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CLINICAL BIOCHEMISTRY

The Prevalence of Vitamin D Deficiency among Students of Faculty of Engineering and Technical Sciences in Brack Al-Shatti

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A B S T R A C T

Vitamin D deficiency is one of the major health problems facing the world. Different factors could play significant roles regarding its metabolism, such as environmental and dietary factors. Accordingly, the aim of the current study was to determine vitamin D status among healthy volunteers studying at faculty of Engineering and Technology, Sebha University, and to investigate its relationship with nutritional and environmental factors. Seventy-one healthy students aged between 18-26 years participated in this study and each one of them asked to fill the questionnaire. The vitamin D level was measured, and their weight and height were taken and body mass index (BMI) was calculated. The mean value of vitamin D concentration for participants was 15.9±7.51 ng/ml. The results reflect that 38.02% of the participants had deficiency of vitamin D, while only 5.64% of the volunteers had normal vitamin D levels. Insufficient vitamin D levels were observed in 56.34% of volunteers. In conclusion, vitamin D insufficiency and deficiency are highly prevalent among healthy students studying at faculty of Engineering and Technology. The factors which may be playing an important role in effecting the vitamin D status were low dietary intake and the limitation of sunlight exposure.

دراسة مدى انتشارنقص فيتامين د بين طلاب كلية العلوم الهندسية والتقنية براك الشاطئ.

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الكلمات المفتاحية

حالة فيتامين د
واقي الشمس
العوامل الغذائية
العوامل البيئية
التعرض لأشعة الشمس

الملخص

نقص فيتامين (د) هو واحد من المشاكل الصحية الرئيسية التي تواجه العالم. يمكن أن تلعب عوامل مختلفة أدوارا مهمة فيما يتعلق بعملية التمثيل الغذائي، مثل العوامل البيئية والغذائية. وبناء على ذلك، كان الهدف من الدراسة الحالية هو تحديد حالة فيتامين (د) لدى المتطوعين الأصحاء الذين يدرسون في كلية الهندسة والتقنية براك، والتحقق في علاقته بالعوامل الغذائية والبيئية باستخدام استبانة. شارك في الدراسة واحد وسبعون طالبا يبدوا ظاهريا اصحاء، تراوحت أعمارهم بين 18-26 عاما، أُخذت منهم عينة من الدم الوريدي وُضعت في انبوبة خالية من مانع التجلط حيث تُركت في درجة حرارة الغرفة لتكتمل عملية التجلط والحصول على مصل الدم بعد وضعها في جهاز الطرد المركزي لمدة عشرة دقائق وبسرعة ثلاثة الاف دورة في الدقيقة، تم تعبئة استبيان الدراسة لكل مشارك.وأُخذت أوزانهم وأطوالهم وحُسب مؤشر كتلة الجسم لكل مشارك. قيس تركيز فيتامين (د) في العينات. كان متوسط تركيزات فيتامين (د) للمشاركين 15.9±7.51 نانوغرام/مل. تعكس النتائج المتحصل عليها أن 38.02٪ من المشاركين يعانون من نقص فيتامين (د)، في حين أن 5.64٪ من المتطوعين لديهم مستويات طبيعية من فيتامين. تم تحديد مستويات فيتامين (د) غير الكافية في 56.34٪ من المتطوعين. الخلاصة، ينتشر نقص فيتامين (د) وبشكل كبير بين الطلاب الأصحاء الذين يدرسون في كلية العلوم الهندسية والتقنية.وقد تلعب بعض العوامل دورا مهما في التأثير على حالة فيتامين (د) في الجسم مثل انخفاض المحتوى الغذائي من فيتامين (د) والتعرض المحدود لأشعة الشمس.

Introduction

Vitamins are an essential group of organic nutrients found in food that the body needs in small quantities. They play various biochemical functions in the body systems and maintain optimal health. The body cannot synthesise them; accordingly, they must be supplied from outside sources like sunlight and foods. They are classified into two groups based on their solubility. For example, fat-soluble vitamins include A, E, K, and D, while vitamin C and B complexes are water soluble vitamins [1].

Vitamin D is a fat-soluble prohormone that is synthesised in the body in response to sunlight and plays several roles to retain its health [2]. Sunlight has a major role in providing optimal vitamin D levels. Where Ultraviolet (UV) rays stimulate its endogenous synthesis. Consequently, maintaining a normal serum level of vitamin D that largely depends on sun exposure period rather than its dietary intake. Moreover, few food

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varieties contain abundant quantities of this vitamin, such as fish oil and milk [3].

There are two types of vitamin D: vitamin D2 (ergocalciferol), which is obtained from yeast and plants, and vitamin D3 (cholecalciferol), which is produced in the skin during exposure to sunlight, and is also found in some foods such as eggs [3]. Epidermis is the major endogenous synthetic source of vitamin D when the skin is exposed to ultraviolet B (UVB) rays from the sun [4]. Clinical studies pointed out that adequate circulating 25-hydroxy vitamin D concentration is required to maintain metabolic, immune, reproductive, muscular, skeletal, and respiratory functions in the human body [5].

Currently, many individual environmental and social factors interfere with sufficient exposure to sunlight and then having enough endogenously vitamin D [6]. Vitamin D deficiency is known to affect over a billion people worldwide. The higher prevalence of vitamin D deficiency is more popular in women compared to men. The reason might be due to socio-economic and environmental factors [7].

The physiological functions of active vitamin D (calcitriol) are associated with calcium homeostasis and osteoporosis, with potential protective roles against diabetes, cancer, and ischemic heart disease, autoimmune and infectious diseases. In addition to skeletal disorders, calcium and vitamin D deficiency increase the risk of malignant tumours, especially colon, breast, and prostate infections, autoimmune diseases (such as insulin-dependent diabetes mellitus, inflammatory bowel disease, and multiple sclerosis), as well as metabolic disorders. For example, metabolic syndrome and high blood pressure [8].

Nowadays, scientific evidence demonstrates insufficient vitamin D worldwide [9]. Factors which play a crucial role in the globally occurrence of vitamin D insufficiency vary among countries; but in all cases involve limitations in either or both cutaneous synthesis of the vitamin and its dietary sources. Therefore, the objective of the present study was to evaluate vitamin D status among students from faculty of Engineering and Technology, Sebha University, and its relationship with sex, BMI, sunlight exposure and diet.

Materials and Methods

Location of study

This study was conducted in Brack Alshatti, a sunny town located in the south-west of Libya. Seventy-one students from faculty of Engineering and Technology who were apparently healthy and their age range was between 18-26 years, they are Participating as volunteers in this study. Any volunteers having signs and symptoms of vitamin D deficiency like unexplained body aches and pains, bone deformation \ tenderness, proximal muscle weakness, history of any endocrine disorder, hepatic and renal diseases, malabsorption syndrome or history of gastrointestinal surgery, chronic diarrhoea, diabetes mellitus, malignancy, and medications influencing bone metabolism were not eligible for the study.

Determination of vitamin D

Five mL of blood sample was taken from the cubital vein of each volunteer to estimate serum vitamin D level by using I-chroma instrument. Fifty µl (50µl) of serum sample was added tothebuffer solution, and the mixture was mixed and lifted at room temperature for exactly 5 min. Then 100uL of the detection buffer was added to the mixture and mixed well. The mixture was incubated at 37^0C for15 minutes, the 75µl was taken from the mixture solution and butted into the I-chroma cared. The procedures were accomplished according to the used kits (Korea) [10].

The questionnaire

A questionnaire was used to collect characterization (age, sex, residence, weight, and height) of participants, and the BMI was calculated for every individual. In addition to several questions about their dietary habits regarding consumption of vitamin D sources such as milk, dairy products, and sea foods. They were also asked about the duration of sun exposure and the frequency exposure/ week.

Results

Level of vitamin D

The data in table 1 show insufficiency of vitamin D status in all participants when compared with the normal range of vitamin D which is from 30 to 80 g/ml. Also, when classified the participates according to the vitamin D level as normal, insufficiency and deficiency which were 31.8±3.08 ng/ml (5.64%), 19.4±4.68 ng/ml (56.34%) and 8.3±0.59 ng/ml (38.02%) respectively (Table 1).

Table 1: The classification of vitamin D level in all participants.

Vit. D level Mean ± SD (ng/ml)	Normal (30-80)	Insufficiency (10-29)	Deficiency (< 10)
All Participants (71)	31.8±3.08	19.4±4.68	8.3±0.59
Percentage (%)	(4) 5.64%	(40) 56.34%	(27) 38.02%

The majority of male participants had insufficient of vitamin D level which represent 20.4±4.31 ng/ml (87.88%) while the female participants were 14.5±3.4 ng/ml (28.95%). On the other hand, the majority of female volunteers had deficiency of vitamin D (8.2±0.5 ng/ml) (68.42%). Only about 5.64% of all volunteers had normal vitamin D level (31.8±3.08 ng/ml) from which 1 was female 30.0ng/ml (2.63%) and 3 were males 32.4±3.5 ng/ml (9.09%). Also the data demonstrated that there may be a relationship between vitamin D status and gender. The female volunteers showed lower vitamin D status compared to the male volunteers, which had higher vitamin D level (Table 1, 2).

Table 2: The effects of gender on vitamin D status.

Gender Vit.D status	Normal (%) (30-80 ng/ml)	Insufficiency (%) (10-29 ng/ml)	Deficiency (%) (< 10 ng/ml)
Male (33)	(3) 9.09%	(29) 87.88%	(1) 3.03%
M±SD	32.4±3.5	20.4±4.31	9.3±0.0
Female (38)	(1) 2.63%	(11) 28.95%	(26) 68.42%
M±SD	30.0±0.0	14.5±3.4	8.2±0.5

The results in Table 3 showed the vitamin D status in the volunteers after categorizing them according to their BMI. Most of the participants (63.38%) had normal BMI (15.5–24.5 kg/m^2) with insufficient status of vitamin D (16.4±7.6 ng/ml), and they indicated that the high incidence of vitamin D deficiency was in the underweight volunteers which was 57.15% (8.5±0.66 ng/ml). The obese participants were 2.82%, which shows insufficient status of vitamin D (19.1±0.0 ng/ml). However, the same trend was observed for sever underweight students (16.45 ng/ml) (Table 3).

Table 3: The relationship between vitamin D status and BMI.

BMI (Kg/m^2)	No of volunteers (%)	Normal (30-80 ng/ml)	Insufficiency (10-29 ng/ml)	Deficiency (< 10 ng/ml)
Sever under-weight (15<) n=2 (2.82%)	(2/71) 2.82%	0 0%	(1/2) 50%	(1/2) 50%
Vit.D state M±SD (ng/ml)	16.45±0.0	0	24.9±0.0	8.0±0.0
Under-weight (<18.5) n=7(9.85%)	(7/71) 9.85%	0%	(3/7) 42.86%	(4/7) 57.14%
Vit.D state M±SD(ng/ml)	12.9±7.02	0	18.6±7.7	8.5±0.66
Normal (15.5–24.5) n=45(63.38%)	(45/71) 63.38%	(3/45) 6.67 %	(27/45) 60%	(15/45) 33.33%
Vit.D state M±SD (ng/ml)	16.4±7.6	32.5±3 5	19.3±4.7	8.5±0.66
Over-weight (25–29.9) n=15(21.13%)	(15/71) 1.13%	(1/15) 6.66%	(7/15) 46.67%	(7/15) 46.67%
Vit.D state M±SD (ng/ml)	15.4±7.7	30.0±0	20.3±4.3	8.3±0.68
Obese (>30) n=2(2.82%)	(2/71) 2.82%	0 0%	(2/2) 100%	0 0%
Vit.D state M±SD (ng/ml)	19.1±0.0	0	19.1±0.0	0

The questionnaire

The level of vitamin D was insufficient in all volunteers who were exposed to sunlight daily, weekly and monthly, with a ratio of 91.55, 5.63, 2.82%, respectively, and the best level of vitamin D was among the volunteers who were exposed daily to sunlight when compared with the normal levels of the vitamin. Also in all male volunteers the concentration of vitamin D was insufficient and their exposure to sunlight on a daily, weekly and monthly, with ratio of 47.69, 25, 50%, respectively, where the best level of vitamin D was among males who were exposed to sunlight weekly when compared to the normal level of the vitamin D. Regarding female volunteers, the vitamin D level was insufficient for those who were exposed to sunlight daily, but it was better than that of females who were exposed to sunlight weekly and monthly respectively, with a ratio of 52.31, 75, 50%, respectively (Table 4).

Table 4: The sunlight exposure of all participants.

Duration of sunlight exposure	Daily (%)	Weekly (%)	Monthly (%)
All volunteers (71)	(65/71) 91.55٪	(4/71)5.63٪	(2/71)2.82٪
Vit.D statues (ng/ml)	15.7±7.05	11.1±4.8	11.1±0.0
Male (33)	(31/65) 47.69٪	(1/4) 25٪	(1/2) 50٪
Vit.D statues (ng/ml)	21.5± 5.7	27.5	19.8
Female (38)	(34/65) 52.31٪	(3/4) 75٪	(1/2) 50٪
Vit.D statues (ng/ml)	11.4± 4.9	8.3±0.5	8.0
Outside thecampus	(40) 61.54%	(1) 25%	0٪
Vit.D statues (ng/ml)	15.2±7.3	8.0	0
Inside the campus	(25) 38.46%	(3) 75%	(2)100٪
Vit.D statues (ng/ml)	17.2±7.3	13.4±5.3	13.94±0.0

Regarding the duration of sunlight exposure in the present study, 43.66% of the volunteers were exposed to the sunlight at the period of 15-20 min/day with vitamin D level of 16.4±7.6 ng/ml, a 54.84% of them were males with level of 21±5.7 ng/ml and 45.16% were females with low level of vitamin 10.07±3.5 ng/ml. On the other hand, a higher percentage (60%) of female participants had a low duration of sunlight exposure than males which was 40% (Table 5).

Table 5: Duration of sunlight exposure of males& females

Duration of sunlight Exposure	Yes (>15min)	Yes (<15min)
All Participants (71)	(31/71) 43.66%	(40/70) 56.34%
Vit.D state M±SD (ng/ml)	16.4±7.6	15.6±7.3
Male (33)	(17/31) 54.84%	(16/40) 40%
Vit.D state M±SD (ng/ml)	21±5.7	20.14±7.2
Female (38)	(14/31) 45.16%	(24/40) 60%
Vit.D state M±SD (ng/ml)	10.07±3.5	11.8±5.6

The data in Table (6) showed that 74.65% of the participants did not use sunscreen with a vitamin level of 17.4 ng/ml, where the percentage of males among them was 49.58% with a vitamin level of 5.21 ng/ml, and the percentage of females was 51.41% with a vitamin level of 11.08 ng/ml. Daily use of sunscreen was mentioned by only 5.6% of female participants, with a low level of the vitamin D reaching 7.8 ng/ml. This may explain the high prevalence of vitamin D deficiency among female students.

Table 6: The sunscreen usage among males and females.

sunscreen usage	Not used	Sometimes	Constantly
All students (71)	(53/71) 74.65**%**	(14/71) 19.72**%**	(4/71) 5.63**%**
Vit.D state M±SD (ng/ml)	17.4±7.8	11.2±4.04	8.7± 0. 07
Male (33)	(31/53) 58.49**%**	(2/14) 14.29**%**	0٪
Vit.D state M±SD (ng/ml)	21.5±5.8	20.9±0.0	0
Female (38)	(22/53) 41.51**%**	(12/14) 85.71**%**	(4/4)100**%**
Vit.D state M±SD (ng/ml)	11.08± 5.7	11.4± 4.08	8.7± 0.07

Table (7) showed that the percentage of milk consumption among participants daily, weekly, monthly and not consuming it was 38.02, 40.85, 14.08 and 7.04%, respectively, with insufficient level of vitamin D (< 21-30 ng/ml). Also, insufficient of vitamin D was found in the participants who consumed fish and meat daily, weekly and monthly and never consumed it, similarly all participants who are not consuming milk, fish and meat or who frequently consume have insufficient level of vitamin D (<2 1-30 ng/ml).

Table 7: The consumption of milk, fish and meat among the volunteers.

Frequency Consumption	Daily	Weekly	Monthly	Not
Milk	(27)	(29)	(10)	(5)
Vit.D state M±SD(ng/ml)	38.03**%** 17.9±7.7	40.85**%** 13.6±6.3	14.08**%** 18.4±7.6	7.04**%** 10.7±4.7
Fish	0	(8)	(56)	(7)
Vit.D state M±SD(ng/ml)	0% 0	11.3**%** 18.6±6.1	78.9**%** 15.1±6.8	9.8**%** 15.1±7.3
Meat	(9)	(37)	(20)	(5)
Vit.D state M±SD(ng/ml)	12.68**%** 15.8±5.5	52.12**%** 17.1±7.5	28.16**%** 13.6±7.4	7.04**%** 10.4±4.8

Daily, monthly consumption and not-consumption of meat by male's participants show deficiency of vitamin D (< 20 ng/ml), while weekly consumption shows insufficient status of vitamin D (< 21-30 ng/ml), on the other hand daily, weekly and monthly consumption and non-consumption of meat by female's participants show deficient of vitamin D status (less than 20 ng/ml). The frequency of milk consumption was significantly related to vitamin D status. The percentage of volunteers who consumed milk every day was 38.03%. They were 51.85% of

males with insufficient status of vitamin D (22.7±4.09 ng/ml), and 48.15% was females showing deficient status of vitamin D (10.6±3.6 ng/ml). Most of the participants 40.85% were weekly consumed milk. Only male's participants who did not consume fish showed normal status of vitamin D. While insufficient status of vitamin D was shown in male's participants who consumed fish weekly and monthly, on the other hand deficiency status of this vitamin was shown in the female's participants who never consumed fish (Table8).

Discussion

Vitamin D deficiency continues to be an unrecognised epidemic globally, and Vitamin D deficiency is associated with an increased risk of obesity, diabetes, cardiovascular disorders, autoimmune diseases, infectious diseases, and neurodegenerative diseases including Alzheimer's and Parkinson's disease [11,12]. 25(OH)D is a precursor to the active hormone, 1,25-dihydroxyvitamin D (1,25(OH)2D) and is the best indicator of total vitamin D stores and its availability for biological functions [13].

The Institute of Medicine (US) Committee to Review Dietary Reference Intakes for Vitamin D and Calcium has recently recommended that serum 25(OH)D is adequate when it is higher than 50 nmol/l [14]. The clinical picture includes muscle weakness, bone pain, and fractures, while joint swelling and deformity prevail in children. In patients with rickets and osteomalacia, serum 25(OH)D is usually less than 15nmol/L or even below the detection limit [15].

In our study female subjects displayed a lower vitamin D status compared to the male subjects, similar finding was reported by Khushdil et al., in 2017 [3]. Several factors have been hypothesized for lower vitamin D levels in females including dietary habits, lack of sunlight exposure, sunscreen usage, skin hyperpigmentation, poor nutrition, breastfeeding, pregnancy, lactation, and longer indoor stay in college as well as at home [16]. Hypovitaminosis D has been reported in the literature as being more prevalent in females due to poor dietary habits, decreased exposure to sunlight and widespread use of sunscreens. Differences in hormonal milieu between the sexes also affect transport proteins and enzymes involved in vitamin D metabolism [17]. In another study female with age group 18 to 25 years are more likely to be deficient in Vitamin D [18].Some studies of medical students and residents in other parts of the world have found a higher prevalence of vitamin D deficiency and also these finding was consistent with that published by Multani et al., in 2010 [19].

The data of this study showed that the majority of male volunteers had an insufficient level of vitamin D, and the majority of female volunteers had deficient levels of vitamin D. This may be due to dietary habits such as low intake of vitamin D sources or lack of exposure to sunlight, decreased duration of exposure to sunlight or it may be due to the use of sunscreen. The high prevalence of vitamin D deficiency has been reported in many previous studies among people of both sexes and in all age groups, including from the lowest to highest socioeconomic level [20], also, populations living in rural and urban areas [21,22], and pregnant women and their new-bornbabies [20,23], and post-menopausal women and healthy young men [24].Vitamin D is a prohormone and adequate levels of vitamin D in plasma are considered a sign of “good” health. Aside from the well-established role of vitamin D in skeletal health (including osteoporosis, phosphorus, calcium, fractures, and bone metabolism), and also increased risk of obesity, infectious diseases, autoimmune diseases, diabetes, cardiovascular disorders, and neurodegenerative diseases including Alzheimer's and Parkinson's disease [11,12].

In the present study, the mean of BMI was 22.25±4.5 kg/m^2. The majority of participants (63.38%) had normal BMI with Insufficient level of vitamin D (Table 3), Hasanato et al., in 2015 [2] have reported a similar result of BMI, and these findings were consistent with that published by Khushdil et al., in 2015 [3].

Obesity and low vitamin D concentrations complement each other; because the fatty tissues retain vitamin D and make it unavailable for the body [12], these findings were also consistent with that stated by Sharif and Rizk in 2011 [25]. Obesity is a risk factor for low vitamin D levels. A previous study showed that being overweight or obese and not participating in outdoor sports are risk factors for vitamin D deficiency [26-29].

In obese people, there is a suppressing effect of high quantities of subcutaneous fat on circulating Vitamin D [6]. The obese participants in this study were 2.82%, and all of them had insufficient vitamin D status. However, the same trend was observed for the severely underweight students. Studies have also shown that risk factors that lead to vitamin D deficiency include insufficient exposure to sunlight, such as skin pigmentation, living at higher latitudes (above 35 degrees north or below 35 degrees south), excessive use of sunscreen, and covering the body [12]. The presence of vitamin D receptor in

Table 8: The consumption of milk, meat and fish in males and females.

Frequency consumption	Meat		Milk		Fish	
	Males	Females	Males	Females	Males	Females
Daily	(4/9) 44.4%	(5/9) 55.6%	(14/27) 51.8%	(13/27) 48.2%	0%	0%
Vit.D state M±SD (ng/ml)	20.3±4.08	11.5±5.2	22.7±4.09	10.6±3.6	0	0
Weekly (%)	(20/37) 54.0%	(17/37) 45.9%	(11/29) 37.0%	(18//29) 62.1%	(6/8) 75%	(2/8) 25%
Vit.D state M±SD(ng/ml)	21.1±5.5	11.5±5.8	19.5±5.2	10.3±3.6	22.8±4.0	12.7±0.0
Monthly (%)	(8/20) 40%	(12/20) 60%	(7/10) 70%	(3/10) 30%	(24/56) 42.8%	(32/56) 57.2%
Vit.D state M±SD (ng/ml)	20.8±6.9	9.3±1.9	19.9±6.9	17.3±8.5	20.6±5.2	11.2±5.06
Not consumption (%)	(1/5) 20%	(4/5) 80%	(1/5) 20%	(4/5) 80%	(3/7) 42.8%	(4/7) 57.2%
Vit.D state M±SD(ng/ml)	20.1±0.0	8.0±0.0	20.2±0.0	8.4±0.7	26.2±9.3	8.0±0.0

most tissues of the body indicate its broader physiological role beyond calcium and bone metabolism [30].

The questionnaire

The participants of this study, 91.5% of all volunteers (males and females) are exposed to sunlight on a daily, weekly, or monthly basis; they still suffer from insufficient level of vitamin D in their bodies. On the other hand, volunteers who were exposed to sunlight on a daily basis they had insufficient levels of the vitamin D, while those who were exposed to sunlight on a weekly or monthly basis had a deficiency in the level of the vitamin D, when comparing these rates with the rates of vitamin D classification (Table 4). Exposure of the skin to sunlight is of paramount importance for vitamin D synthesis, as it activates the synthesis of vitamin D from the precursor 7-dehydrocholesterol, which is naturally available in the skin [31,32]. In some previous studies, low levels of vitamin D were associated with sunlight exposure, dietary factors, and social reasons. Sunlight exposure is an important factor determining the serum vitamin D levels [12].

The percentage of duration of sunlight exposure in our study was 43.66% of the studied group was exposed to the sunlight at the period of 15-20 min/day, 54.84% of them were males and 45.16% were females (Table 5), this finding as same with the study by Khushdil et al. in 2015 [3]. On the other hand, the percentage of people who were exposed to the sunlight for less than 15 minutes in this study was 56.34%, which in turn affected the level of vitamin D in their bodies, which could be due to a decrease in the internal synthesis of the vitamin D, which occurs through adequate exposure to sunlight, especially among female students, due to the excessive use of sunscreen preparations or clothing style. This could be due to social customs, or cosmetic usage reasons [6]. It is necessary to obtain sufficient exposure to sunlight to obtain a sufficient amount of vitamin D. Recently, 15 minutes of exposure per day has been recommended [33].

In this study, female students who used various sunscreens daily (8.7 ng/ml) experienced a decrease in vitamin D deficiency, while the volunteers who did not use sunscreen products at all had a higher level of vitamin D (11.08 ng/ml) (Table 6), which indicates that these preparations can block the sun's rays from reaching the skin and convert 7-dehydrocholesterol to the active form, which is Cholecalciferol (previtamin D), which is considered the main source of vitamin D in the body. In other studies, it was shown that a negative approach towards sun exposure was observed in the majority of participants. A small number of participants were exposed to more sunlight in summer and fall. The vast majority of participants were aware that sunlight is one of the main sources of vitamin D, but the majority avoided sun exposure by covering themselves with clothing or sunscreen. Moreover, the studied sample revealed that 69.2% were exposing only their hands and face, and 68.2% of the participants were using sunscreen on a daily basis. 57.7% of participants indicated that the main reason for not being exposed to sunlight is avoiding direct sunlight and heat. Other studies conducted in the Kingdom of Saudi Arabia reported that exposure to sunlight is limited due to excessive heat and cultural reasons [33,34].

Conclusions

It can be concluded that occurrence of vitamin D insufficiency and deficiency among students of faculty of Engineering and Technology Brack AlShatti was observed in this study. The results of the questionnaire indicated that nutritional, environmental and social factors could be the main causes. The recommendation to eliminate this health problem is to have enough daily sunlight exposure and consumption of vitamin D sources such as dairy products, fish and red meat. Vitamin D deficiency, especially among female students, is alarmingly widespread. Increased use of sunscreen lotions and style of clothing that covers all parts of the body can be major factors that inhibit endogenous vitamin D synthesis leading to its deficiency.

Recommendation

Conducting more studies on a larger scale to include different groups of society, and there is a need for experiments designed to draw more stable and clear conclusions about the relationship of vitamin D level to some other phenomena such as birth weight of children, tooth decay in children, and thyroid disorders in dialysis patients.

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