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Original Article

Nutritional and General Awareness of Vitamin D Status among Adult Population: A Cross-Sectional Study

Reder Rafiq Mohammed Salih [a*], Fadhluddin Nasruddin Shakor [b], Dalia Ardal Ali [a], Rafiq Mohammed Salih Rashid [a]

[a] Food Science and Quality Control Department, College of Agricultural Engineering Sciences, University of Sulaimani, Sulaimani, Iraq

[b] Nursing Department, Sulaimani Polytechnic University, Sulaimani, Iraq

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Corresponding Author: reder.mohamed@univsul.edu.iq

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Abstract: The health benefits of vitamin D are widely acknowledged by scientific and public health specialists. In Iraq, vitamin D deficiency and inadequacy are highly prevalent. However, public knowledge on this problem is scarce. This research aimed to evaluate the participants' knowledge about vitamin D, particularly their nutrition-related understanding and behavior, along with their overall attitude toward sun exposure. A descriptive cross-sectional survey of Iraqi adults over 18 was performed with a collection of serum 25(OH)D result between June and September 2022. The observed serum vitamin D indicated that only 25% of the participant had healthy (>30 ng/ml) vitamin D levels. The majority of participants, 90.9%, were aware of vitamin D. Media and primary health care centers were major vitamin D information sources (57.3 and 32%, respectively). Despite believing sunshine is the principal source of vitamin D (90.2%), respondents lacked understanding about the duration (26.3%) and frequency (30%) of sun exposure. In addition, less than 10% of individuals attributed vitamin D shortage to kidney and liver problems, fat malabsorption, obesity, and bariatric surgery. Nevertheless, more than two-thirds (83.3%) of participants defined the positive role of vitamin D in preventing osteoporosis and immune system strengthening (61%). Furthermore, nutritional awareness among the participants was variable. Approximately, 75% misrepresented the percentage of vitamin D supplied by food, over 50% believed that fruit and vegetables are vitamin D sources, 43% of vegetarians are not at risk for vitamin D deficiency, and rather plants considered (70.3%) as an approach to lessen vitamin D deficiency. Additionally, optimal daily intake was recognized by only 10%. Similarly, only 18.3% was aware of the optimal level of serum vitamin D. Notably, 54% was entirely ignorant of the benefits of dietary fortification. Although 55% of the surveyed population used vitamin D supplements, and 76% acknowledged it through their doctor's recommendation, exceeding two-thirds incorrectly anticipated that drinking tea would impair vitamin D absorption. Therefore, 90% would buy supplements without a prescription if needed. Implementing nutrition education initiatives, encouraging healthy lifestyles, and supporting vitamin D examination should be included in Iraq's health care system.

1. Introduction

Vitamin D (also called "calciferol") is a fat-soluble vitamin that naturally exists in a few food, is fortified in others, and is available as a nutritional supplement [1, 2]. The crucial benefits of vitamin D in human health, its applications, and inadequacies have been encouraging numerous researchers to explore further in the past period [3-6], mainly due to its vital role in modulating certain health-related risk factors during the COVID-19 pandemic [6, 7].

Vitamin D deficiency (VDD) is a worldwide public health concern. The issue of poor vitamin D levels have been reported in many studies from east to west, in high latitude to long sunshine duration countries, and among whole-food consumer to vegetarian [5, 8-13]. According to many studies, a region such as the Middle East and Northern Africa, with a long sunny day duration, has recorded a very high incidence of VDD. These include over 90% of the population residing in the United Arab Emirates [9, 14, 15], around 80% of Saudis with different age groups [16, 17], data from Iraq [8, 13, 18-21], Qatar [22], and Jordan [23, 24]. Similarly, deficiency is also prevalent among the American [1, 4], Chines [25], Indian [26-28], British [5], and Norwegian [10] populations, among others. Despite health-related demands, the overall explanation might be limited contact with the sun radiation ray, poor nutrition intake, education, food choices, and an unhealthy shift toward a sedentary lifestyle [29, 30]. Most people worldwide acquire roughly 80-90% of their vitamin D endogenously synthesized via sunlight exposure (ultraviolet B), with the remaining 10-20% coming from food and dietary supplements [6, 29, 31, 32]. However, the formerly mentioned factors of a short period of sunshine hours, particularly for those living in high latitudes and adopting a sedentary lifestyle, add additional weight to dietary vitamin D contribution and compensation. Therefore, it became a crucial approach for ensuring enough vitamin D intake, it is indicated by Bjørklund [10] that oily fish, fortified butter, and margarine make up the majority of the vitamin D source in the Norwegian diet. Also, in the United States and Canada, fortified milk and juices are added to 100 IU per 8-oz serving [29]; however, fortification is uncommon in the United Kingdom [30, 33].

There are five different forms of vitamin D, numbered D1 to D5, with D3 (cholecalciferol) and D2 (ergocalciferol) receiving the most research attention [29]. The dietary vitamin D2 can be obtained either from mushrooms (plant source) exposed to sunlight [1] and invertebrates [29] or in the form of dietary fortification of cereal breakfast products, for instance. Vitamin D3, however, is considered much more functional than vitamin D2 in the human body. Its primary dietary sources are animal products such as oily fish (salmon, tuna, and sardines), egg yolk, meat, and liver. It can also be added to dairy products such as milk and supplementation [1, 30, 34].

In the biological system, the vitamin D is synthesis by the skin (vitamin D3: after conversion of 7-dehydrocholesterol) and acquired through food and supplements (vitamin D3 and/or D2: absorbed through the small intestine in the chylomicron to reach liver eventually) is not functioning and requires to pass through two hydroxylation to become active [13, 16]. In the liver, the initial hydroxylation occurs, transforming vitamin D into 25-hydroxy vitamin D (25(OH)D) (calcidiol: the inactive form that represents vitamin D status when bio-medically assessed). Then, it follows by second hydroxylation in the kidney via a 25-hydroxyvitamin D-1 alpha-hydroxylase enzyme to yield an activated form of vitamin D, known as a 1,25-dihydroxy vitamin D (1,25(OH)2D) (calcitriol: functional form in body tissues and organ) [9, 32]. Because 1,25(OH)2D has a shorter half-life (2–3 weeks) and circulates at a lower level than 25(OH)D, it is commonly assessed 25(OH)D to determine individual vitamin D storage and status so that it represent cutaneous production and dietary vitamin D intakes [11, 29]. The values below 30 ng/ml (1 ng/ml = 2.25 nmol/L) are deemed insufficient for adults' overall health and well-being [27, 35], while levels <20 ng/ml are viewed as deficient and recognized health problems [36]. Frequently occurring VDD is a significant public health concern.

Females are more susceptible to VDD than males. Pregnant women, mothers of multiple children, postmenopausal women who breastfeed, children, people who cover their entire body when they go outside for religious or cultural reasons, and those who spend most of their time indoors are more prone to developing VDD [11, 27, 34]. Seasonal variation and air pollution probably influence vitamin D status [5, 6]. Additionally, vegetarians, hospitalized, elder, inactive, have dark skin [11], obese, malnourished, and use sunscreen with ultraviolent protection are more susceptible to VDD [1, 11, 34, 37]. So, most professionals concur that a 50 or 75 ng/ml level is optimal and most favorable. In contrast,

hypervitaminosis D is probably rare, caused by continuous intake of large supplement doses for a long time [1, 29, 30]. The reason behind the fluctuation in overall vitamin D rate is referred to as the involvement of multi-regulator organs and physiological and practical factors [38]. Despite kidney enzymatic cascade activation of vitamin D, the vitamin D receptors (VDR) found in numerous cells and organs, indicate that vitamin D can exert its physiological functions far beyond the well-established bone homeostasis contribution [16, 29, 38].

Numerous vitamin D studies have elucidated key regulations input regarding healthy muscle system [39] and non-skeletal functions, including blood pressure, diabetes mellitus, cardiovascular disease, metabolic syndrome, cancer, depression, aging, immunological modulation, neurodevelopment, brain homeostasis, and continuing research is ongoing exploring on its anti-inflammatory properties [1, 17, 38-40]. Numerous studies have evaluated the vitamin D status of the population in Iraq, similar to many other nations. These studies revealed a significant prevalence of vitamin D insufficiency across different age groups and females, regardless of variable rates of VDD [8, 13]. However, no research has quantitatively examined the population's fundamental understanding of vitamin D and its possible effects on public health, attitudes, and behavior toward raising the level of vitamin D among Iraqis up to this point. Therefore, evaluating the Iraqi population's awareness, knowledge, and attitudes concerning vitamin D might assist in direct interventions to ensure they have an appropriate vitamin D level. A representative random sample of the Iraqi population was questioned to obtain this knowledge, particularly their nutrition-related understanding and behavior, as well as their overall attitude toward sun exposure. The results of this research will contribute to creating efficient clinical and public health plans to raise vitamin D status. This might be implemented by creating focused interventions for health promotion and education on VDD in Iraq.

2. Materials and Methods

This observational, cross-sectional study was performed among the general population attending a private clinical laboratory (Nwa diagnostic laboratory) in Sulaymaniyah, Iraq. The study was executed over three months, from Jun to September 2022. Adopting a convenient sampling method, the attending subjects to examine their serum vitamin D level were targeted and introduced to a validated questionnaire for data gathering. Accordingly, each participant was provided an explanation of the study's goals and content, and a verbal agreement was obtained. Thus, data about nutrition, general knowledge, and perspective toward vitamin D and vitamin D levels were gathered for interpretation.

To determine sample size, the software https://www.surveysystem.com/sscalc.htm was used. According to the population of Sulaymaniyah governorate, estimated to be about 1613397 [41] with a 95% confidence level and a 5% confidence interval, the needed sample size was computed to be 384 subjects. The inclusion criteria comprised male and female adults (ages >18 years). The exclusion criteria were individuals aged less than 18 and involved in a medical profession, including doctors, dentists, nurses, dietitians, pharmacists, and medical students. The study was authorized by the University of Sulaimani's Scientific and Ethical Committee, and the Declaration of Helsinki standards were followed throughout the investigation.

Practically, individuals (N= 384) directly visited the laboratory for various reasons for vitamin D checkups. Vacutainer tubes were provided under sterile conditions to collect a blood sample. Based on the laboratory protocol for assessing vitamin D, samples were centrifuged to separate the serum. 1 ml of this serum was transferred directly to process via a designed tube (vitamin D kit) loaded into the Roche E411 Analyzer (Cobas e immunoassay analyzers, Roche Company) to run. The adopted classification of patient vitamin D level was as follows, safety margin (intoxication) level ≥100 ng/ml, sufficient group 30-100 ng/ml, Insufficient group 20-29 ng/ml, and deficient group <20 ng/ml[2, 32].

For the initial empirical questionnaire, several works of literature [5, 14, 16, 17, 23, 25-27] were examined to meet the study's aims. Accordingly, a comprehensive questionnaire was newly constructed by the authors. Then, for further refining, it was presented for validation by members of the scientific committee from the Food Science and Quality Control Department, College of Agricultural Engineering Sciences at the University of Sulaimani. Eventually, the final version of the questionnaire was modified appropriately and restated for face-to-face interviews.

The questionnaires had three parts with thirty-one multiple choices and dichotomous closed-ended questions in total. The sociodemographic information of the participants (gender, age, social standing, levels of education, and monthly family income) was included in table 1. The questions in table 2 evaluated general information and perception about sunlight and vitamin D-related health aspects (sunlight contribution, duration, and frequency of sun exposure, serum level and how often its examined, physiological functions, with deficiency causes, symptoms, and overcome practice). The final section (Table 3) was created to assess participants' primary nutritional information and attitude toward vitamin D (proportion and significant dietary sources, dietary interaction and existence part, the recommended intake dosage, and dietary supplementation). The interview was presented mainly in Kurdish (Sorani) and Arabic language if required, and it took each participant 15-20 minutes to complete the questionnaire.

2.1 Statistical Analysis

A descriptive analysis was conducted to determine the nutritional and general knowledge and perceptions of Vitamin D status among the Iraqi population. All data and created Figures were entered and analyzed using the data analysis-Microsoft Excel 2016. All results are presented as percentages (%).

3. Results and Discussion

The represented outcome in the first part of the study is serum vitamin D evaluation, which has yet to be examined in depth because the format of the current work is an observation assessment (rather than a cause-and-effect analysis) of community nutritional and general vitamin D knowledge. However, as a part of responders attending clinical laboratory, current data had been obtained to overview the level of vitamin D. Undoubtedly, individual knowledge is varied and essentially impacts the incidence of VDD and how to manage its complications. In Iraq, the frequency of VDD has been reported in many studies [8, 13, 18-21]. In the current study, according to population vitamin D serum analysis data presented in Figure 1, only one-quarter of participants had healthy vitamin D levels. At the same time, the rate under 30 ng/ml was 75% of the total examined subjects, and VDD was the highest at 52%. Despite serum vitamin D variance cut-offs consideration, the current result is consistent with the findings of the Iraqi population research (Sulaymaniyah [18], Erbil [8], Duhok [13], Baghdad [20], and Karbala [19]. It is possible that this is the result of maintaining comparable dietary and lifestyle practices.

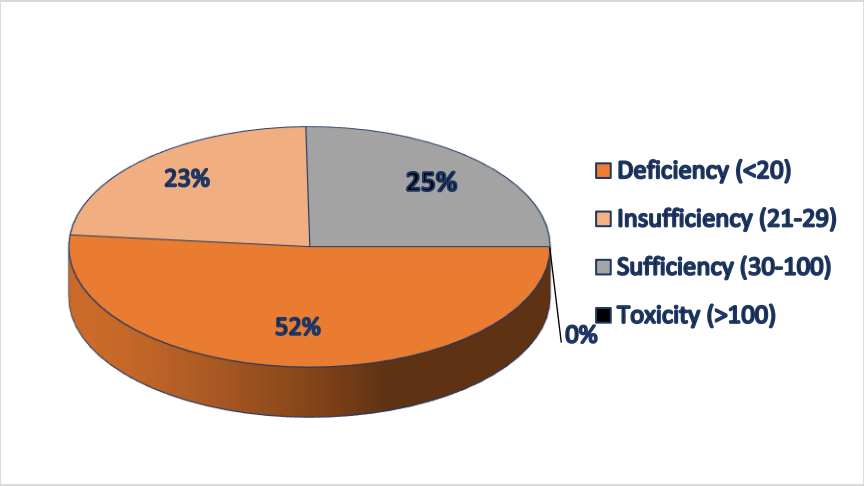

Figure 1: Vitamin D status concerning 25(OH)D* levels.

A total of 384 people aged >18 years participated in the current study. Almost 50% of the population study was 18-39 years, and 35.9% was 40-59 years, with 14.3% representing age beyond 60. The majority of the participants was female (69.8%), married (63.3%), and had a higher education beyond a bachelor's degree (52.3%). Further, the employed rate was 68.2%, with almost 45.8% of the population categorized under middle monthly income. A summary of the participant's socio-demographics is presented in Table 1.

Table 1: The socio-economic characteristics of participants (n=384).

Characteristics	No.	%
Age		
18 - 39	191	49.7
40 - 59	138	35.9
>60	55	14.3
Gender		
Male	116	30.2
Female	268	69.8
Maternal status		
Single	75	19.5
Married	243	63.3
Divorced	21	5.5
Widowed	45	11.7
Education (year of completed formal schooling)		
Illiterate	42	10.9
Up to High School levels	141	36.7
Bachelor or diploma degree onward	201	52.3
Employment (sector)		
Unemployed (Student, Retired, Housewife)	122	31.8
Employed (Full-time, Part-time, self-employed)	262	68.2
Family income (IQD*/month)		
Low (500,000 – 1,000,000)	88	22.9
Medium (1,000,000-2,000,000)	176	45.8
High (>2,000,000)	120	31.3

Frequency (n); percentage (%), * IQD: Iraqi Dinar.

General knowledge and attitudes about vitamin D are illustrated in Table 2. Among the study participants, the vast majority (90.9%) acknowledged having heard about vitamin D. Media including the internet website, were the main source of information; nearly 57.3% of individuals learned about vitamin D via the various media types.

Other possibilities were primary health care services, physicians, and medical professionals (32%) then, followed by academic institutions (27%), and finally, family and friends (25%). This finding aligns with data from the UK [5, 25], Jourdan [23], Australia [42], and Saudi Arabia [17], where the media was the main source of information. However, verifying the accuracy of information is challenging. Some people employed tactics to increase legitimacy, such as utilizing websites that appeared "authoritative," comparing data from numerous websites, and/or looking for websites with references. It is also important to highlight that the role of a medical professional should be further developed in society [9]. Poor contribution of the health care system was stated in Kuwaiti and Jordanian societies [23]. Almost half of respondents (49.2%) believed that sunshine is the most significant source of vitamin D. So, when asked how long one must spend in contact with sun waves to achieve any noticeable effect, the correct response was provided by only 26.3% of respondents (10–20 minutes per day) [6, 9, 30]. About 44% believed that spending less than 15 minutes in the sun each day was adequate to produce adequate vitamin D. Also, when participants were asked about the frequency of their direct exposure, around 70% spent < 3 times per week. This agrees with research from Oman and Jordan [23].

It is common poor believe that more prolonged exposure to the sun will further aid the synthesis of biological vitamin D. Moreover, The American Cancer Society opposes sun exposure as a method of boosting vitamin D levels [6]. The American Academy for Dermatology Association guidelines [43] also does promote minimal or no sun exposure primarily due to the risk of skin cancer associated with sun exposure. Given the prevalence and impact of VDD in Iraq, the country must take action. Therefore, it is essential to understand the factors contributing to obtaining vitamin D. Excluding dietary input, participants provided the option to select more than one answer. The above one-third had knowledgeable identified the following factors with various weights: seasonality (40.4%) [37], applying sunscreen

(35.4%), and geographical area (33.3%) [1, 6, 9, 27]. In contrast, the least selected factor that is considered to interfere with vitamin D production was environmental condition (timing of day, cloud, and pollution), skin phototype, and glass barrier that prevent UV light from contact with the skin. This is consistent with earlier research highlights [23]. Additionally, none among the 384 participants had recognized the glass cover effect. It is considered that glasses serve no barrier function to stop sunlight from contributing to the production of vitamin D.

This outcome is in line with findings from research on Indian medical students' awareness [26]. There are variations in the cut-off values used in different nations to evaluate vitamin D status. Most surveys followed the American Institute of Medicine's or the Endocrine Society's recommendations. However, even these definitions of insufficiency and deficiency overlapped. The credibility of the results and regional and international comparability are at risk due to this discrepancy in cut-offs [2, 32]. Undoubtedly, the healthy level of serum vitamin D should be around 30 ng/ml; approximately one-half of the study sample (53.6%) answered that they do not know, and merely 18.3% were aware of the correct answer of 30-100 ng/ml [2, 32]. Further, more than two-thirds (83.3%) of participants defined the positive role of vitamin D in preventing osteoporosis, followed by enhancing calcium uptakes (68%) and immune system strengthening (61%). Bone health results were better than those found in Australian research (43.1%) but consistent with those seen Saudi population in Jeddah [16] and the UK [27]. However, vitamin D participation in chronic illnesses has not been detected, and almost 11% indicate its potential effectiveness in diabetes, cancer, and cardiovascular disease [4, 29].

Regarding the causality of VDD, despite the permission to select more than one option, the first recognized answer by the majority of participants (80.2%) was limited exposure to sunlight. In the second stage, heredity (31.5%) had been mistakenly chosen as a risk factor for VDD. However, kidney and liver disorders, along with fat malabsorption, obesity, and bariatric surgery, have not been considered a factor contributing to VDD as it was acknowledged poorly by less than 10% of responders [32]. Furthermore, as VDD symptoms, the three most recognized manifestations were skeletal pain and deformation, rickets in children, and teeth growth delay, with 74%, 40.5%, and 35%, respectively. In comparison, the correlation between vitamin D and muscle pain, a neuropsychological impairment that draws much research attention, has yet to be primarily recognized. However, it received a minor selection of less than 25% of the total participants. This outcome accords with the findings of the study conducted in Kuwait and Jordan [28].

Table 2: General knowledge and practice of the respondents about vitamin D.

Variables	No	%
Have you heard about vitamin D? (one answer)		
Yes	353	91.9
No	31	8.1
From where do you hear/learn about vitamin D? (multiple answer selection possible)		
Media (Newspaper, magazines, TV, radio, Internet websites)	220	57.3
Educational institutions (school, college, university)	104	27.1
Primary health care centers, medical professionals, and physician	123	32.0
Relatives, friends	96	25.0
What is the primary source of vitamin D? (one answer)		
*Sunlight	189	49.2
Diet	42	10.9
Supplement	151	39.3
I do not know	2	0.5
How much time do you need to spend in the sun to get enough vitamin D? (one answer)		
<15 min	168	43.8
*15-30 min	101	26.3
>30 min	89	23.2
I do not know	26	6.8

Table 2: Continue

How frequently are you exposed to the sun (times/week)? (one answer)		
<2	141	36.7
2_3	126	32.8
>3	97	25.3
I do not know	20	5.2
Factors affecting synthesis from (multiple answer selection possible)		
*Season	155	40.4
*Skin Pigmentation	45	11.7
*Sunscreen use	136	35.4
*Time of day	86	22.4
*Cloud cover	65	16.9
*Latitude	128	33.3
*Pollution	8	2.1
Smoking	22	5.7
*Glass cover (sunlight that passed through glass)	0	0.0
I do not know	16	4.2
What is vitamin D's average (optimal) level (ng/ml) level? (one answer)		
<10	8	2.1
11_29	99	25.8
*30-70	71	18.5
I do not know	206	53.6
Vitamin D functions positively toward (multiple answer selection possible)		
*Prevents osteoporosis (bone health)	320	83.3
*Prevents general weakness	97	25.3
*Prevents chronic diseases (diabetes, cancer, cardiac disease)	44	11.5
*Enhance calcium absorption	261	68.0
*Support the immune system	234	60.9
Good for vision	25	6.5
I do not know	18	4.7
What are the causes of vitamin D deficiency? (multiple answer selection possible)		
*Less exposure to the sun	188	49.0
*Fat malabsorption	24	6.3
*Live disease	25	6.5
*Gastric bypass operation	14	3.6
*Kidney disease	35	9.1
*Obesity	16	4.2
Hereditary	120	31.3
I do not know	22	5.7
What is/are the symptom/s of vitamin D deficiency? (multiple answer selection possible)		
*Pain and deformation in joints and bones	285	74.2
*Delayed growth of teeth	134	34.9
*Delayed walking in children (rickets/osteomalacia)	155	40.4
*Muscle pain	68	17.7
*Neuropsychological dysfunction (Depression, Autism, and Cognitive function)	75	19.5
Autoimmune disorders (Alopecia)	99	25.8
I do not know	25	6.5

Frequency (n); percentage (%), * indicates correct answer

Vitamin D is a fat-soluble vitamin that exists mainly in animal products food [1], however, surveyed subjects had a different opinion. Exceeding 50% believed negatively that fruits and vegetables are the sources of vitamin D due to commonly misperceived knowledge that plants are the primary source of all sorts of vitamins. This could be confirmed when 43.2% of responders also believed vegetarians are not at risk for VDD [6, 30]. Moreover, when a multiple answer selection is allowed about identifying the dietary source of vitamin D, similarly, 70.3% and 59.4% (highest chosen answer) of participants poorly selected fruit and vegetable, respectively. While mushroom (a sun-exposed type), as a sole plant source of vitamin D [1, 40], had been chosen by only 3.6% of participants. When considering the animal source, milk and dairy products (83.3%) were deemed to be nearly as twice significant as egg (42%) and fish (41%) forms of diet. Similar results were documented in research from Hong Kong [25], India [26], Saudi Arabia [16], and the UK [27], where high percentages of the population consider vegetables as one optimal source of dietary vitamin D after milk and dairy products.

On the other hand, fortification is a valuable addition to counteracting nutritional deficiencies in today's overpopulated eras, particularly in non-sunny regions and for highly vulnerable individuals. Numerous governments have strategies to include these facilities in their national food programming systems [6, 33]. According to [4] literature regarding vitamin D "what we should know," a few nations has reset a program to encourage the fortification of milk, cooking oil, and some other foods to improve the vitamin D status of their community. The US, Finland, Sweden, Canada, and India are among those countries. However, in the Iraqi population, represented by the current study sample, for whatever reason, few (38.3%) fortified cereal breakfast selections had been made by respondents, and unexpectedly, nearly 54% of the population was completely unaware of the dietary fortification. In view of the reasons, it could be related to the lack of dietary program promotion adopted by the Iraqi and local government healthcare system, a meager and unsorted selection of fortified foods available on the market, and the belief that fortified foods are designed for children foods like milk, rather than an adult. Similar to fortification regulation, the intake of vitamin D, which cover 97.5% of the healthy population needs, needs to be unified [6].

Despite classifying vitamin D intake according to age, for example, the recommended dietary allowance as a part of the dietary reference intake benchmark for the American population is 600 international units (IU)/day for individual age 1 to 70 years [6, 45]. In the UK, however, the reference nutrient intake (RNI) for vitamin D as a part of the Dietary Reference Values (DRVs) benchmark (like RDI) set 400 IU/day for population ages four years and older [5, 45]. The World Health Organization (WHO), the foremost organization for providing evidence-based defining recommendations for most EMR countries, does not have worldwide guidelines on measuring vitamin D levels [44]. Hence, both value 400 and 600 is considered the correct answer, which only 10% of the population recognizes as an optimal daily intake dose.

Dietary awareness and attitude regarding fat and vitamin D are also covered in the study questionnaire. Participants had limited knowledge and misperceived information regarding the dietary part of vitamins, as 67% had no idea that vitamin D exists in the fat part of the diet. Likewise, more than half (50%) of responders had poorly thought that vitamin D exists in the fat part of the body or in the form of a cholesterol precursor. While it is essential to distinguish between excessive body fat (obesity) [40] and moderate consumption of dietary fats that are rich in vitamin D, diet free-fat may increase the risk of VDD [16]. Practically, vitamin D can be taken with or without food. It can be absorbed without dietary fat [32]. More than 50% of participants take supplements with water, then milk (35%). Unfortunately, more than two-thirds assumed poorly that drinking tea will negatively impact vitamin D absorption in a manner similar to the interfering effect on iron. Providing a favorable environment for absorption will aid its vitamin D bioavailability. For this reason, many vitamin D supplements are available in a combination form with oil packages, such as sunflower oil.

In the surveyed population, 55% used vitamin D supplements, but only 32% were interested in monitoring serum vitamin D levels. Notably, the majority of the supplement users (76%) acknowledged that their doctors had advised them to take them, while only 37% considered it as a part of their regular health regimen. Despite what has been said, the clear majority (90%) stated that they would purchase supplements without a prescription when necessary. This is a common practice that has been seen among Indian individuals [26]. The general public should be informed that medication side effects can

be severe, even though vitamin D poisoning is one of the rarest medical diseases. Treatment must be administered in the proper dosage, form, and duration to protect against vitamin D intoxication or shortage and its potential health consequences [4, 26, 27, 32]. Participants appeared to choose sun exposure (87%) as the best practical way to lessen VDD, followed by eating fruits and vegetables (70.3%) and supplements (67%) in that order. Lastly, the prospect of replenishing our biological vitamin D by prolonged sun exposure, similar to supplemental intake, is widely accepted (79%). Literature; however, does not support this approach [1, 43].

Table 3: Nutritional knowledge and practice of the respondents about vitamin D.

Variables	No	%
What percentage of vitamin D comes from food? (one answer)		
< 1%	92	24.0
1-10%	118	30.7
*10-20%	95	24.7
> 20%	79	20.6
What is the primary source of vitamin D? (one answer)		
*Animal-source diet	163	42.4
Plant source diet	221	57.6
What are the important dietary sources of vitamin D? (multiple answer selection possible)		
*Mushroom	14	3.6
*Fatty fish (e.g., tuna, salmon, mackerel)	159	41.4
*Code liver oil	24	6.3
*Egg yolk	161	41.9
*Fortified cereal breakfast	147	38.3
*Milk and dairy products	320	83.3
Vegetables	228	59.4
Fruits	270	70.3
Vegetarians are more likely to have vitamin D deficiency than non-vegetarians, Is not it? (one answer)		
Yes	118	30.7
No	166	43.2
I do not know	100	26.0
Have you heard about dietary fortification with vitamin D? (one answer)		
Yes	152	39.6
No	203	52.9
I do not know	29	7.6
What is the daily recommended dose of vitamin D (IU)? (one answer)		
200	55	14.3
*ŧ400-600	38	9.9
> 600	86	22.4
I do not know	205	53.4
Does Vitamin D exist in fat parts of foods? (one answer)		
Yes	61	15.9
No	64	16.7
I do not know	259	67.4
The cholesterol component is the primary source of vitamin D in the body? (one answer)		
Yes	18	4.7
No	202	52.6
I do not know	164	42.7
Do you take vitamin D supplements? (one answer)		
No	174	45.3
Yes, with an estimation of serum 25(OH)D levels	87	22.7
Yes, without estimation of serum 25(OH)D levels	123	32.0
A vitamin D supplement is taken with (one answer)		

Table 3: Continue		
Water	197	51.3
Milk	136	35.4
The fat source of the diet	51	13.3
Is drinking tea affect vitamin D absorption in the body, similar to iron? (one answer)		
Yes	309	80.5
No	55	14.3
I do not know	20	5.2
Why do you take vitamin D supplements? (one answer)		
Doctor/physician advice	160	76.2
Personal health routine	47	22.4
I do not know	3	1.4
Do you buy vitamin D supplements without a prescription? (one answer)		
Yes	189	90.0
No	19	9.0
I do not know	2	1.0
What practices do you apply to prevent vitamin D deficiency? (multiple answer selection possible)		
Exposure to sunlight	334	87.0
Take vitamin D supplement	256	66.7
Drink 2 cups of milk	122	31.8
Eat seafood (such as fish)	98	25.5
Eat vegetables and fruits	270	70.3
Like supplementation, can you overdose on vitamin D through exposure longer to sunlight? (one answer)		
Yes	304	79.2
No	18	4.7
I do not know	62	16.1

* indicates correct response, ŧReference Nutrient Intake (RNI) in the UK is 10 μg /400 IU, whereas the recommended daily allowance (RDA) in the US is 600 IU

4. Conclusions

The research accentuates nutritional and general awareness gaps concerning vitamin D among people. To understand the mechanisms contributing to this issue; however, health policy should address the public's need for precision nutrition, misperceiving information, and more straightforward messages are needed about the risks and benefits of sun exposure. The following outcome should be highlighted for the general public; plants are not the source of vitamin D, and drinking tea does not influence vitamin D bioavailability. Practically also, more prolonged sun exposure is not raising biological vitamin D like supplements; it is probably associated with the risk of skin cancer. Undauntedly, Iraq needs a comprehensive health care understanding and further data to imply this recommendation.

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