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# The Impact of Sun Exposure Duration and Dietary Patterns on Vitamin D3 Levels in the Iraqi Population

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**ABSTRACT**
**Background:** Vitamin D3 is a crucial nutrient involved in various physiological processes, including calcium absorption, bone health, immune function, and inflammation regulation Vitamin D deficiency is considered to be one of the most common medical conditions worldwide.
**Aim:** to evaluate Levels of Vitamin D3 and its correlation with Sun Exposure Duration And Dietary Patterns at AL-Karama Hospital .
**Method:** In this cross-sectional study, a sample of 500 persons was randomly selected from those who visited. The data collecting period spanned from April to October . It involved conducting direct interviews utilizing a specifically designed questionnaire for the study. The data was analyzed using the SPSS program, specifically version 24. A p-value is deemed significant if it is less than 0.05.
**Results:**Males A significant proportion of males are deficient in vitamin D3 (22.8%), with 6.8% falling into the insufficient category and 3.4% classified as sufficient. Females A higher percentage of females are deficient (45.6%) in vitamin D3, with 13.4% falling in the insufficient category and 8% having sufficient levels.A large proportion of individuals consuming both types of food are deficient (59.2%), while 20% are insufficient and 11.4% are sufficient.Also a highly significant relationship between serum vitamin D3 levels and duration of sun exposure.
**Conclusion :** Vitamin D deficiency appears to be more common in femalesAlso diverse diet that includes both plant and animal sources improves Vitamin D levels.Adequate sun exposure (at least 1 hour daily) is a critical factor for maintaining sufficient Vitamin D levels.

**Keywords:** Vitamin D3,Sun Exposure, Dietary Patterns,

## INTRODUCTION

Vitamin D is a hormone acquired by food intake and dermal synthesis. Ultraviolet B (UVB) light, with a wavelength of 290 to 315 nm, transforms 7-dehydrocholesterol in the epidermis into pre-vitamin D. This pre-vitamin D undergoes thermal isomerization and is transformed into vitamin D.Vitamin D obtained from the skin and food is converted in the liver to 25-hydroxyvitamin D (25 OH D), which is crucial in evaluating vitamin D levels. In the kidneys, 25-hydroxyvitamin D is converted to its physiologically active form, 1,25-dihydroxyvitamin D (1,25 (OH)), by the enzyme 25-hydroxyvitamin D-1 alpha-hydroxylase (CYP27B1). The renal synthesis of 1,25-dihydroxy vitamin is regulated by parathyroid hormone, calcium, and phosphorus concentrations. 1,25-dihydroxy vitamin D binds to the vitamin D receptor, a hormone receptor located in the cell nucleus. Vitamin D attaching to its receptor alters gene transcription, activating some genes while inhibiting others. It enhances the absorption of calcium and phosphorus in the intestines.Without vitamin D, around 10 to 15% of dietary calcium and 60% of phosphorus are absorbed. With the presence of vitamin D, calcium absorption increases to 30% to 40% and phosphorus absorption rises to 80%.In the kidneys, 1,25-dihydroxyvitamin facilitates calcium reabsorption.Vitamin D serves a physiological role beyond calcium metabolism. The vitamin D receptor is located in the small intestine, colon, T and B lymphocytes, mononuclear cells, brain, and skin. It enhances insulin synthesis, regulates the activity of activated T and B lymphocytes, inhibits inflammatory bowel disorders, and influences cardiac contractility[(3)].

**Study population and Sampling technique**
In this cross-sectional study, a sample of 500 persons was randomly selected from those who visited..It involved conducting direct interviews utilizing a specifically designed questionnaire for the study.

**Subjects And Methods**
A cross sectional study from The data collecting period spanned from April to October.Data was collected by directly interviewing the participants, the time needed for each interview was 10-15 minutes, About four days per week (from Sunday to Wednesday) start at 9 a.m. to 1 p.m.

**Statistical analysis**
Data entry and analysis was done using SPSS version 24 computer software (statistical package for social sciences), categorical variables were presented as frequencies and percentages. Figures were used as needed. Chi square test was also used .

**RESULT**
**1.Gender Distribution:**The distribution of serum vitamin D3 levels among males and females is as follows:
Males: A significant proportion of males are deficient in vitamin D3 (22.8%), with 6.8% falling into the insufficient category and 3.4% classified as sufficient.
Females: A higher percentage of females are deficient (45.6%) in vitamin D3, with 13.4% falling in the insufficient category and 8% having sufficient levels.

**Table 1:** Statistical Test for the Association Between Serum Vitamin D3 Levels (ng/ml) and Gender.

| **Variables** | | **Serum Vitamin D3 Level (ng/ml)** | | | **Chi-square test** | **P value** |
|---|---|---|---|---|---|---|
| | | Deficient (<20ng/mL) | Insufficient (20-29 ng/mL) | Sufficient (≥30 ng/mL) | | |
| Gender | Male | 114 (22.8%) | 34 (6.8%) | 17 (3.4%) | 0.297 | 0.862 |
| | Female | 228 (45.6%) | 67 (13.4%) | 40 (8%) | | |
| Total | | 342 (68.4%) | 101 (20.2%) | 57 (11.4%) | | |

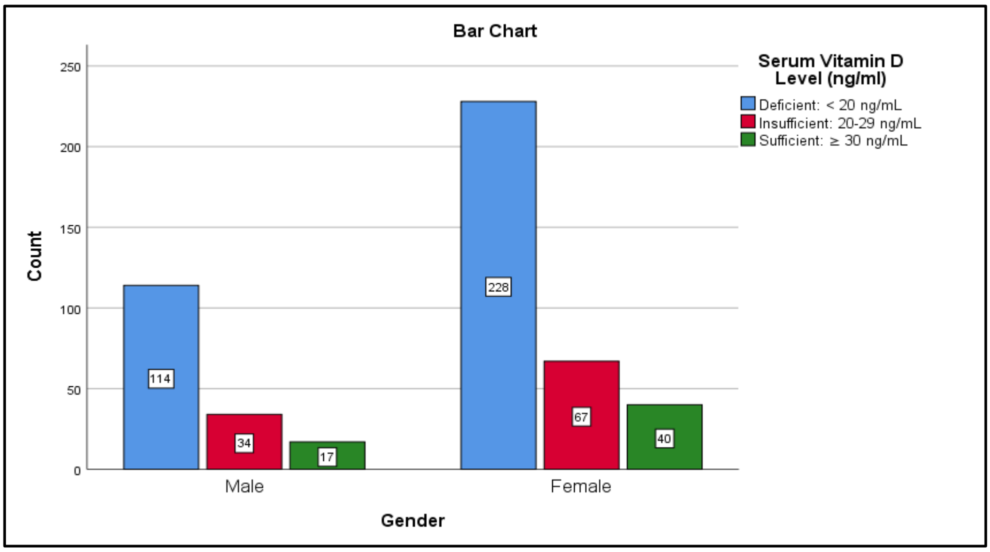


**Figure 1:** The Association Between Serum Vitamin D3 Levels (ng/ml) and Gender.

**2.Vitamin D3 Levels by Quality of Food:**

- Plant-based food: The majority of individuals who consume a plant-based diet are deficient in vitamin D3 (**9.2%**), with no individuals classified as insufficient **or** sufficient.
- Animal-based food: A very small percentage (**0.2%**) of individuals with an animal-based food consumption are classified as **insufficient**, and no individuals are deficient **or** sufficient.

- Both plant and animal-based food: A large proportion of individuals consuming both types of food are deficient **(**59.2%**), while** 20% are insufficient **and** 11.4% **are** sufficient.

**Table 2:** Statistical Test for the Association Between Serum Vitamin D3 Levels (ng/ml) and Quality of food.

| **Variables** | | **Serum Vitamin D3 Level (ng/ml)** | | | **Chi-square test** | **P value** |
|---|---|---|---|---|---|---|
| | | Deficient (<20ng/mL) | Insufficient (20-29 ng/mL) | Sufficient (≥30 ng/mL) | | |
| Quality of food | Plant | 46 (9.2%) | 0 (0%) | 0 (0%) | **27.166** | <0.001* |
| | Animal | 0 (0%) | 1 (0.2%) | 0 (0%) | | |
| | Both | 296 (59.2%) | 100 (20%) | 57 (11.4%) | | |
| **Total** | | 342 (68.4%) | 101 (20.2%) | 57 (11.4%) | | |

*** Significant association between groups (p value <0.05)**

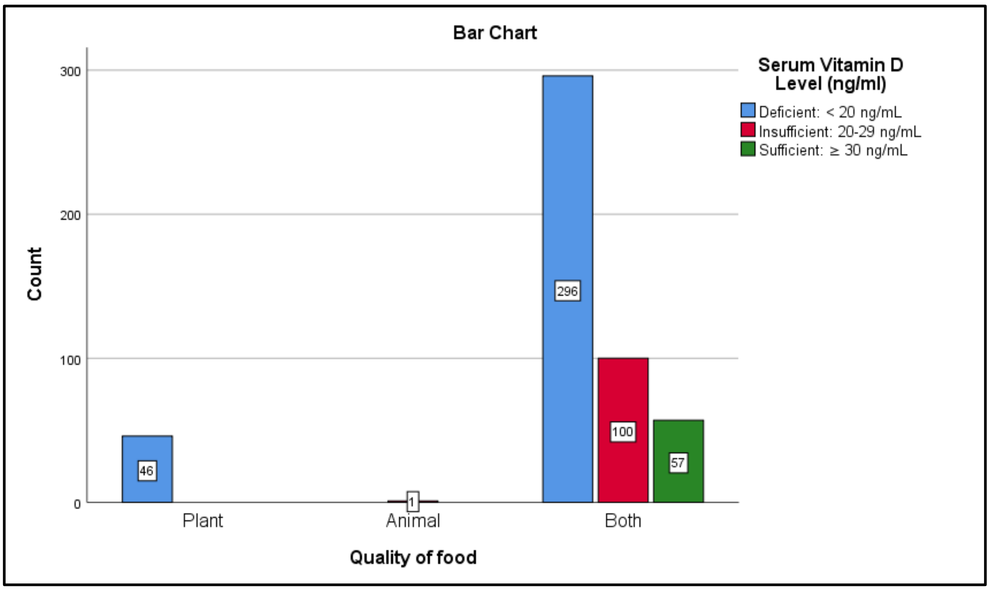


**Figure 2:** The Association Between Serum Vitamin D3 Levels (ng/ml) and Quality of food.

**3. Vitamin D3 Levels by Duration of Sun Exposure**

- **<1 hour of sun exposure**: A significant proportion of individuals with less than one hour of sun exposure are **deficient** in vitamin D3 (**66.4%**), while **15.2%** are **insufficient** and **6.8%** are **sufficient**.
- **>1 hour of sun exposure**: Only a small percentage of individuals with more than one hour of sun exposure are **deficient** (**2%**), while **5%** are **insufficient** and **4.6%** are **sufficient**.

**Table 3:** Statistical Test for the Association Between Serum Vitamin D3 Levels (ng/ml) and Duration of exposure to the sun.

| **Variables** | | **Serum Vitamin D3 Level (ng/ml)** | | | **Chi-square test** | **P value** |
|---|---|---|---|---|---|---|
| | | Deficient (<20ng/mL) | Insufficient (20-29 ng/mL) | Sufficient (≥30 ng/mL) | | |
| Duration of exposure to the sun | <1 hr | 332 (66.4%) | 76 (15.2%) | 34 (6.8%) | 88.091 | <0.001* |
| | >1 hr | 10 (2%) | 25 (5%) | 23 (4.6%) | | |
| **Total** | | 342 (68.4%) | 101 (20.2%) | 57 (11.4%) | | |

* Significant association between groups (p value <0.05)

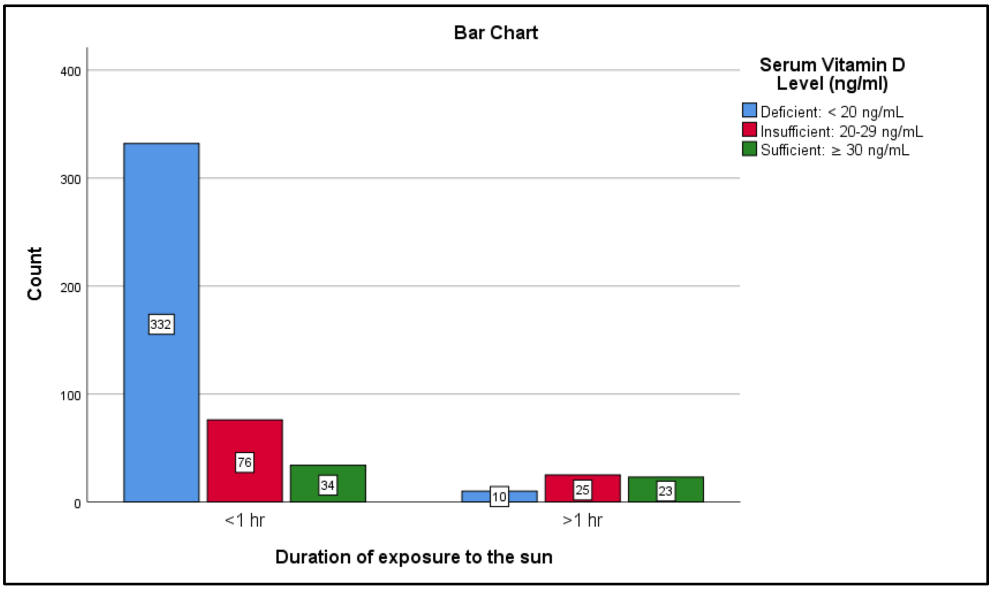


**Figure 3:** The Association Between Serum Vitamin D3 Levels (ng/ml) and Duration of exposure to the sun.

## DISCUSSION

In our study the association between serum Vitamin D3 levels (categorized as deficient, insufficient, and sufficient) and gender.data reveals that Vitamin D deficiency (<20 ng/mL) is more prevalent in females (45.6%) than males (22.8%), although this difference is not statistically significant. This finding is consistent with studies in similar contexts, such as Bener et al. (2009), who reported higher deficiency rates among females due to cultural practices (e.g., limited sun exposure) and physiological factors like pregnancy and lactation[4]. In contrast, studies in Western populations (Holick et al., 2011) show less disparity between genders, likely due to higher supplementation rates and better awareness of sun exposure benefits[5].A smaller proportion of both genders (3.4% males and 8% females) have sufficient Vitamin D levels (≥30 ng/mL). This aligns with global reports of widespread insufficiency across genders due to dietary inadequacies and reduced sun exposure (Mithal et al., 2009)[6].The non-significant P-value (0.862) may indicate that while females exhibit a higher prevalence of deficiency, other factors such as age, BMI, or lifestyle differences may play a more significant role in determining Vitamin D levels. Studies such as Roth et al. (2018) suggest that gender differences in deficiency often disappear when controlled for these confounders[7].

In our study we found Individuals consuming only plant-based foods are all Vitamin D deficient, with no representation in the insufficient or sufficient categories. Those consuming animal-based foods alone have negligible representation (1 individual with insufficient Vitamin D). Majority of individuals consuming both plant and animal-based foods are distributed across all categories (59.2% deficient, 20% insufficient, and 11.4% sufficient).

This suggests that a mixed diet incorporating both plant and animal sources is associated with better Vitamin D status, aligning with findings from studies such as Cashman et al. (2008), which emphasize the role of dietary diversity in achieving adequate Vitamin D levels[8].We found100% deficiency in individuals consuming plant-based foods aligns with studies like Rizzo et al. (2016), which report a high prevalence of Vitamin D deficiency in vegetarians and vegans due to the lack of animal-based Vitamin D sources[9]. Plant-based diets often rely on fortified foods or supplements, which, if not consumed, lead to deficiencies.The minimal representation of individuals consuming only animal-based diets could reflect the rarity of such diets or limited intake of Vitamin D-rich animal foods. Studies such as Lanham-New et al. (2011) highlight that while animal-based foods are primary sources of Vitamin D, intake must be consistent to prevent insufficiency[10].The better Vitamin D levels in individuals consuming both plant and animal foods reinforce the importance of dietary balance. Studies like Heaney et al. (2003) have shown that mixed diets provide a combination of natural Vitamin D from animal sources and fortified options in plant-based products, improving overall Vitamin D status[11].

Individuals with less than 1 hour of sun exposure daily have significantly higher rates of Vitamin D deficiency (66.4%) compared to those with more than 1 hour (2%).

In our research we found Individuals exposed to the sun for more than 1 hour daily show a greater proportion of sufficient Vitamin D levels (4.6%) than those with limited exposure (6.8%).These findings align with Holick et al. (2007), who reported that adequate sun exposure is the primary natural source of Vitamin D synthesis in the skin[12].

While Individuals exposed to the sun for >1 hour daily show better Vitamin D sufficiency rates. Studies like Cashman et al. (2008) highlight that longer sun exposure, especially in areas with high UV index, significantly enhances Vitamin D synthesis[13].

## CONCLUSION

Vitamin D deficiency appears to be more common in females, other factors such as age, lifestyle, and physical activity levels may play a more significant role in influencing Vitamin D status.Also diverse diet that includes both plant and animal sources improves Vitamin D levels, while purely plant-based diets without supplementation or fortification put individuals at a high risk of deficiency.Adequate sun exposure (at least 1 hour daily) is a critical factor for maintaining sufficient Vitamin D levels. Limited exposure significantly increases the risk of deficiency.

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