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ASSESSMENT OF THE AWARENESS LEVELS TOWARDS VITAMIN D CHECK, MEDICATION AND RELATED DISORDERS

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ABSTRACT: Background: Vitamin D deficiency and its associated disorders are prevalent in Saudi Arabia. This study aimed to assess the awareness levels towards vitamin D, check, medication, and related disorders. **Methodology:** In this cross-sectional study, a total of 500 Saudi volunteers living in the city of Hail (A region in Northern Saudi Arabia) and surrounding towns were included during the period from January 2020 to March 2020. **Results:** Out of the 500 participants, 295/500(59%) were found to complain from one or more VDD related conditions. Out of the 500 participants, only 214/500 (42.8%) experienced previous vitamin D testing. According to vitamin D testing results, 107/214 (50%) and 53/214 (24.8%) of the individuals did the test was found with vitamin D deficiency and vitamin D insufficiency, respectively. **Conclusion:** VDD is prevalent in Hail Region, Saudi Arabia, particularly among females. The scarcity of routine testing for vitamin D status resulted in multifarious VDD related disorders. Hail's population has a low awareness of vitamin D check, medication and related disorders.

INTRODUCTION: Vitamin D deficiency (VDD) is a major health problem afflicting over one billion people worldwide [1]. In numerous countries, the inadequate exposure to natural sunlight and the intake of foods with poor in vitamin D contents embodying most populations around the globe at risk of VDD [2]. Many diseases affecting humans are attributed to VDD. Multiple sclerosis, cardiovascular disease, hypertension, Parkinson's disease, Alzheimer's disease [3] and osteoporotic fractures [4], *etc*.

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Vitamin D as a guardian of phenotypic stability through conserving the redox and Ca (2+) signaling systems. Vitamin D insufficiency results in a weakening in the stability of this regulatory signaling linkage, including a dysregulation in both reactive oxygen species (ROS) and Ca (2+) signaling. This is supposed to be responsible for numerous diseases [3]. The vitamin D3 metabolite 1α, 25-dihydroxy vitamin D3 (1, 25 $(OH)_2$ D3), which activates Vitamin D receptor (VDR).

VDR, besides its control of cellular metabolism, modulates mechanisms essential for immunity, including anti-microbial defense and the initiation of T cell tolerance [5]. Low vitamin D is considered when the serum level is below 30ng/ml. Low vitamin D can be categorized into insufficient vitamin D (in the range of 21-29 ng/mL) and VDD (serum vitamin D below 21 ng/mL) [6].

VDD is prevalent in Saudi Arabia, particularly among women. The prevalence of VDD is reported to be over 80% in Saudi Arabia [7, 8]. Diverse efforts are urgently needed to implement appropriate strategies to reduce the burden of VDD consequences in Saudi Arabia. Consequently, this study aimed to assess the awareness levels towards vitamin D, check, medication, and related disorders.

MATERIALS AND METHOD: In this cross-sectional study, a total of 500 Saudi volunteers living in the city of Hail (A region in Northern Saudi Arabia) and surrounding towns were included during the period from January 2020 to March 2020. Data were obtained from the general Saudi population. Adults aged 15 years or older were randomly selected regardless of gender, occupation, or marital status. A purposeful questionnaire was thoughtfully deliberated and used to collect the data. Each participant was interviewed to fulfill the variables including age, gender, symptoms of vitamin D deficiency, level of vitamin D (vitamin D deficiency defined as vitamin D level less than 20 ng/ml), treatment, and impact of vitamin D on the body and relation to diseases.

Ethical Consent: Ethical approval for this study was obtained from the ethical committee of the College of Medicine, University of Hail. All measures included in the current study comply with ethical standards of the 1964 Helsinki declaration, as well as its related subsequent modifications. Ethical approval number: HREC 00113/CM-UOH.04/20

Statistical Analysis: Data was entered a computer software SPSS. Frequencies, percentages, and statistical values considering 95% confidence interval were calculated. The Chi-square test was calculated, P-value less than 0.05 considered statistically significant.

RESULTS: Out of 500 Saudi volunteers investigated 207 (41.4%) were males, and 293 (58.6%) were females, ages 15-67 years old with a mean ± STD age of 29 ±10.5 years. The bulk of the participants were at age group 19-24 years followed by 25-34 and 35-44 years, representing 187/500 (37.4%), 131/500 (26.2%), and 82/500(16.4%), in this order. Males and females have relatively similar age distribution with elevation in the upper mentioned groups, as indicated in **Table 1** and **Fig. 1**. The majority of the study subjects were students followed by employees and self-employed constituting 219/500 (43.8%), 176/500 (35.2%), and 86/500 (17.2%), respectively. These occupations were similarly escalating in males and females groups, as indicated in **Table 1**, **Fig. 1**. **Table 2** and **Fig. 2**, summarized the distribution of the study population VDD symptoms and estimated values. Out of the 500 participants, 295/500(59%) were found to complain from one or more VDD related conditions. The most-reported condition was tiredness, followed by bone pain and muscle pain constituting 66/295 (22.4%), 52/295 (17.6%), and 28/295 (9.5%), correspondingly. Most males were suffering from bone pain 33/99 (33.3%) followed by tiredness 28/99 (28.3%). Most females were tiredness 38/196 (19.4%) followed by bone pain 29/196 (14.8%). The risk of VDD related disorders was more common among women compared to men, the relative risk (RR) and 95% confidence interval (95% CI), RR (95% CI) = 1.3987 (1.1877 to 1.6472), P = 0.0001, as indicated in **Table 2**, **Fig. 2**.

TABLE 1: STUDY POPULATION BY DEMOGRAPHICAL CHARACTERISTICS

Category	Variable	Males	Females	Total
	Age			
	≤18years	25	19	44
	19-24	87	100	187
	25-34	51	80	131
	35-44	26	56	82
	≥45	18	38	56
	Total	207	293	500
	Occupation			
	Self-employed	12	74	86
	Students	103	116	219
	Employees	85	91	176
	Retired	7	12	19
	Total	207	293	500

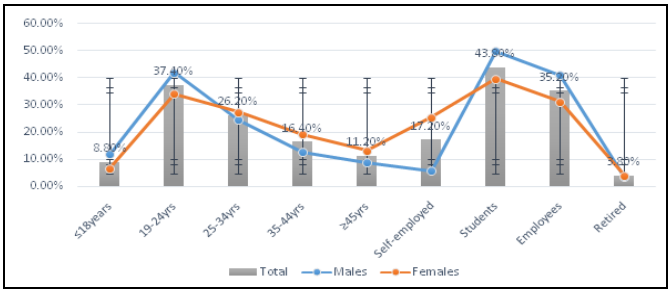

FIG. 1: PROPORTIONS OF THE STUDY SUBJECTS BY DEMOGRAPHICAL CHARACTERISTICS

Out of the 500 participants, only 214/500 (42.8%) experienced previous vitamin D testing (72/207 (34.8%) were males, and 142/293 (48.5%) were females. Women were mutually doing testing compared to men, and this was found to be statistically significant (P = 0.0032), as indicated in **Table 2**, **Fig. 2.** According to vitamin D testing results, 107/214 (50%) and 53/2014(24.8%) of the individuals did the test was found with vitamin D and vitamin D insufficiency, respectively. Out of 160 persons with low vitamin D, 54/160 (33.8%) were males, and 106/160 (66.2%) were females. The risk of low vitamin D among women, RR (95% CI) was 1.3868 (1.0532 to 1.8261), P = 0.0198, as indicated in **Table 2**, **Fig. 2**. About 68/500(13.6%) of the study subjects have reported as having a chronic disease with the most frequent being hypertension 48/68(70.6%), as indicated in **Table 2**, **Fig. 2**.

TABLE 2: STUDY POPULATION BY VDD SYMPTOMS AND ESTIMATED VALUES

Category	Variable	Males (N=207)	Females (N=293)	Total (N=500)
Do you suffer from any of the following symptoms?				
	Bone pain	33	29	52
	Muscle pain	12	16	28
	Depression	13	10	23
	Tiredness	28	38	66
	Miscellaneous symptoms	23	103	126
	No symptoms	108	97	205
Have you been tested for vitamin D levels?				
	Yes	72	142	214
	No	116	143	259
	Don’t know	19	8	27
If you test it, what was the vitamin D level: (ng/ml)				
	0- <20 (deficiency	35	72	107
	20-30 insufficiency	19	34	53
	31-90 normal	9	22	31
	>150 toxicity	1	0	1
	Don’t remember	39	22	61
	never tested it	104	143	247
Were you diagnosed with one of these diseases				
	Bone deformity	5	5	10
	Hypertension	18	30	48
	Multiple sclerosis	3	4	7
	CVD	0	3	3
	Never have chronic disease	181	251	432

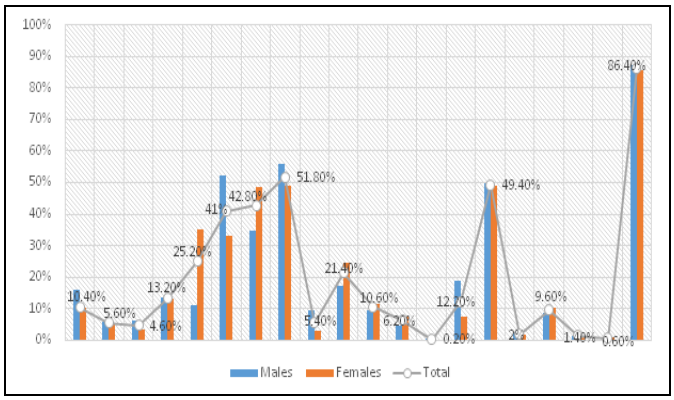

FIG. 2: VITAMIN D DEFICIENCY SYMPTOMS AND ESTIMATED VALUES

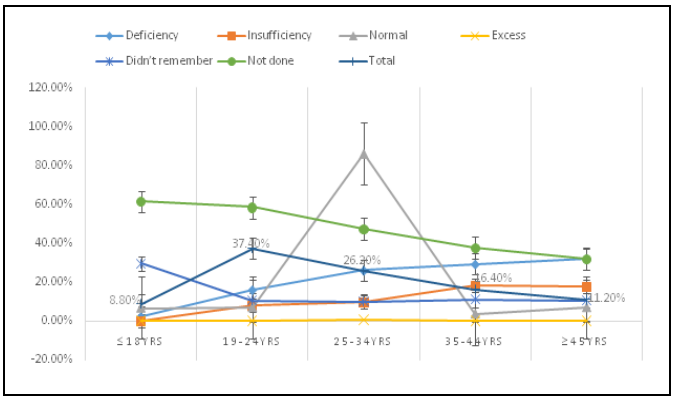

FIG. 3: DESCRIPTION OF THE STUDY POPULATION BY VITAMIN DSTATUS WITHIN ENTIRE AGE GROUPS

Table 3 summarizes the distribution of the study population by vitamin D treatment status. About 190/500 (38%) denoted a previous intake of vitamin D therapy 64/207 (31%) were males, and 126/293 (43%) were females). Out of 190 persons, 37/190 (19.5%) have taken the medication without a prescription. Subsequent maintenance dose of vitamin D was received by 74/190 (39%)

individuals, most of them were females. The distribution of the study population by follow up after treatment of vitamin D related disorders was summarized in **Table 4**. Out of the 190 patients underwent vitamin D treatment, 69/190 (36.3%) did subsequent vitamin D check test. About 118/190 (62%) experienced musculoskeletal symptoms improvement after the treatment course. Approximately 66/190 (34.7%) of the treated patients developed vitamin D levels declining following quitting of the treatment. Concerning, the distribution of the study population by vitamin D status and age VDD and /or insufficiency status was proportionally increasing with the increase of age, as indicated in **Table 5**, **Fig. 3**. Concerning occupation, low vitamin D levels were observed among employees followed by students, representing 82/160 (51.3%) and 42/160 (26.3%), respectively (see **Table 6.**). However, when calculating the percentage within the entire occupation, the values changes, as shown in **Fig. 4**.

TABLE 3: STUDY POPULATION BY VITAMIN D TREATMENT STATUS

Category	Variable	Males (N=207)	Females (N=293)	Total (N=500)
Did you receive vitamin D treatment before?				
	Yes	64	126	190
	No	128	164	292
	Don't know	15	3	18
Who gave you vitamin D treatment?				
	Doctor's prescription	54	106	160
	Pharmacist without prescription	13	24	37
	Didn't take medication	140	163	303
Did you receive the loading dose of vitamin D treatment?				
	Yes	16	36	52
	No	147	212	359
	Don't know	44	45	89
Did you receive the maintenance dose of vitamin D treatment?				
	Yes	21	53	74
	No	146	200	346
	Don't know	40	40	80

TABLE 4: STUDY POPULATION BY FOLLOW UP AFTER-TREATMENT OF VITAMIN D RELATED DISORDERS

Category	Variable	Males (N=207)	Females (N=293)	Total (N=500)
Did you check the level of vitamin D after treatment?				
	Yes	18	51	69
	No	47	74	121
	Don't know	7	11	18
	Didn't take treatment	135	157	292
Did your musculoskeletal symptoms improve after the treatment course?				
	Yes	42	76	118
	No	10	36	46
	Don't know	18	22	40
	Didn't take treatment	137	159	296
Did you notice that the level of vitamin D dropped again after stopping treatment?				
	Yes	17	49	66
	No	18	28	44
	Don't know	37	59	96
	Didn't take treatment	135	159	294

TABLE 5: STUDY POPULATION BY VITAMIN D STATUS AND AGE

Vitamin D Status	≤18 years	19-24	25-34	35-44	≥45	Total
Deficiency	1	30	34	24	18	107
Insufficiency	0	15	13	15	10	53
Normal	3	13	8	3	4	31
Excess	0	0	1	0	0	1
Didn't remember	13	20	13	9	6	61
Not done	27	109	62	31	18	247
Total	44	187	131	82	56	500

TABLE 6: STUDY POPULATION BY VITAMIN D STATUS AND OCCUPATION

Vitamin D Status	Self-employed	Students	Employees	Retired	Total
Deficiency	21	27	54	5	107
Insufficiency	4	15	28	6	53
Normal	6	16	9	0	31
Excess	0	0	1	0	1
Didn't remember	11	29	21	0	61
Not done	44	132	63	8	247
Total	86	219	176	19	500

FIG. 4: DESCRIPTION OF THE STUDY POPULATION BY VITAMIN D STATUS WITHIN THE ENTIRE OCCUPATION

DISCUSSION: VDD represents a major health problem in Saudi Arabia, particularly among women. The present study was showing that 59% of study subjects were complaining from VDD related symptoms with a significant increase among females (RR (95% CI) = 1.3987 (1.1877 to 1.6472), P = 0.0001). Moreover, only 42.8% of these patients did vitamin D investigation. These percentages were far less than reported values from Saudi Arabia, which might be attributed to the presence of asymptomatic individuals in this study. A Saudi study has reported a VDD prevalence of 83.6% (31.9% severe, 32.0% moderate, and 19.7% mild) [9].

Another systemic review showed a VDD prevalence of 81% among all Saudi population settings (newborns, children, adults, newborns, and pregnant/lactating women) [10]. However, studies reported VDD among populations with the specific condition had indicated much less prevalence rates. A study reported a VDD prevalence of 60.8% among Saudi patients with type 2 diabetes mellitus [11]. Another study has reported a VDD prevalence of 60.2% among Saudi women [7]. The decreased rates of testing for VDD might be attributed to the lack of routine VDD testing required by health practitioners. The significant increase of testing among women (P = 0.0032) was in line with the predominant of VDD among females equated to males. VDD and vitamin D insufficiency were reported in 50% and 43.8% of group pregnant Saudi ladies [12]. This was relatively similar to the findings in the current study; 50% and 24.8% were found with VDD and vitamin D insufficiency, respectively. Another study reported VDD (25(OH) D < 20 ng/mL) in 60.2% of studied Saudi women [7]. In the present study, the risk of low vitamin D among women, RR (95% CI) was 1.3868 (1.0532 to 1.8261), P = 0.0198. In many countries, particularly Arabian states, women have less outdoor activities. Due to sociocultural restrictions on female physical activities, Saudi woman has the least level of physical activity compared to other Arabian countries [13]. As it was well established that VDD is associated with several chronic diseases [14], approximately 13.6% of the participants in the present study were found with chronic diseases, with hypertension being the most prevalent. Such an assumption was previously reported [15].

In this study, about 38% denoted a previous intake of vitamin D therapy (31% males *vs.* 43% females). Although the prevalence rates of VDD (≥67.5%) and vitamin D insufficiency (≥21%) are high in Saudi Arabia [16], there is no available literature on the prevalence rates of vitamin D supplementation in the country [17]. However, a high percentage of patients with VDD related symptoms reported improvement. Therefore, some studies have called for widespread recommendations for routine testing and vitamin D supplementation in Saudi Arabia among healthcare practitioners. Deficiencies related to factors such as sunlight exposure and nutrients intake should be encountered when assessing patients in Saudi Arabia [18]. The present study was showing that VDD was more prevalent among the older population, which might be attributed to their relatively low outdoor activities. Moreover, the majority of those with VDD were employees, as this occupation frequently the indoor activity in most

settings. The limitation of the present study includes its cross-sectional design and lack of some quantitative measures, though it provided an essential set of information useful for health policymakers and health practitioners.

CONCLUSION: VDD is prevalent in Hail Region, Saudi Arabia, particularly among females. The scarcity of routine testing for vitamin D status resulted in multifarious VDD related disorders. Hail's population has a low awareness of vitamin D check, medication, and related disorders. Vitamin D testing should be applied as a routine in primary health centers. Rising of population awareness toward VDD is highly recommended in Hail Region.

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