 60-90(F) | 274 | 13.4 winter |
| **Sweden** | 2009 | 61-83(F) | 100 | 28.8 winter |
| **Netherlands** | 2009 | 50-75 | 614 | 21.5 |
| **United Kingdom** | 2014 | 65+ | 212 | 17.8 (16.2: Jan. – March 20.2: July – Sept.) |

**F=** Female; **M=** Male

TABLE XII. SERUM LEVEL OF PHOSPHORUS, CALCIUM AND ALKALINE PHOSPHATASE IN THE PARTICIPANTS WHOSE SERUM LEVEL OF VITAMIN 25(OH) D LESS THAN 10 ng/ml (SEVERE DEFICIENCY).

| Groups | Number of Participants | Serum Calcium mg/dl | Serum Level of Phosphorus mg/dl | Number of cases with increased alkaline phosphatase | Number of Symptomatic Individuals |
|---|---|---|---|---|---|
| **Group A** | 30 | 7.2 – 8.0 | 1.8 – 2.2 | 24 | 7 |
| **Group B** | 9 | 7.4 – 8.1 | 1.9 – 2.3 | 8 | 2 |
| **Group C** | 7 | 7.8 – 8.2 | 2.0 – 2.3 | 6 | 0 |
| **Group D** | 14 | 7.1 – 8.0 | 1.9 – 2.2 | 12 | 3 |
| **Total** | 60 | | | 50 | 12 |

FIGURE I. HISTOGRAM REVEALING GLOBAL PREVALENCE OF VITAMIN D DEFICIENCY.

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