ARTICLES

Knowledge of Vitamin D Deficiency Factors among a Sample of the Kuwaiti Population: A Socio-Cultural Study

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Abstract:

Kuwait is considered as one of the best geographical locations to obtain sufficient solar UV rays for optimal synthesis of vitamin D. However, high prevalence of Vitamin D deficiency has been reported among Kuwaiti citizens.

Study Objectives: The current study aims to measure the association between participants' socio-cultural variables, and to know factors that cause vitamin D deficiency. It also seeks to find the association between participants' lifestyle behaviors and knowledge of factors that cause vitamin D deficiency and to assess participants' knowledge of vitamin D deficiency symptoms.

Study Method: A questionnaire was distributed among 276 adults. It comprised five parts of data: Socio-demographic information, lifestyle assessment, vitamin D deficiency symptoms, vitamin D deficiency source of information, and causes of vitamin D deficiency. Analysis of variance (ANOVA) and Chi-square test statistics were performed to test the study's questions.

Results: The study revealed that Kuwaiti participants' knowledge of vitamin D deficiency factors is significantly associated with age, BMI, occupational and marital status, and that knowledge of vitamin D deficiency causes is associated positively with participants' hours of exposure to sunlight, and negatively with participants' taknig vitamin D supplements.

Keywords: Vitamin D Deficiency, Knowledge, Risk Factors. Kuwaiti, Anthropology.

Introduction

Vitamin D deficiency has been documented as a common public health problem in various regions around the Middle East and worldwide with striking geographical variations (Daly et al., 2012;

- Submitted: 1/3/2018, Revised: 7/6/2018, Accepted: 21/6/2018.

Lips, 2001; Lips, 2010). It has been estimated that around one billion individuals globally have sub-optimal levels of vitamin D in their blood, across all age groups and ethnicities (Gordon et al., 2004;Holick, 2007). Due to the significant impacts of low serum concentrations of 25-hydroxy vitamin D (25(OH) D) on individual's health and well-being, several clinical and socio-cultural studies have been conducted to assess the impact of vitamin D deficiency on individual's health outcomes. The findings detect the following health morbidity that are not only associated with non-skeletal disorders (Hossein-nezhad & Holick, 2013), but also include the following diseases: asthma (Bosse et al., 2009, Type 1 diabetes (Borkar et al., 2010, Type 2 diabetes mellitus (Al-Daghri et al., 2013), obesity (Al-Daghri et al., 2014), cardiovascular disease (Autier et al., 2014), cancer (Garland et al., 2006), autoimmune disorders (Fahed et al., 2012). As a result of the negative impact of vitamin D deficiency on a population's health conditions, many research studies have been carried out to identify vitamin D deficiency risk factors in order to maintain the optimal level of serum concentrations of 25 (OH) D among population and sustain their healthy musculoskeletal and biological system (Alkoot, 2016). These research findings reveal several vitamin D deficiency risk factors that include both biological and cultural elements, some of which are related to the individual's duration and frequency of exposure to sunrays (Maeda et al., 2007), amount of unprotected skin exposed to UV radiation due to extensive sunscreen application, or extensive clothing due to traditional clothing style (Glerup, 2000; Grant,2009 ; Holick, 2004;). Other risk factors that are related to physiological causes are genetic factors affecting sufficient synthesis and function of vitamin D (25 (OH) D) in the blood (Elkum et al. 2014; Powe et al., 2013), anthropometric ratios (Tønnesen et al. 2016), and skin pigmentation (Roughani & Al-Mulla 2015). Also, individual's lifestyle behaviors and unhealthy dietary habits, such as a suboptimal intake of foods containing vitamin D like fish and fortified milk and sedentary daily lifestyle behaviors, are detected as vitamin D deficiency risk factors (Holick et al., 2011; Murni et al., 2016).

Kuwait is considered as one of the best geographical locations to obtain sufficient solar UV radiation for optimal synthesis of vitamin D. However, high prevalence of low levels of vitamin D (25(OH) D) serum has been reported among Kuwaitis (Fields et al. 2011; Alyahya et al. 2014; Al-Lahou et al. 2016). This might be attributed several factors. First, there is the traditional style of clothing, which obscures direct sunlight and blocks it from reaching the skin, thus affecting the synthesis of vitamin D in the body (Alsuwaida et al., 2013; Golbahar et al., 2013; Hatun et al., 2005). The traditional garments, it is assumed, that cover the body from the shoulders down to the feet, with scarf-like covers for the hair, both for women (*Hijab*) and *(Ghetra*) for men, and long dark dresses for women (*Abayah*) and long white dresses for men (*Dishdasha*) largely obscure the sunlight and contribute to the high prevalence of vitamin D deficiency among Kuwaitis. Second, the indoor lifestyle activity during most of the year minimizes the extent of exposure to sunlight and contributes to this deficiency. That is to say, people tend to plan almost all their family social events and leisure activities indoor to avoid excessive heat during the summer, thus preventing the skin from obtaining optimal amount of sunlight rays for synthesis - an adequate level of serum 25(OH)D concentration in the body (Al-Kandari, 2006; Molla et al., 2005; Awad & Al-Nafisi, 2014). Third, lack of intake of dietary sources rich in vitamin D, lower consumption of food fortification such as milk and orange juice, and high intake of fast-food instead also contribute to high prevalence of vitamin D deficiency among Kuwaitis (Al-Kandari, 2006; Jarman et al., 2012).

Research conducted in Kuwait about vitamin D status

There are many cross-sectional studies that have been conducted among Kuwaitis to evaluate the vitamin D status and its causes. The correlation between vitamin D deficiency and clothing style among veiled Kuwaiti women, aged 14 and above, has been established by El-Sonbaty (1996); the results show that veiled Kuwaiti women reported significantly lower serum 25(OH)D levels than non-veiled women. Incidence of rickets among the neonates and their mothers, on the day

of delivery in Kuwait, has been examined by Molla et al., (2005). The findings show that (40%) of Kuwaiti mothers and (60%) of the neonates have vitamin D deficiency.

To determine vitamin D deficiency influence on Kuwaiti adolescent female's bone mass, risk factors of vitamin D deficiency such as sun exposure, skin color, anthropometric measurements, clothing styles, dietary habits, and physical activity, have been studied by Alyahya et al. (2014). The findings reveal that most of the adolescents (98.7 %) have < 50 nmol/L of 25(OH)D serum levels and that the main factors of suboptimal level of vitamin D among Kuwaiti adolescent females are waist/hip ratio, not having a private room, and veiling. In their study, anthropometric measurements, bone mineral content, month since menarche, animal protein consumption, and daily physical activity are employed independent predictors. Moreover, skin pigmentation, vitamin D supplement intake, and indications influencing vitamin D level and metabolism among multiple sclerosis (MS) Kuwaiti patients have been examined by Roughani and Al-Mulla (2015); the findings demonstrate that MS Kuwaiti patients have vitamin D deficiency.

Fasting in the month of Ramadan, lifestyle behaviors, and body composition as vitamin D deficiency risk factors have been reported among Kuwaiti athletes by Alkoot (2016). The data reveals that the athletes' body fat and fasting during Ramadan have an inverse relationship with serum of 25(OH)D and contribute to vitamin D insufficiency. On the other hand, both factors of prescribed high intake of vitamin D supplements and dietary habits have positive correlations with sufficient vitamin D levels. Age, anthropometric measurements, physical activity, and family income as vitamin D insufficiency causes among Kuwaiti children aged between 5 to 19 year old have been studied by Al-Lahou et al. (2016). The findings show that 2.1% of the children have vitamin D deficiency. They also indicate that vitamin D sufficiency is positively associated with income and physical activity of the child's family, but it is negatively associated with the child's age.

Objective of the Study and Research Questions

Due to the high incidence of vitamin D inadequacy among Kuwaitis, as previous studies have shown, the current study, informed by a medical and anthropological perspective, aims to examine: (1) the association between participants' socio-cultural variables and knowledge of factors that cause vitamin D deficiency, (2) the association between participants' lifestyle behaviors (clothing style, exposure to sun, smoking status, and physical activity) and knowledge of factors that cause vitamin D deficiency, (3) the source of information regarding vitamin D deficiency, and (4) the participants' knowledge of vitamin D deficiency symptoms.

Research questions:

1 - Are there significant differences between knowledge of factors that cause vitamin D deficiency and Kuwaitis' socio-cultural characteristics?

2 - Are there significant differences between knowledge of factors that cause vitamin D deficiency and participants' lifestyle behaviors (clothing style, exposure to sun, smoking status, and physical activity)?

3 - What are the main sources of information regarding vitamin D deficiency among Kuwaiti adults?

4 - What are the most common symptoms of vitamin D deficiency among Kuwaiti adults?

METHODOLOGY

Study Design and Population

This is a cross-sectional study that was carried out from March 2017 to January 2018 among 276 Kuwaiti adults. The mean age of the participants was 31.55 years old ($SD = 13.52$). Three-fourths ($n=209$; 75.7%) of the participants reported suboptimal level of total serum 25(OH)D < 50 nmol/L. Participants enrolled conveniently by using a non-random opportunistic sample from six Kuwaiti governorates. The participation was voluntary and participants were asked to assess their

willingness and eligibility to join in the study. After participants being completely informed of the study objectives and procedures, a written consent form was given to all, informing them that they could withdraw at any time from the study. The data collection procedures followed the Kuwait University research method rules and regulations. Representative participants included both who wore traditional Kuwaiti long garments and who wore western clothing style. The questionnaire was translated into Arabic and went through a process of forward and backward translation by four faculty experts at Kuwait University in the fields of public health and medical anthropology to ensure its content validity. To ensure the accuracy of the questions, the translated questionnaire was pretested for content, design, question clarity, and recognition to 20 participants. The reliability of the study instrument showed high internal consistency (Cronbach's alpha was 0.80).

Study instruments and data collection

The self-administrative questionnaire composed of closed-ended questions was adapted from a previously used questionnaire by Tønnesen et al. (2016) and Al-Daghri et al. (2017), to measure the identified study variables in the following five sections:

(1) Socio-demographic characteristics (age, marital status, educational level, working patterns, ethnic background, religious affiliation, monthly income, and government district);

(2) Lifestyle assessment such as (BMI, consumption of fast food, exercising indoor or outdoor, clothing style, smoking habits, use of vitamin D supplements, and exposure to the sun);

(3) Vitamin D deficiency symptoms (tiredness and fatigue, osteoporosis, feeling cold, cardiovascular diseases, asthma, and depression);

(4) Vitamin D deficiency source of information (family and friends, social media, and medical centers); and

(5) Causes of vitamin D deficiency such as lack of a strict diet, lack of physical activity, dark pigmentation, smoking, and obesity, and self-reported physical activity (hours of exercising, and indoor or outdoor exercising).

Sun exposure information includes hours of exposing to the sun,

and time of exposing to the sun according to season. Conservative style of clothing is defined as women wearing a traditional long dress that covers the body from the shoulders down to the feet, called "*abayah*", with scarf-like cover that covers the hair, called "*hejab*". According to National Institute of Health (2018), Vitamin D sufficiency is diagnosed as serum 25(OH)D level < 50 nmol/L, insufficiency 50-75 nmol/L and sufficiency 75 -250 nmol/ L. BMI is calculated by dividing participants' weight in kilograms by their height in meters squared. According to the World Health Organization's definition of obesity, participants are classified as underweight (BMI < 18.5 kg/m2), normal (BMI 18.5 - 24.9 kg/m2), overweight (BMI 25-29.9 kg/m2) and obese (BMI 29.9 kg/m2) (WHO, 2018).

Statistical Analysis

For data analysis, the SPSS (Statistical Package for the Social Sciences, Windows version 23. 2015; SPSS Inc., Chicago, Ill., USA) was used to test the associations between study's variables. Analysis of variance (ANOVA) and Chi-square test statistics were performed to assess correlations between participants' socio-cultural characteristics and knowledge of vitamin D deficiency symptoms and risk factors. Vitamin D deficiency knowledge was considered as the dependent variable, while socio-cultural characteristics such as age, gender, BMI, educational level, marital status, working environment, smoking status, physical activity, dairy intake, duration of sun exposure, clothing style were the independent variables. A *P*-value of .05 was used as the criterion of statistical significance.

RESULTS

Description of the population

Table 1 reveals that (42.0%) of participants' age was between 23 to 39 years old, and more than half (52.9%) of participants were female. More than half (56.5%) of the participants' were overweight, and those educational level was university degree and above was 63.8%. Half (50.0%) of the participants' marital status were single, and (45.7%) of the participants' occupational status were students. A

percentage of (18.1%) reported monthly income between 801-1110 KD, and (22.5%) of them lived in Al-Jahra district. Most of the participants' religious affiliation was Sunni (88.8%), and participants' home descendant from Bedouin ethnicity background was (58.7%).

Table (1)
Distribution of Participants' Socio-demographic Variables of the sample (N* = 276)

Characteristics	*N* (%)	Characteristics	*N* (%)
Age category, years		**Income K.D**	
		< 500	27 (9.8)
< 22	94 (34.1)	501-800	19 (6.9)
23-39	116 (42.0)	801-1110	50 (18.1)
> 40	63 (22.8)	1101-1400	46 (16.7)
Sex		1401-1700	27(9.8)
Male	130 (47.1)	1701-2000	21 (7.6)
Female	146 (52.9)	2001-2300	23 (8.3)
BMI, kg/m2		2301-2600	8 (2.9)
Normal	114 (41.3)	2601-2900	5 (1.8)
Overweight	156 (56.5)	> 2901	26 (9.4)
Religious affiliation		**Occupational status**	
		Student	126 (45.7)
Sunni	245 (88.8)	Student & employed	32 (11.6)
Shiite	28 (10.1)	Employed	74 (26.8)
Educational level		Retired	24 (8.7)
< High school	20 (7.2)	Private business	7 (2.5)
High school & Diploma	78 (28.3)	Housewife	12 (4.3)
> University	176 (63.8)	**Marital status**	
Kuwait governorates		Not married	138 (50.0)
		Married	129 (46.7)
AlAsimah	44 (15.9)	**Roots**	
Hawalli	37 (13.4)	Urban	101 (36.6)
Mubarak Al-kabeer	38 (13.8)	Bedouin	162 (58.7)
ALFarwayniyah	56 (20.3)		
ALJahra	62 (22.5)		
ALAhmadi	35 (12.7)		

* Total number without missing values.

Table 2 shows that (81.16%) of the female participants reported wearing headscarf (*Hijab*), and (67.4%) of the participants reported wearing long clothes that covers their whole body. Regarding working environments, (75.4%) of the participants reported indoor working environment; and (43.5%) reported eating fast food on a weekly basis between 2 to 6 times. Concerning participants' daily physical activity habits, Table 2 shows that (73.9%) of the participants did not walk in open-air, (52.2%) usually engaged in outdoor exercise for less than half an hour, and (59.4%) practiced walking in winter. Regarding participants' duration and frequency of sunlight exposure and seasonal exposing to sunlight, Table 2 reveals that only (27.9%) of the participants said that, on average, they exposed to optimal sunlight three to four days a week in summer from 9-9:30 am and from 2-3 pm. One-third (35.1%) of the participants said that, on average, they exposed to sunlight three to four days a week in winter from 10 am-2 pm. As for participants' health history, taking vitamin D supplements was reported by only one-third (32.6%) of the participants, not diagnosed with chronic disease reported by the majority (86.6%) of the participants, and member of family diagnosed with vitamin D deficiency reported by the majority (90.9%) of the participants (Table 2).

Table (2)
Distribution of Participants' Lifestyle Behaviors and Health History
(N* = 276)

Characteristics	*N* (%)	Characteristics	*N* (%)
Do you wear a scarf (*hijab*)		**Walking outdoor**	
Yes	125 (81.16)	Yes	72 (26.1)
No	29 (18.83)	No	204 (73.9)
Working indoor			
Yes	208 (75.4)	**Season of walking**	59 (21.4)
No	44 (15. 9)	summer	164 (59.4)
Do you your family have Vit D deficiency?		winter	
Yes	251 (90.9)	**Hours of exercising**	
No	20 (7.2)	**outdoor**	

Cont| Table (2)
Distribution of Participants' Lifestyle Behaviors and Health History (N* = 276)

Characteristics	*N* (%)	Characteristics	*N* (%)
Do you regularly go for walking		< than half an hour	144 (52.2)
		.5 to 2	37 (13.4)
Yes	88 (31.9)	2-4	31 (11.2)
No	183 (66.3)	> 4	15 (5.4)
Do you have vitamin D deficiency		**Smoking habits**	
		Never smoker	184 (66.7)
Yes	246 (89.1)	Previous smoker	23 (8.3)
No	26 (9.4)	Current smoker	56 (20.3)
		Frequency of eating fast food weekly	
		Non	58 (21.0)
		Once	76 (27.5)
		2-6 times	120 (43.5)
		Everyday	18 (6.5)
Taking vitamin D supplement		**Exposing to sun (3-4 days) in summer from 9-10:30 am and from 2-3 pm**	
Yes	90 (32.6)		
No	182 (65.9)		
Diagnosed with chronic disease		Yes	77 (27.9)
		No	196 (71.0)
Yes	35 (12.7)	**Exposing to sun (3-4 days) in winter from 10 -2**	
No	239 (86.6)		
My dress covers my whole body		Yes	97 (35.1)
		No	176 (63.8)
Yes	186 (67.4)		
No	87 (31.5)		

* Total number without missing values.

Sociocultural Characteristics and knowledge of vitamin D deficiency risk factors:

The results of one-way ANOVA demonstrated that the Kuwaiti participants knowledge of vitamin D deficiency risk factors ($p < 0.0001$) is inversely associated with age. The participants who

aged 22 years and younger were more knowledgeable about vitamin D deficiency causes (*M* = 34.51, *SD* = 7.36) than participants who aged 23-39 years (*M* = 33.33, *SD* = 6.92) and above 40 years (*M* = 29.04, *SD* = 6.18) (Table 3). Also, the current results showed an inverse significant association between participants' BMI and awareness of vitamin D deficiency risk factors ($p < 0.05$) (Table 4). Kuwaitis whose BMI is 18.49 and lower had more knowledge of vitamin D deficiency causes (*M* = 37.00, *SD* = 9.75) than Kuwaitis whose BMI was between 18.50 and 24.99 (*M* = 33.26, *SD* = 7.74), 25.00 and 29.99 (*M* = 32.67, *SD* = 6.53), and 30 and above (*M* = 30.91, *SD* = 6.68).

Moreover, Table 3 reveals that Kuwaitis' occupational status has a significant association with their knowledge of vitamin D deficiency causes ($p < 0.05$). Full-time students (*M* = 33.98, *SD* = 7.44), and working students (*M* = 33.25, *SD* = 7.93) exhibited more awareness about vitamin D deficiency risk factors than Kuwaitis who owned private businesses (*M* = 32.42, *SD* = 9.37), Kuwaitis working full-time (*M* = 32.01, *SD* = 6.15), and retired Kuwaitis (*M* = 29.54, *SD* = 5.65). The lowest level of knowledge about vitamin D deficiency risk factors among Kuwaiti participants was found among housewives (*M* = 28.66, *SD* = 8.01). Furthermore, unmarried participants have more information about vitamin D deficiency risk factors (*M* = 33.70, *SD* = 7.65) than married Kuwaiti participants (*M* = 31.51, *SD* = 6.72).

Table (3)

One-way ANOVA between participants' Sociocultural Characteristics and Knowledge of vitamin D risk factors.

Variables	Knowledge of vitamin D risk factors		
	M	**SD**	*P*
Age (in years)			
< 22	34.51	7.36	.000
23-39	33.33	6.92	
> 40	29.04	6.18	
BMI			
< 18.49	37.00	9.75	.054

Cont| Table (3)
One-way ANOVA between participants' Sociocultural Characteristics and Knowledge of vitamin D risk factors.

Variables	Knowledge of vitamin D risk factors		
	M	SD	*P*
18.50-24.99	33.26	7.74	
25.00-29.99	32.67	6.53	
> 30	30.91	6.68	
Occupational status			
Student	33.98	7.44	.021
Student & employed	33.25	7.93	
Employed	32.01	6.15	
Retired	29.54	5.65	
Private business	32.42	9.37	
House wife	28.66	8.01	
Marital status			
Married	31.51	6.72	.014
Unmarried	33.70	7.65	

Knowledge of vitamin D deficiency risk factors and participants' lifestyle behaviors, and health history

The findings of one-way ANOVA illustrated that Kuwaiti participants' knowledge of vitamin D deficiency causes is positively associated with participants' hours of exposure to sunlight ($p < 0.05$). Participants who stayed outdoors and exposed to sunlight three hours and above reported more corrected information about vitamin D deficiency risk factors ($M = 35.33$, $SD = 8.18$) than participants whose exposure to sunlight was two hours and less ($M = 32.58$, $SD = 6.99$), and participants who avoided sunlight ($M = 31.10$, $SD = 6.88$) (Table 3). The findings also reveal an inverse association between participants' history of chronic disease and awareness of vitamin D deficiency causes ($p < 0.05$) (Table 4). Kuwaitis who were not

diagnosed with chronic diseases had more awareness of vitamin D deficiency risk factors ($M = 33.18$, $SD = 7.10$) than Kuwaitis who had chronic diseases ($M = 29.65$, $SD = 7.31$). Taking vitamin D supplements shows a significant negative association with participants' knowledge about causes of vitamin D deficiency ($M = 33.86$, $SD = 6.96$), compared to participants who reported not taking vitamin D supplements ($M = 30.45$, $SD = 7.27$).

Table (4)
One-way ANOVA between participants' lifestyle behaviors and Knowledge of vitamin D risk factors

Variables	Knowledge of vitamin D risk factors		
	M	SD	*P*
Exposing to sunlight			
I don't expose	31.10	6.88	.029
<2 hours	32.58	6.99	
> 3 hours	35.33	8.18	
Having chronic disease			
Yes	29.65	7.31	.007
No	33. 18	7.10	
Taking vitamin D supplements			
Yes	30.45	7.27	.000
No	33.86	6.96	

Kuwaitis' knowledge of vitamin D deficiency risk factors

Participants' awareness of vitamin D deficiency risk factors are displayed in Table 5. (53.6%) of the participants strongly agreed that not exposing enough to sunlight contributes to vitamin D deficiency, compared with: Following unhealthy diet (35.1%), Intake of soft drinks (31.2%), Not taking vitamin D supplements (28.3%), and Not exercising (25.7%).

The percentages of the participants who agreed with the following

vitamin D deficiency causes were as follows: Following unhealthy diet (44.2%), No exercise (42.8%), Not taking vitamin D supplements (41.3%), Aging (40.2%), Intake of soft drinks (33.0%), Not exposing enough to sunlight (27.9%), Genetic inheritance (24.3%), Smoking (24.3%), Obesity (22.8%), Pregnancy and breast feeding (20.7%), and Having chronic disease (18.5%). The participants who said they did not know whether the listed factors were the main causes of vitamin D deficiency are as follows: Decline in feminine hormones (65.9%), Dark skin (52.5%), Having chronic disease (51.1%), Genetic inheritance (48.2%), Pregnancy and breast feeding (43.8%), Smoking (38.4%), Obesity (35.1%), and Aging (23.9%) (Table 5).

Table (5)
Kuwaitis' knowledge of vitamin D deficiency risk factors

Vitamin D deficiency risk factors	Strongly agree N (%)	Agree N (%)	I don't know N (%)	Dis-agree N (%)	Strongly disagree N (%)	Total N (%)
Following unhealthy diet	97 (35.1)	122 (44.2)	28 (10.1)	20 (7.2)	6 (2.2)	273 (98.8)
Do not exercise	71 (25.7)	118 (42.8)	48 (17.4)	21 (7.6)	13 (4.7)	271 (98.2)
Not exposing enough to sunlight	148 (53.6)	77 (27.9)	14 (5.1)	28 (10.1)	5 (1.8)	272 (98.5)
Genetic inheritance	21 (7.6)	67 (24.3)	133 (48.2)	37 (13.4)	11 (4.0)	269 (97.5)
Not taking vitamin D supplements	78 (28.3)	114 (41.3)	43 (15.6)	28 (10.1)	5 (1.8)	268 (97.1)
Obesity	42 (15.2)	63 (22.8)	97 (35.1)	45 (16.3)	23 (8.3)	270 (97.7)
Decline in feminine hormones	5 (1.8)	27 (9.8)	182 (65.9)	31 (11.2)	16 (5.8)	261 (94.5)
Having chronic disease	18 (6.5)	51 (18.5)	141 (51.1)	39 (14.1)	24 (8.7)	273 (98.9)

Cont/ Table (5)
Kuwaitis' knowledge of vitamin D deficiency risk factors

Vitamin D deficiency risk factors	Strongly agree N (%)	Agree N (%)	I don't know N (%)	Dis-agree N (%)	Strongly disagree N (%)	Total N (%)
Pregnancy and breast feeding	37 (13.4)	57 (20.7)	121 (43.8)	25 (9.1)	21 (7.6)	261 (94.6)
Smoking	44 (15.9)	67 (24.3)	106 (38.4)	29 (10.5)	26 (9.4)	272 (98.5)
Aging	51 (18.5)	111 (40.2)	66 (23.9)	30 (10.9)	14 (5.1)	272 (98.6)
Intake of soft drinks	86 (31.2)	91 (33.0)	65 (23.6)	21 (7.6)	10 (3.6)	273 (99.0)
Dark skin	15 (5.4)	28 (10.1)	145 (52.5)	51 (18.5)	34 (12.3)	273 (98.9)

Source of information about vitamin D deficiency

Table 6 shows that the main source of information about vitamin D deficiency was 'Health Center' that had been reported by half (51.8%) of the participants, compared with (44.5%) for family and friends, (35.7%) for social media, (30.5%) for traditional media, and only (12.5%) for educational institutions.

Table (6)
Source of information about vitamin D deficiency

Source of information about vitamin D deficiency	N (%)
Health center	141 (51.8)
Family and friends	121 (44.5)
Social media	97 (35.7)
Traditional media	83 (30.5)
Educational institutions	34 (12.5)

Knowledge of vitamin D deficiency symptoms

As can be seen in Table 7, the strongest symptom of vitamin D

deficiency as identified by the participants was fatigue and tiredness (80.4%), followed by joint pains (72.7%), osteoporosis (68.3%), depression (48.7%), poor concentration (41.0%), feeling cold (35.8%), heart disease (5.9%), asthma (4.1%), and cancer (3.0%). Even though there were differences between participants' gender and identified symptoms of vitamin D deficiency, the differences were not significant.

Table (7)
Symptoms associated with vitamin D deficiency

Symptoms associated with vitamin D deficiency	Gender		Total N (%)
	Male N (%)	Female N (%)	
fatigue and tiredness	94 (43.1%)	124 (56.9%)	218 (80.4%)
Joint pain	89 (45.2%)	108 (54.8%)	197 (72.7%)
Osteoporosis	81 (43.8%)	104 (56.2%)	185 (68.3%)
Depression	58 (43.9%)	74 (56.1%)	132 (48.7%)
Poor concentration	50 (45.0%)	61 (55.0%)	111 (41.0%)
Feeling cold	39 (40.2%)	58 (59.8%)	97 (35.8%)
Heart disease	6 (37.5%)	10 (62.5%)	16 (5.9%)
Asthma	4 (36.4%)	7 (63.6%)	11 (4.1%)
Cancer	3 (37.5%)	5 (62.5%)	8 (3.0%)

DISCUSSION

The present study reveals that most Kuwaiti participants (89.1%) stated that they were clinically diagnosed this year with vitamin D deficiency, which is similar to results obtained from other Gulf countries (85.4%) in Yammine & Al Adham (2016)/UAE, 80% in Mithal et al. (2009)/ Saudi Arabia, and 90% in Badawi et al. (2012)/ Qatar. These findings could be attributed to several bio-cultural factors such as lifestyle behaviors including indoor physical activity, indoor working environments, sedentary lifestyle, unhealthy dietary intake, and traditional clothing styles, which are common in Arab Gulf

populations. The current study also indicates that young participants have more information about vitamin D deficiency risk factors than older ones, which might be because their families' members are diagnosed with vitamin D deficiency. Other factors that might explain the high awareness of vitamin D deficiency among young participants is the high prevalence of vitamin D suboptimal levels among them, which has already been detected in previous studies (Al- Lahou et al., 2016; Alyahya et al., 2014;Molla et al., 2005; Zhang et al., 2016).

The current study shows that half of the participants (51.8%) said that their main source of knowledge about vitamin D deficiency causes and symptoms is 'the medical centre', followed by 'family and friends', which is different from Al-Mutairi et al's. (2012) results, who reported 'mass media' as the main source of information (68.58%), followed by 'family and friends' (20.88%) and social media, and only (19.54%) by 'a health professional'. The findings also show that participants' anthropometric characteristic (BMI) had a significant inverse association with their information about vitamin D deficiency risks causes, which is similar to results obtained by Cheng et al., 2010; Gordon et al., 2004; Rockell et al., 2005; Skaaby et al., 2015; Zhang et al., 2016. This finding might be attributed to the participants' knowledge of chronic diseases risk factors such as sedentary lifestyle, unhealthy food consumption, and avoidance of outdoor activities.

The present study indicates that student participants gain more information about vitamin D deficiency risk factors, which might be attributed to Kuwaiti clinical studies documenting a high prevalence of vitamin D deficiency among young population (Alkoot, 2016; Alyahya et al., 2014; Al-Lahou et al., 2016). Therefore, there is a serious need to establish an inclusive health program that includes nutritionists, fitness trainers, and physicians in order to increase the level of awareness among students at different educational levels about the psychosomatic symptoms associated with vitamin D deficiency. Moreover, school curriculums should contain topics about the benefits of adapting healthy lifestyle behaviours to our body and well-being, especially practicing outdoor activity and exposure to sunlight.

This study further shows that participants who engaged in

outdoor activity and exposure to sunlight had more correct information about vitamin D deficiency risk causes than those who did not, a finding that is confirmed by several previous studies (Dawodu et al., 2011; Heaney, 2008; Holick, 2006; Sharif & Rizk, 2011). Moreover, the present study indicates that Kuwaitis with no chronic diseases gave more correct answers of vitamin D deficiency risk causes than Kuwaitis with such chronic diseases did, which is similar to results by (Al-Daghri et al., 2012; Damanhouri, 2009; Jafari et al., 2016).

Individuals' higher awareness of metabolic syndrome risk factors, such as sedentary lifestyle, high carbohydrate intake, low fortified dairy consumption, avoidance of outdoor physical activities play a major role in enhancing their health condition by engaging in healthy lifestyle programs to avoid having chronic diseases. Also, individuals who take vitamin D supplements have less knowledge about the risk factors than those who do not. This contributes to vitamin D deficiency and explains the strong relationship between participants' knowledge about vitamin D deficiency risk factors such as low consumption of fortified diet and medication supplements, and being diagnosed with vitamin D deficiency (See, Al-Daghri et al., 2017; Al-Turki et al., 2008; Mahdy et al., 2010; Zhang et al, 2016, for similar findings).

CONCLUSION:

The present study reveals that Kuwaiti university students have more knowledge about vitamin D deficiency risk factors, which reflects the essential role of educational institutions in providing students with nutritional and healthy lifestyle education. This finding calls for the need to provide the public community with such education in order to increase their knowledge and awareness about chronic diseases risk factors.

This study also indicates that three-fourths of Kuwaitis are reported not to walk in open air or engage in outdoor physical activities, which contributes to less time exposed to optimal sunlight that is vital for vitamin D synthesis. Such unhealthy lifestyle behaviors need to be altered through medical campaigns, social media advertise-

ments, and educational curriculums that encourage communities to adapt to healthy daily behaviors of outdoor activities. The finding that there is an association between Kuwaitis healthy lifestyle behaviors, and health conditions and their knowledge of vitamin D deficiency risk factors further confirms this need.

Finally, the following recommendations will help to minimize the prevalence of vitamin D deficiency among Kuwaiti population:

(1) Governmental policies about food fortification for dairy products with vitamin D should be encouraged and adopted by Ministry of Health;

(2) Local agricultural markets should be financially supported by the government to produce organic food with vitamin D fortified products;

(3) Fast food restaurants should be replaced by restaurants which provide healthy and organic food by including in their menus a variety of protein foods, seafood, seeds, and soy products;

(4) The government should encourage architectural engineers to design an ideal environment for employees that offers them optimal exposure to sunlight during their work;

(5) Governmental bodies should establish networks between the Ministry of Health, the Ministry of Information, and the Ministry of Education through the provision of seminars, conferences and workshops aimed at raising awareness of vitamin D deficiency symptoms and risk factors among all segments of society.

(6) The Ministry of Health should link the assessment of 25-hydroxy vitamin D 25(OH)D blood test levels with the immunization schedule of the children, and link the assessment of 25-hydroxy vitamin D 25(OH)D blood test levels among the elderly with the health screening for job recruitment.

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المعرفة بالعوامل المسببة لنقص فيتامين (د) بين عينة من السكان الكويتيين: دراسة اجتماعية ثقافية

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ملخص:
تعتبر الكويت أحد أفضل المواقع الجغرافية للحصول على ما يكفي من الأشعة فوق البنفسجية للتركيب الأمثل لفيتامين (د)، ومع ذلك تم الكشف عن ارتفاع معدل انتشار نقص فيتامين (د) بين الكويتيين.
أهداف الدراسة: قياس الارتباط بين المتغيرات الاجتماعية والثقافية للمشاركين ومعرفة العوامل المسببة لنقص فيتامين (د)، الارتباط بين سلوكيات نمط الحياة للمشاركين ومعرفة العوامل المسببة لنقص فيتامين (د)، تقييم معرفة المشاركين بالأعراض المصاحبة لنقص فيتامين (د).
منهجية الدراسة: تم توزيع الاستبانة على ٢٧٦ من البالغين، وتحتوي الاستبانة على خمسة أجزاء من البيانات: المعلومات الاجتماعية – الثقافية، تقييم نمط الحياة، الأعراض المصاحبة لنقص فيتامين (د)، مصدر المعلومات المتعلقة بنقص فيتامين (د). أجري التحليل Anova واختبار Chi-square لاختبار أسئلة الدراسة.
نتائج الدراسة: كشفت الدراسة أن معرفة المشاركين الكويتيين بالعوامل المسببة لنقص فيتامين (د) ترتبط إحصائياً بشكل كبير بالعمر ومؤشر كتلة الجسم والوضع المهني والحالة الاجتماعية. وأن معرفة أسباب نقص فيتامين (د) ترتبط إيجابياً بعدد الساعات التي يتعرض لها المشاركون لأشعة الشمس وسلبياً بتناول العقاقير المكملة لفيتامين (د).

المصطلحات العلمية: نقص فيتامين (د)، المعرفة، العوامل المسببة، الكويتيون، الأنثروبولوجيا.

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