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A CROSS-SECTIONAL STUDY ON PERCEPTIONS AND PRACTICES TOWARDS VITAMIN D AMONG ADULT MEN AND WOMEN IN A GULF ARAB POPULATION

Dr. Khaldoon Al-Roomi[*1] and Dr. Hala Mohamed Sanad[2]

[1]*Associate Professor, Department of Family and Community Medicine, College of Medicine and Medical Sciences, Arabian Gulf University, Kingdom of Bahrain.*
[2]*Assistant professor, College of Health and Sport Sciences, Nursing Department-WHO Collaborating Center for Nursing Development, University of Bahrain, Fellow HEA.*
[*]Corresponding Author: Dr. Khaldoon Al-Roomi; Email: alroomi@agu.edu.bh

***Abstract*:**
Background: while vitamin D deficiency is acknowledged as a leading dietary health problem in most Arab countries, limited information exists on the perceptions and practices of adult men and women towards this condition.
Methods: A sample of subjects age 18 years and older was obtained using a cross-sectional study design. A previously tested self-administered questionnaire was employed to obtain data from participants on their socio-demographic characteristics, perceptions and practices towards vitamin D health related items. Both univariate and multivariate analysis were performed in order to identify the independent factors.
Results: A total number of 335 subjects were included in the sample. The mean age of the participants was 32.6±11.5 years and females comprised 67.8% of the sample. The practice of consuming food items rich in vitamin D was significantly higher among those subjects with higher levels of education (p value = 0.04). In addition, the consumption of vitamin D fortified food items was significantly higher among females compared to males (OR = 2.70; 95% CI 1.34 to 5.43). The eagerness of the participants to have undergone a vitamin D blood testing in the past was significantly related to their level of education. Further, such a decision to take the test has had a significant impact on their current practice to consume daily vitamin D supplements (OR = 131.82; 95% CI 56.92 to 305.28).
Conclusion: In view of the apparent consumers unfavorable perceptions towards the intake of vitamin D fortified food items, consumption of vitamin D supplements and need for vitamin D testing, effective strategies are urgently required to improve public practices towards vitamin D.

Keywords: Vitamin D, Deficiency, Perception, Attitude, Practice, Arab World.

INTRODUCTION

Vitamin D deficiency is a common nutritional disorder in the Gulf area and worldwide [1-5]. Its importance lies in the vital role that vitamin D plays in the musculoskeletal system, growth, and development of a healthy body throughout the life span spectrum [6]. It is one of the highly significant components that are required for the maintenance of bone mass density and musculoskeletal development [7]. In addition, vitamin D deficiency has also been linked to increases in the risk of developing cancers, inflammatory diseases, and disorders of immune system [8]. Further, recently it has been reported that improving vitamin D status of patients with COVID-19 virus constitute an integral part in the management of patients with severe forms of this illness [9].

While the production of vitamin D is mainly based on the optimal exposure to sun light, it is interesting that even in countries with abundant sun exposure throughout the year such as Arab Gulf countries, high prevalence rates of vitamin D deficiency exists. This is widely thought to reflect the preference of people in these areas to avoid the direct exposure to sunlight in view of the extreme high temperatures, opting for the indoor lifestyle [5]. Moreover, the exposure to sun light in the Gulf areas is probably limited due to cultural reasons in the way of dressing (abaya) that hide the women's' body from head to toe [10].

The biological factors that contribute to low serum levels of vitamin D among the population in the region are identified. However, the barriers and challenges towards vitamin D deficiency are not fully understood and need further investigations [11,12]. Many research projects have highlighted the need for effective public health strategies that target vitamin D deficiency [13,14], for which identifying factors that affect persons' perceptions, attitudes, behaviors, and practices would be essential [15,4]. In a study that was conducted in eastern province of Saudi Arabia, it was found that there are generally unfavorable practices and negative attitudes towards Vitamin D deficiency. Another study has reported poor practices regarding vitamin D among female students [16], and similar findings were observed among adult females in Riyadh [17]. Such unfavorable practices would need to be addressed before implementing any successful program to prevent the health consequences of vitamin D deficiency [18].

Published literature shows that many studies have addressed the level of knowledge and awareness of vitamin D deficiency among different age and ethnic groups, including children, toddlers, adults, and elderly. However, little data exists on the attitudes and perceptions towards vitamin D deficiency. Thus, the aim of this study was to describe the attitudes, perceptions, and practices towards vitamin D deficiency in the adult population of Bahrain. Potential differences between adult men and women in the factors that affect the perception towards vitamin D are also explored.

STUDY METHODS

A cross-sectional study design was employed to conduct this research project. The respondents were adult men and women aged 18 years or older who were recruited from visitors to shopping malls in the four governorates of Bahrain (Capital, Southern, Northern, and Muharraq) in order to ensure geographical coverage of the study population. Those subjects who had communication or language difficulties were excluded from the study population. The size of this sample of convenience was estimated based on a 95% confidence interval for a mean correct score with 5.0 width and 15.0 standard deviation [19].

The study instrument was based on a previously tested and validated self-administered questionnaire on the attitude and practices towards vitamin D. The questionnaire was tested in many countries, including Arab populations. [20,21]**.**

The items in this questionnaire were grouped into four sections; the first section sought information on the participants' demographic characteristics, such as age, gender, residential area, and level of education. The second section asked participants questions on their knowledge about vitamin D (e.g., sources of vitamin D in diet, health benefits of vitamin D). The subjects' attitudes towards vitamin D were explored in the third section via asking participants, for example questions about their views on daily intake of vitamin D rich food items and how they perceive the importance of daily exposure to sun light. The final section attained information on the practice of the participants about vitamin D, such as if the persons were ever tested for vitamin D blood levels, how much time they daily spent in sunlight and if they consume vitamin D supplements in their dietary intake. A five- points Likert scale was used to measure the responses of the participants to the graded items in the questionnaire. A "zero" score was assigned to the incorrect answers and a score of "one" was given to the correct ones. The sum of the total scores were then calculated for each participant by dividing the total score obtained by the number of items.

An informed verbal consent was obtained from each participant after explaining to him/her the purpose of the study. Subjects were assured about their right to withdraw from the study at any stage if they felt they do not wish to continue. Data was analyzed collectively and not on an individual basis in order to ensure the anonymity and confidentiality of the participant identity.

After the study was completed, the questionnaires were coded and entered on a standard micro-computer data base. Statistical analysis was performed using the statistical software SPSS version 23. Frequency distribution tables, proportions, percentages and means with their standard deviations were produced to describe the socio-demographic characteristics of the participants. A cross-tabulation test (chi-squared) was employed in order to find out whether there were any significant relationships between the participants' attitudes and practices with their socio-demographic features. If the p-value was less than 0.05, it was considered statistically significant. Multiple logistic regression model was used to detect the independent socio-demographic characteristics for attitudes and practices of the subjects in the sample. The odds ratio (OR) was considered significant if the confidence interval (CI) did not include the value of one (1).

RESULTS

The study sample included 335 participants whose ages ranged from 18 to 60 years with a mean age of 32.6±11.5 years (Table 1). Two–thirds of the participants were females, 70% were citizens of Bahrain and most participants have attained a university degree or higher (67.2%) – Table 1. The participants were residents from cities in all the four governorates of Bahrain which ensures the geographical coverage of the sample.

Table 1: Socio-demographic characteristics of the study sample (n=335)

	Frequency	Percent
Age:		
<30	155	46.3
30-	144	43.0
50+	36	10.7
Range	13-77	
Mean±SD	32.6±11.5	
Median	30.0	
Gender:		
Male	108	32.2
Female	227	67.8
Nationality:		
Bahraini	234	69.9
Non-Bahraini	101	30.1
Education:		
Basic/Intermediate	110	32.8
University	198	59.1
Postgraduate	27	8.1
Governorate of residence:		
Capital	88	26.3
Southern	135	40.3
Northern	45	13.4
Muharaq	67	20.0

Table 2 shows that only one-third of subjects expose themselves to sun light. Over half of participants stated that they do not perceive risk from taking vitamin D fortified food items. However, only 12% of subjects tried to check for the vitamin D content label on the food items that they purchase. It is also interesting that while most participants (89%) are willing to consume vitamin D rich food items, only half of the subjects have ever undergone a vitamin D testing. This contrasting behavioral pattern towards vitamin D consumption is further emphasized in the data presented in Table 2 which reveals that while half of the participants have reported taking vitamin D supplements, 70% of respondents have based such a decision on physicians' instructions rather than their own personal initiative.

The relationship between the participants undergoing a vitamin D testing in the past and the socio-demographic features is presented in Table 3. It appears that having attained a university degree or higher levels of education (p value = 0.04) and having received information about the benefits of vitamin D intake (p value = 0.04) were significantly related to the participants decision to have a vitamin D testing in the past (Table 3).

Table 4 shows that taking any food supplements that contained vitamin D was significantly higher among those subjects with higher levels of education (p value = 0.04). Participants who have received prior information about vitamin D were also more likely to consume vitamin D supplements (80.2%) compared to those who did not have such prior knowledge (45.4%). However, there was no statistical difference in the practice of taking vitamin D supplements between males and females (p value = 0.18).

Table 2: Attitudes and behaviors related to Vitamin D among subjects in the study sample (n=335)

	Frequency	Percent
Sun exposure habits:		
Usually, direct sun	104	31.0
Usually, shade	170	50.7
Usually cover up	49	14.6
I do not go outside	12	3.6
Sun exposure habits:		
Direct sun	104	31.0
Indirect (shade)	170	50.7
None	61	18.2
Use of sunscreen:		
Never	111	33.1
Rarely	126	37.6
Often	53	15.8
Always	45	13.4
Look for Vit D label on purchased food:		
No	232	69.3
Yes	41	12.2
Yes, but do not understand	62	18.5
Attitude towards food fortified in Vit D:		
No risk	183	54.6
Uncertain	105	31.3
Risky	47	14.0
Willing to purchase and consume Vit D rich food:		
No	37	11.0
Yes	298	89.0
Ever undergone vitamin D testing:		
No	167	49.9
Yes	168	50.1
Frequency (n=168):		
Bi-monthly	8	4.8
Six-monthly	37	22.0
Yearly	18	10.7
As requested,	105	62.5
Ever taken vitamin D supplement:		
No	153	45.7
Yes	182	54.3
Prescribed by (n=182):		
Physician	129	70.9
Pharmacist	2	1.1
Lab technician	10	5.5
None	41	22.5

Table 3: Relationship between subjects' practice of Vitamin D testing and their demographic characteristics

	Had Vit D testing				x^2 test	p-value
	No		Yes			
	No.	%	No.	%		
Age:						
<30	78	50.3	77	49.7		
30-	69	47.9	75	52.1	0.70	0.71
50+	20	55.6	16	44.4		
Gender:						
Male	59	54.6	49	45.4		
Female	108	47.6	119	52.4	1.46	0.23
Nationality:						
Bahraini	114	48.7	120	51.3		
Non-Bahraini	53	52.5	48	47.5	0.40	0.53
Education:						
Basic/Intermediate	62	56.4	48	43.6		
University	97	49.0	101	51.0	6.34	0.04*
Postgraduate	8	29.6	19	70.4		
Governorate:						
Capital	37	42.0	51	58.0		
Southern	77	57.0	58	43.0	5.47	0.14
Northern	20	44.4	25	55.6		
Muharaq	33	49.3	34	50.7		
Received information about Vit D:						
No	12	75.0	4	25.0		
Yes	155	48.6	164	51.4	4.25	0.04*

(*) Statistically significant at p<0.05

Table 4: Relationship between subjects' Vitamin D supplement intake and their demographic characteristics

	Had Vit D supplement				x^2 test	p-value
	No		Yes			
	No.	%	No.	%		
Age:						
<30	71	45.8	84	54.2		
30-	65	45.1	79	54.9	0.05	0.97
50+	17	47.2	19	52.8		
Gender:						
Male	55	50.9	53	49.1		
Female	98	43.2	129	56.8	1.77	0.18
Nationality:						
Bahraini	101	43.2	133	56.8		
Non-Bahraini	52	51.5	49	48.5	1.97	0.16
Education:						
Basic/Intermediate	58	52.7	52	47.3		
University	88	44.4	110	55.6	6.57	0.04*
Postgraduate	7	25.9	20	74.1		
Governorate:						
Capital	33	37.5	55	62.5		
Southern	69	51.1	66	48.9	4.01	0.26
Northern	20	44.4	25	55.6		
Muharaq	31	46.3	36	53.7		
Received information about Vit D:						
No	11	68.8	5	31.3		
Yes	142	44.5	177	55.5	3.61	0.06

(*) Statistically significant at p<0.05

Table 5 demonstrates that intake of vitamin D fortified food items was significantly higher among females compared to their male counterpart (p value = 0.003). In line with the participants willingness to take vitamin D supplements, their practice to consume vitamin D fortified food items was also significantly associated with having had a prior information about vitamin D (p value = 0.02). However, such a decision to consume vitamin D fortified food items was not related to the participants' level of education (p value = 0.17).

Table 5: Relationship between subjects' willingness to consume Vitamin D fortified food and their characteristics

	Would consume vitamin D fortified food				x^2 test	p-value
	No		Yes			
	No.	%	No.	%		
Age:						
<30	16	10.3	139	89.7		
30-	13	9.0	131	91.0	5.26	0.07
50+	8	22.2	28	77.8		
Gender:						
Male	20	18.5	88	81.5		
Female	17	7.5	210	92.5	9.06	0.003*
Nationality:						
Bahraini	26	11.1	208	88.9		
Non-Bahraini	11	10.9	90	89.1	0.00	0.95
Education:						
Basic/Intermediate	15	13.6	95	86.4		
University	17	8.6	181	91.4	3.51	0.17
Postgraduate	5	18.5	22	81.5		
Governorate:						
Capital	7	8.0	81	92.0		
Southern	14	10.4	121	89.6	2.18	0.53
Northern	6	13.3	89	86.7		
Muharaq	10	14.9	57	85.1		
Received information about Vit D:						
No	5	31.3	11	68.8		
Yes	32	10.0	287	90.0	Fisher	0.02*

(*) Statistically significant at p<0.05

Surprisingly, none of the participants behavioral actions was significantly related to their knowledge scores about vitamin D. Neither the willingness to take vitamin D food rich items nor the consumptions of vitamin D supplements were related to the knowledge score of the subject – Table 6. A similar pattern was also observed for the decision of the participants to have a vitamin D testing in the past – Table 6.

The multiple logistic regression model demonstrates that a participants' initiative for having a vitamin D testing in the past was significantly related to their level of education (OR= 1.55; 95.0% CI 1.07 to 2.25) – Table 7.

In addition, the decision of the participants to have undergone a vitamin D testing in the past had highly significant impact on their current practice to consume vitamin D supplements as part of their daily dietary intake (OR= 131.82; 95.0% CI 56.92 to 305.28) – Table 8.

Table 9 demonstrates that female gender was the main significant demographic factor in the decision of a participants to consume vitamin D fortified food items compared to males, even after adjusting for all the other relevant socio-demographic factors in the logistic regression model (OR= 2.70; 95.0% CI 1.34 to 5.43).

Table 6: Relationship between subjects' knowledge scores and their attitudes and behaviors

	Knowledge score		Mann-Whitney Test	p-value
	Mean±SD	Median		
Sun exposure habits:				
Direct sun	8.7±3.7	8.50		
Indirect (shade)	8.9±4.0	9.00	H=0.32	0.85
None	8.6±3.6	8.00		
Use of sunscreen:				
Never	9.2±3.6	9.00		
Rarely	8.0±3.6	8.00	H=7.34	0.06
Often	8.8±4.1	9.00		
Always	9.7±4.3	9.00		
Look for Vit D label on purchased food:				
No	8.8±4.00	8.50		
Yes	8.7±3.2	9.00	H=0.01	1.00
Yes, but do not understand	8.8±3.5	9.00		
Attitude towards food fortified in Vit D:				
No risk	8.7±3.8	9.00		
Uncertain	8.4±3.8	8.00	H=3.83	0.15
Risky	9.7±3.9	9.00		
Willing to purchase and consume Vit D rich food:				
No	9.0±3.8	9.00		
Yes	8.7±3.8	9.00	0.20	0.66
Ever undergone vitamin D testing:				
No	8.5±3.6	8.00		
Yes	9.0±4.0	9.00	1.08	0.30
Ever taken vitamin D supplement:				
No	8.7±3.7	9.00		
Yes	8.8±3.9	8.50	0.00	0.95

(H) Kruskal Wallis test

Table 7: Best fitting multiple logistic regression model for having Vitamin D test

	Wald	Df	P	OR	95.0% CI for OR	
					Upper	Lower
Constant	5.237	1	.02	.19		
Education	5.400	1	.02	1.55	1.07	2.25
Nagelkerke R Square: 0.02						
Hosmer and Lemeshow Test: p=0.33						
Omnibus Tests of Model Coefficients: p<0.001						

Table 8: Best fitting multiple logistic regression model for having Vitamin D supplements

	Wald	Df	P	OR	95.0% CI for OR	
					Upper	Lower
Constant	67.923	1	.00	.15		
Previous testing	129.783	1	.00	131.82	56.92	305.28
Nagelkerke R Square: 0.74						
Hosmer and Lemeshow Test: p=0.993						
Omnibus Tests of Model Coefficients: p<0.001						

Table 9: Best fitting multiple logistic regression model for willingness to consume of Vitamin D fortified food items

	Wald	Df	P	OR	95.0% CI for OR	
					Upper	Lower
Constant	.099	1	.75	1.20		
Female gender	7.784	1	.01	2.70	1.34	5.43
Previous testing	4.346		.04	2.18	1.05	4.54
Nagelkerke R Square: 0.08						
Hosmer and Lemeshow Test: p=0.788						
Omnibus Tests of Model Coefficients: p<0.001						

DISCUSSION

The present study showed that the attitudes and perceptions of men and women in the Bahraini population with regards to the importance of vitamin D daily consumption and need for vitamin D blood level testing were generally disappointing. Further, most respondents were hesitant to take vitamin D blood testing.

One out of each eight subjects have attempted to check the vitamin D content of their consumed food items that they purchase although most of the subjects were willing to eat food items that are rich with vitamin D. Moreover, those persons who were consuming daily vitamin D supplements did not take this vitamin based on their own initiatives but rather on physicians' instructions. This finding is further emphasized by the fact that those subjects who had higher levels of education and those persons who received appropriate information about sources of vitamin D were more likely to go for vitamin D blood testing. These results are in line with the findings from other Arab communities [22]. This confused consumer practice towards intake of vitamin D rich food items and vitamin D supplements indicates the need to improve the public knowledge and awareness about the benefits of the intake of vitamin D and the health consequences of its deficiency.

Women were more likely to consume vitamin D fortified food items compared to men even after adjusting for all the other relevant socio-demographic factors. It has been reported that women who had never married had rather poor knowledge and attained lower attitude scores about vitamin supplementations compared to ever gravid women [23]. Thus, one plausible explanation for this observation is that women have better chances to obtain information about the importance of vitamin D intake for their health and wellbeing as they attend ante-natal and post-natal clinics during their childbearing age.

CONCLUSION

The apparent consumers unfavorable perceptions towards the intake of vitamin D fortified food items, consumption of vitamin D supplements and willingness to have vitamin D testing highlights the urgent need to implement effective strategies to solve the barriers and improve public practices towards vitamin D.

DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon request.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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None.

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