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Prevalence of Vitamin D and Calcium Deficiency among Women and Children in AL-Wahat Region, Libya (2022)

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ABSTRACT

Vitamin D deficiency is common in old age, often due to insufficient exposure to sunlight. A deficiency in both VD and Ca has harmful effects on human health, leading to osteoporosis in adults and rickets in children. It also negatively impacts women, as well as individuals with liver, kidney, diabetes, and heart diseases.In a 2022 study conducted in the Al-Wahat area, it was found that 66% of women had a VD deficiency. Most of these women were between the ages of 20 and 40 a critical period for female health, as it includes reproductive years, pregnancy, and lactation factors that affect both mothers and their children, contributing to conditions like osteoporosis, fractures, and rickets. Pearson's correlation coefficient between VD and calcium deficiency in women was calculated to be 0.8, indicating a strong positive correlation. Interestingly, the percentage of deficiency in children was also 66%, mirroring that of the women, suggesting a significant link between VDdeficiency in these two groups. However, no significant association was found between calcium and VD deficiencies in children. While 27% of women had Ca deficiency (again mostly within the 20–40 age range), the calcium deficiency rate in children was only 12%, notably lower than in women this is statistically difference.

دراسة نقص فيتامين د والكالسيوم لدى النساء والأطفال بمنطقة الواحات لعام 2022

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الكلمات المفتاحية:
نقص الكالسيوم
صحة الإنسان
هشاشة العظام والكسور
الحمل
نقص فيتامين د

الملخص

يُعد نقص فيتامين د شائعًا لدى كبار السن، ويعود ذلك غالبًا إلى قلة التعرض لأشعة الشمس. يؤثر نقص كل من فيتامين د والكالسيوم سلبًا على صحة الإنسان، مما يؤدي إلى هشاشة العظام لدى البالغين والكساح لدى الأطفال. كما يؤثر سلبًا على النساء، وكذلك على المصابين بأمراض الكبد والكلى والسكري والقلب.

في دراسة أجريت عام ٢٠٢٢ في منطقة الواحات، وُجد أن ٦٦٪ من النساء يعانين من نقص فيتامين د. تراوحت أعمار معظمهن بين ٢٠ و٤٠ عامًا، وهي فترة حرجة لصحة المرأة، إذ تشمل سنوات الإنجاب والحمل والرضاعة، وهي عوامل تؤثر على كل من الأمهات وأطفالهن، مما يساهم في حالات مثل هشاشة العظام والكسور والكساح. حُسب معامل ارتباط بيرسون بين فيتامين د ونقص الكالسيوم لدى النساء وكان 0.8، مما يشير إلى وجود علاقة إيجابية قوية. ومن المثير للاهتمام أن نسبة النقص لدى الأطفال بلغت أيضًا 66%، وهي نسبة مماثلة لدى النساء، مما يشير إلى وجود صلة مهمة بين نقص فيتامين د في هاتين المجموعتين.

ومع ذلك، لم يُعثر على أي ارتباط ذي دلالة إحصائية بين الكالسيوم ونقص فيتامين د. وبينما عانت 27% من النساء من نقص الكالسيوم (معظمهن في الفئة العمرية 20-40 عامًا)، كان معدل نقص الكالسيوم لدى الأطفال 12% فقط، وهو أقل بشكل ملحوظ من معدل النساء.

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1. Introduction

The main role of Vitamin D (VD) is to regulate the metabolism of Ca and phosphate, which is essential for bone mineralization. VD deficiency is common in old age, often due to insufficient exposure to sunlight. Secondary hyperparathyroidism affects a large proportion of elderly individuals. VD is associated with multiple pathogenic factors and is associated with an increased risk of fractures, falls, muscle weakness, general fatigue, osteomalacia, low bone mineral density, frailty, myopathy, and hypocalcemia [1]. VD deficiency is also common among children with celiac disease, and impaired calcium absorption is exacerbated by this deficiency [2]. Consequently, the incidence of osteoporosis and fractures increases. Bone mass is significantly reduced in elderly individuals with VD deficiency, particularly in the lumbar spine, femur, trochanter, and throughout the body. After supplementation with calcium and vitamin D, bone markers improve as VD levels return to normal [3]. Dietary deficiencies in VD and calcium may lead to renal tubular acidosis, Fanconi syndrome, and osteomalacia in both adults and children [4]. A combination of taurine, calcium, VD, and vitamin K can increase bone mineral density, reduce disability years, and lower mortality and fracture rates in patients with osteoporosis [5]. VD deficiency is often a consequence of fat malabsorption. In patients with cystic fibrosis, this can lead to complications such as osteoporosis [6]. Vitamin K_2 supplementation may improve bone quality and reduce fracture risk in patients with osteoporosis, potentially enhancing the effects of VD [7]. Improving VD levels may also benefit patients with bullous arthritis [8]. Increased intestinal calcium absorption and reduced renal calcium excretion help maintain calcium homeostasis [9]. The main function of VD is to maintain calcium balance by enhancing its absorption. An increase in parathyroid hormone (PTH) levels is often the first indicator of VD deficiency, which is also linked to low bone mineral density [10]. Ca supplementation alone, in the absence of adequate vitamin D, may increase insulin secretion and blood glucose levels in cases of VD deficiency [11]. Low calcium and vitamin levels may result from habits or diet, such as lactose intolerance or not consuming enough dairy products [12]. Rickets is a classic indicator of VD deficiency, and dietary calcium deficiency may worsen this condition [13]. Nutritional rickets can be caused by either VD deficiency or insufficient calcium intake [14], therefore, the previous studies dietary supplementation of VD alongside adequate calcium intake through nutritional means [15–18]. Newborns and young children may experience hypocalcemic convulsions. Older children and adolescents may experience bone pain, muscle weakness, skeletal deformities, and wrist widening. Chest deformities, leg curvature, longitudinal growth delay in adults, muscle weakness, bone pain, and laboratory test findings of hypocalcemia, hypophosphatemia, and high alkaline phosphatase levels [19], are manifestations of VD and Ca deficiency. VD and Ca are major determinants of bone health, and their deficiency can cause rickets in children, osteomalacia in children, and adults. VD is essential for the absorption and supply of calcium and phosphate for bone mineralization, and for improving bone health through dietary calcium enhancement, [20,21] and association of VD deficiency with cognitive abnormalities, particularly those found in autism, schizophrenia, and depression [22], polycystic ovary syndrome that a major cause of female infertility. In individuals with VD deficiency, [23] the risk of skin cancer was greater in those with VD deficiency than in those without a deficiency, and VD deficiency in the first trimester may significantly increase the risk of gestational diabetes [24], VD deficiency before 20 weeks of gestation is a risk factor for prediabetes and eclampsia; [25] and VD deficiency has been associated with an increased risk of delirium and mortality among elderly, chronically ill COVID-19 patients [26]. Serum zinc, Ca, and VD levels in COVID-19 patients are lower than they were accordingly [27]. (VD) is an important immune modifier that plays an emerging role in liver diseases, such as chronic hepatitis B [28]. VD deficiency can accelerate the progression of non-alcoholic fatty liver disease [29], and severe deficiency of fat-soluble vitamins is suspected to be a cause of acute cholestasis [30]. Before prescribing VD or calcium supplementation to patients with chronic kidney disease, the 25(OH)D status must be confirmed to prevent hypervitaminosis D and its complications [31]. The synergistic interaction between VD deficiency and renal hyperfiltration may affect mortality [32]. It is strongly associated with thyroid disease, particularly goiter and parathyroid gland disease [33]. VD deficiency promotes the growth of secondary cancer in the bones and is associated with an increased risk of cancer and worse prognosis in many malignancies [34]. VD deficiency has been significantly associated with bilateral hearing impairment and bilateral sensorineural hearing loss [35]. Hypocalcaemia may inhibit the Synthesis of renin, aldosterone, and prostaglandins, and prolonged aldosterone secretion can persist even after calcium levels have normalized [36]. Decreased levels of serum Zn, Ca, and VD are associated with the severity of COVID-19 [36,37]. An association has been observed between increased levels of VD in the blood and decreased symptoms of depression, anxiety, and mood changes[38], that providing VD supplementation to pregnant women and/or offspring in groups at risk for VD deficiency may reduce later from the occurrence of schizophrenia in the offspring [39], also proved the existence of an association between VD in the blood and phosphorus with restless leg syndrome [40], the consumption of calcium and VD affect weight loss, in some studies, and in contrast, some It does not affect, although supplementation improves BMI and serum levels [41], and patients with intellectual disabilities should have regular monitoring of VD and K levels, and supplementation with these vitamins [42]. VD and Ca deficiencies have negative effects on a healthy human life, as they cause osteoporosis in adults and rickets in children, and have a negative impact on women and patients with liver, kidney, diabetes, and heart diseases. Therefore, we aimed to determine the health status of VD and Ca deficiencies in the El-Wahat region of Libya.

2. Materials and Methods

The Al-Wahat region is located approximately 250 km south of Ajdabiya. It comprises three main areas: Gallo, Awjila, and Jikharra, which are the focus of the current study.

The research relied on the data obtained from laboratories within the Al-Wahat region (1530 women cases and 323 children cases high cases mor than 50 ng/ml, and low cases less than 20 ng/ml for VD, for Ca analyses 134 women cases and 90 children cases, which the analyses carried by using Liquid chromatography–mass spectrometry (LC–MS) is an analytical chemistry technique that combines the physical separation capabilities of liquid chromatography (or HPLC) with the mass analysis capabilities of mass spectrometry (MS).). A comprehensive survey was conducted to assess the prevalence of VD and Ca deficiencies among women and children. The study involved creating Frequency tables were created for different age groups to identify the most affected groups. Statistical analyses were performed to interpret the data, draw meaningful conclusions, and develop recommendations based on the findings.

2.1. Vitamin D. Results for Women

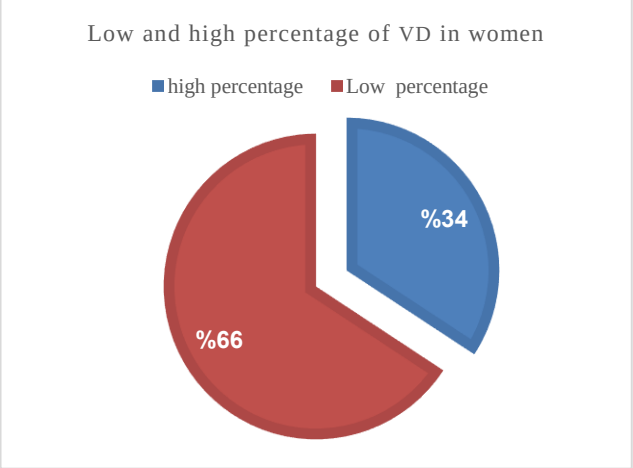

Fig. (1) The percentage of low and high cases of VD in women.

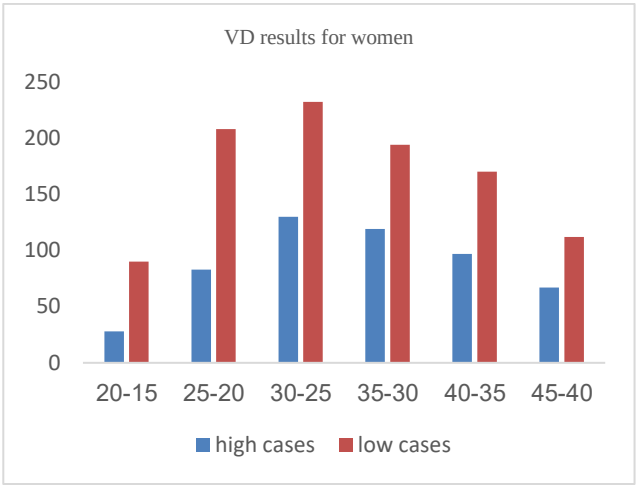

Fig. (2) High and low cases of VD in different age groups of women.

2.2. Vitamin D. Results for children.

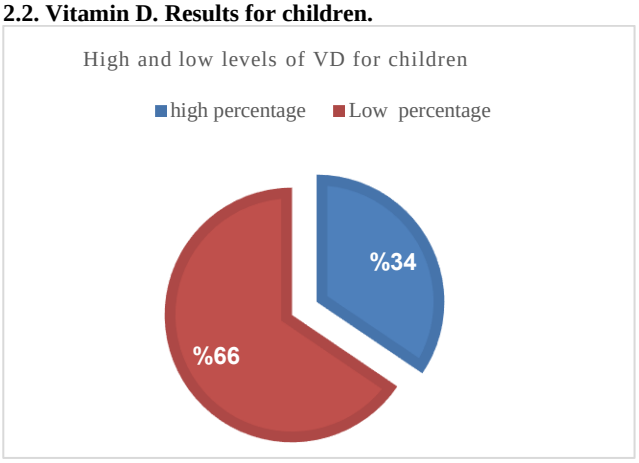

Fig. (3) The percentage of low and high VD cases in children.

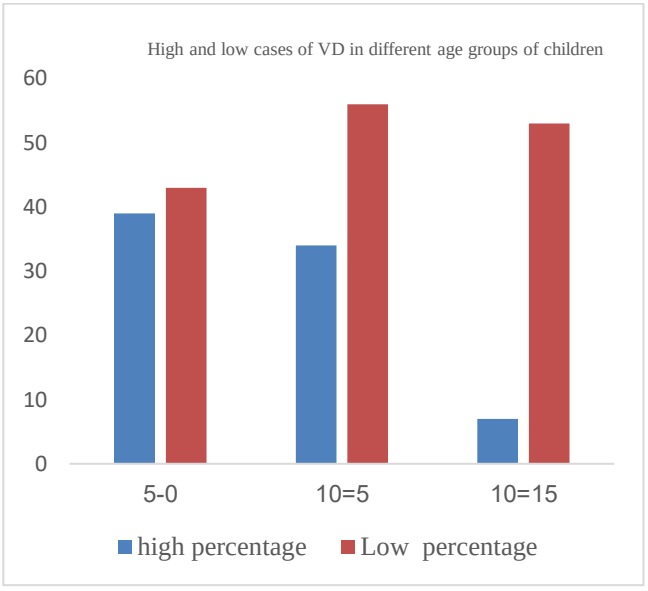

Fig. (4) the high and low cases of VDin different age groups of children

2.3. Calcium results for women

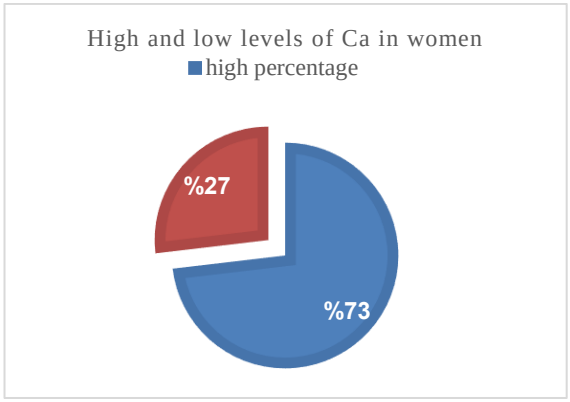

Fig. (5) The percentage of low and high Ca cases in women.

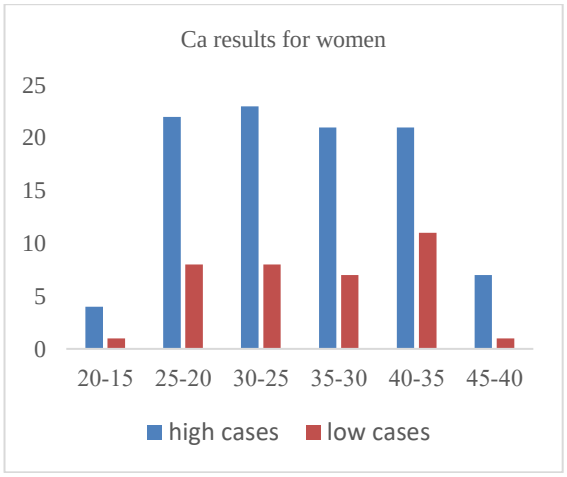

Fig. (6) High and low cases of Ca in different age groups of women.

2.4. Calcium results: for children

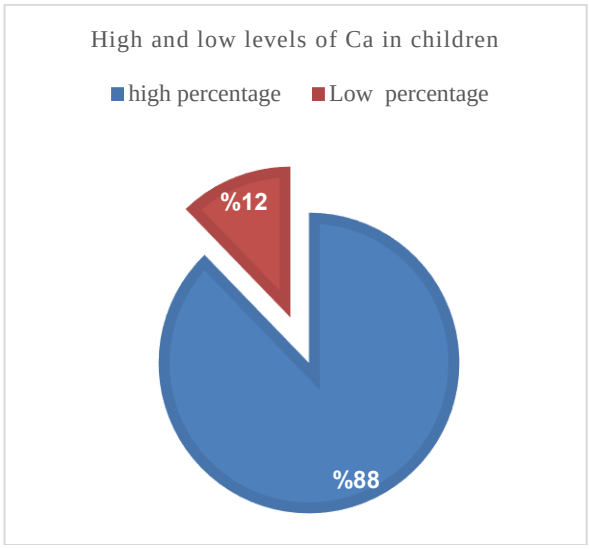

Fig. (7) The percentage of low and high Ca cases in children.

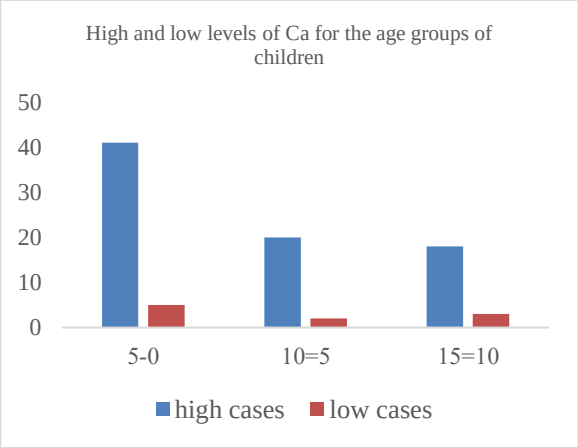

Fig. (8) High and low cases of Ca in different age groups of children.

Table (1) shows the overall statistical processes for VD, and Ca for women (W) and children (Ch)

Kind		X	Med	Mod	S	C.V	SK_1	SK_2	R
W.	D	30	29	27	7.4	24%	0.4	0.4	0.8
	Ca	30.4	30.4	36.4	7.4	24%	-0.8	-0.8	
Ch.	D	7.8	8	9	3.9	50%	-0.3	-0.15	-0.92
	Ca	6.5	5.8	4	4.3	66%	0.58	0.49	

CV; variation coefficient S; the standard deviation X; the arithmetic mean Med.; the median, The mod; The mode, SK; the skewness coefficient and r ;Pearson's Correlation Coefficient

3. Results and Discussion

In 2022, 66% of women in the Al-Wahat region suffered from VD deficiency based on samples analyzed. This indicates that approximately two-thirds of women in the region are affected by this disease. Most affected women fall within the 20–40 age group, representing a period of reproductive maturity, including pregnancy and lactation. This deficiency can significantly impact both mothers and their children, increasing their vulnerability to osteoporosis, fractures, and rickets in children, as shown in Fig. 1.

The mean age of women with VD deficiency was 30 years, with a standard deviation, median, and mode, as shown in Table 1. The coefficient of variation is 24%, and the skewness coefficient is +0.4, indicating a slight positive skew in the data. The Pearson correlation coefficient between VD and calcium deficiencies in women was 0.8, reflecting a strong and direct positive relationship. This suggests that calcium deficiency in women during this age range is closely associated with VD deficiency as shown in Fig. 2.

Regarding children, 66% also suffer from VD deficiency the same proportion as in women indicating a significant and consistent pattern of deficiency across both groups as shown in Fig. 3. The presents further statistics for children with VD deficiency: Mean age, median, mode, standard deviation, coefficient of variation: 50%, skewness coefficient as show in table 1 (indicating slight negative skew)

The Pearson correlation coefficient between calcium and VD deficiency in children was found to be -0.92, indicating a very strong inverse relationship. However, no significant correlation was found between calcium and VD deficiencies in children. This may be explained by the fact that children typically receive adequate calcium from their mothers during pregnancy and lactation, maintaining relatively stable levels until puberty as shown in Fig. 4.

Illustrates the prevalence of calcium deficiency in women, which reached 27%. Most of the affected women were also aged between 20 and 40 years, coinciding with the period of VD deficiency and the reproductive phase of life. During pregnancy and lactation, the fetus draws on the mother's reserves of both calcium and vitamin D, increasing the risk of maternal deficiency. The mean age was approximately 30 years, with a standard deviation, a median, and a mean (possibly intended as mode or second mean) as show in table 1. These values suggest that the deficiency may persist into later ages if not properly addressed. The coefficient of variation was 24%, and the skewness coefficient was -0.8, indicating a moderate negative skew as shown in Fig. 5. The high and low cases of calcium in different age groups of women as shown in Fig. 6.

The presents data on calcium deficiency in children, which was found to be much lower than in women, at 12%. This lower rate may be due to sufficient calcium intake from mothers during pregnancy and lactation. This observation supports the previously noted inverse relationship between VD and calcium deficiencies in children as shown in Fig. 7. The high and low cases of calcium in different age groups less than 15 year of children as shown in Fig. 8.

4. Conclusion

The prevalence of VD deficiency is high among women and children in Al-Wahat region. Approximately two-thirds of women are affected, with the majority falling within the 20-40 age group a critical period encompassing reproductive maturity, pregnancy, and lactation. This widespread deficiency poses significant health risks, including an increased susceptibility to osteoporosis and fractures in mothers, and rickets in children. A very strong positive correlation (greater than 75%) was observed between VD deficiency and calcium deficiency in women, indicating a strong link between VD deficiency and calcium depletion during this age range. The prevalence of calcium deficiency among women reached 27%, with the majority in the 20-40 age group, highlighting the double nutritional vulnerability during pregnancy and lactation. It was found that 66% of children suffer from VD deficiencythe same percentage observed in women and a strong inverse relationship was noted between calcium and VD deficiency. This may reflect the protective effect of calcium transfer from the mother during pregnancy and lactation, which helps maintain calcium levels in early childhood. Overall, VD and Ca deficiencies are prevalent among women of reproductive age and their children. The strong relationship between these nutrients highlights the need for targeted nutritional interventions, public health education programs, and supplementation strategies for women before and during pregnancy, as well as for young children, to prevent long-term skeletal and developmental complications.

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