Study of Vitamin D Deficiency among the Elderly; Insights from Qatar

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Investigators

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Background:

- Vitamin D (VitD)

An important role in normal physiological function and is essential for bone mineralization[1-3].

- Vit D deficiency
  - Its association with cardiovascular disease,cancer and mortality [4-6].
  - Poor muscular, physical and cognitive physical performance as well as falls and fractures [7].
- The present study was designed to assess the prevalence of Vit D deficiency and the associated risk factors among a geriatric population in Qatar.

Objective:

- To determine the prevalence of Vitamin D deficiency among the elderly **Q**atar population.
- To elucidate whether low serum levels of 25-hydroxyvitamin D [25(OH)D] were association with an increased risk on advanced age and age related disorders.
- To assess the effect on HbA1c and Lipids.

Study setting:

All patients seen in geriatrics facilities including

- Rumailah hospital (out- and in-patients)
- Skilled nursing facility (SNF), and
- Home healthcare services (HHCS) under Hamad Medical Corporation

Inclusion criteria: who provided their serum total 25-hydroxyvitamin D [25(OH)D] levels was measured.

Participants:

- A total of 889 patients were enrolled in the study from April 2010 to April 2012

Design:

- We conducted retrospective study for elderly patients (≥65 years).

Measures:

- We developed a data-extraction tool that included information pertaining to demographics, body mass index, routine blood investigations, calcium, phosphorus, parathyroid hormone and thyroid stimulating hormone (TSH), comorbidities identified at admission, medications, serum 25(OH)D level, Vit D supplementation and outcome.
- Patients were followed up after 6 months for re-evaluation of Vit D levels and all-cause mortality.

Statistical Methods:

- The continuous variables were analyzed using student t test or one-way ANOVA wherever applicable.
- For skewed continuous data, a non-parametric Mann-Whitney test was used.
- Categorical variables between groups were compared using the chi-square test.
- We evaluated the associations between VitD deficiency and socio-demographic and clinical indicators.

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- We also studied correlation between Age, Glycoselated Haemoglobin ($HbA_{1c)}$, High density lipoprotein-cholesterol and VitD levels using Pearson's correlation method.

- A 2-tailed $P < 0.05$ was considered significant.

- All data analyses were carried out using the Statistical Package for Social Sciences version 18 (SPSS Inc. USA).

- The Medical Research Center at Hamad Medical Corporation, Qatar provided the ethics approval to conduct the study (IRB# 12122).

Results:

- A total of 889 patients were enrolled in the study with a mean age of 74.9 ± 8.7 years.

- The majority of patients were females (66%) and 77% were Qataris.

- Patients were mainly diagnosed with hypertension (76.5%), diabetes mellitus (63.2%), dyslipidemia, (47.5%), dementia (26.25%), coronary artery disease (23.65%) and cerebrovascular accident(24.4%) **(Table 1).**

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- At baseline, the mean serum Vit D level was 24.4±13.5 ng/ml.
- Majority of patients (72%) had Vit D deficiency [mild (31.4%), moderate (29.6%), and severe (10.8%)] **(Table 1).**
- Oral Vit D supplementation was prescribed for 33.5% patients.
- Follow-up Vit D level (after 6 months) was available in 325 cases; the serum VitD changed to 28.5±13.4; (P value is 0.001).

Table 1: Demographics, clinical presentation and outcome in geriatric patients (n = 889)

Age (years)*	74.9±8.7	**Overall Vitamin D levels***	24.4±13.5
Female	589 (66.3%)	Optimal	175 (28.2%)
Unit		Mild deficiency	195 (31.4%)
Home Care	421 (59.3%)	Moderate Deficiency	184 (29.6%)
Out Patient	283 (31.8%)	Severe Deficiency	67 (10.8%)
In-patient	64 (7.2%)	**Medication**	
Nationality		Multi Vitamin	147 (16.5%)
Qatari	655 (76.6%)	Proton Pump Inhibitors	304 (34.2%)
Non-Qatari	200 (23.4%)	Vitamin D 50000 International Unit (orally)	298 (33.5%)
Marital Status		Calcium supplement	79 (8.9%)
Married	473 (60.1%)	Combined Fosamax + Vit. D	7 (0.8%)
Non-married	314 (39.9%)	Calcium + Vit. D	2 (0.2%)
Diagnosis		**Baseline**	
Hypertension	680 (76.5%)	Vitamin-D (International Unit)*	24.4±13.5
Diabetes Mellitus (Type II)	562 (63.2%)	Calcium (mmol/L)*	2.3±0.14
Dyslipidemia	422 (47.5%)	Phosphorus (mmol/L) *	1.17±0.29
Cerebrovascular Accident	217 (24.4%)	Parathyroid hormone (pmol/L)**	65 (4-625)
Dementia	233 (26.2%)	**Follow-up**	
Coronary Artery Disease	210 (23.6%)	Vitamin-D (ng/ml)*	28.5±13.4
Hypothyroidism	110 (12.4%)	Calcium (mmol/L)*	2.28±0.2
Heart Failure	37 (4.2%)	Phosphorus (mmol/L)*	1.19±0.3
Renal dysfunction	99 (11.1%)	Parathyroid hormone(pmol/L)**	85 (4-848)
Fracture	32 (3.6%)	**Mortality**	11 (1.2%)

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- The mean blood glucose level was significantly higher in the severe VitD deficiency group compared with the optimal group (9.5±5 vs. 7.2±3.2 ng/ml; P = 0.005). (**Table 3**).
- Similarly, more patients in the severe group had increased HbA_{1c} level compared with patients with optimal VitD levels (8.0±1.9 vs. 7.0±1.5 ; P= 0.03).
- Patients with severe VitD deficiency also had lower mean HDL-C level than those with optimal VitD levels (1.1±0.4 vs. 1.4±0.9 ng/ml; P = 0.04).

Table 2: Comparison of qualitative variables according to vitamin D levels (VDL)

	Vitamin D Deficiency				P
	Optimal VDL (n = 175)	**Mild (n = 195)**	**Moderate (n = 184)**	**Severe (n = 67)**	
Gender					
Female	126 (72.0%)	137 (70.3%)	126 (68.5%)	47 (70%)	0.912
Male	49 (28%)	58 (29.7%)	58 (31.5%)	20 (30%)	
Unit					
HHS	66 (42.0%)	91 (54.2%)	102 (68.0%)	49 (87.5%)	0.001
Out Patient	67 (42.7%)	55 (32.7%)	34 (22.7%)	5 (9.4%)	
In-patient	24 (15.3%)	22 (13.1%)	14 (9.3%)	2 (3.6%)	
Nationality					
Qatari	135 (79.4%)	146 (77.2%)	133 (75.6%)	49 (76.6%)	0.354
Non-Qatari	35 (20.6%)	43 (22.8%)	43 (24.4%)	15 (23.4%)	
Marital Status					
Married	104 (69.8%)	88 (52.0%)	89 (54.0%)	28 (43.8%)	0.008
Non-married	45 (30.2%)	81 (48.0%)	76 (46.0%)	36 (56.2%)	
Diagnosis (on-admission)					
Diabetes Mellitus	107 (61.1%)	128 (65.6%)	124 (67.4%)	46 (68.7%)	0.566
Hypertension	135 (77.1%)	159 (81.5%)	148 (80.4%)	47 (70.1%)	0.217
Dementia	43 (24.6%)	60 (30.8%)	44 (23.9%)	16 (23.9%)	0.388
Coronary Artery Disease	37 (21.1%)	36 (18.6%)	49 (26.6%)	22 (32.8%)	0.055
Heart Failure	7 (4.0%)	7 (3.6%)	11 (6.0%)	3 (4.5%)	0.703
Dyslipidemia	85 (48.6%)	97 (49.7%)	95 (51.6%)	31 (46.3%)	0.879
Renal Dysfunction	24 (13.7%)	15 (2.4%)	31 (5%)	10 (1.6%)	0.055
Cerebrevascular Accident	46 (26.3%)	50 (25.6%)	47 (25.5%)	18 (26.9%)	0.996
Hypothyroidism	26 (14.9%)	33 (16.98%)	25 (13.6%)	11 (16.4%)	0.824

Table 3: Comparison of quantitative variables according to vitamin D levels (VDL)

		Vitamin D Deficiency			P
Baseline	**Optimal VDL (n=175)**	**Mild (n=195)**	**Moderate (n=184)**	**Severe (n=67)**	
Age (years)	74±8.4	75.3±8.3	74.8±7.6	75.5±9.8	0.462
Body Mass Index	24.7±5.7	23.1±5.2	26.7±6.5	27.2±7.4	0.263
Vitamin-D (ng/ml)	41.2±11.5	24.6±2.9	14.9±2.9	6.5±1.9	0.001
Calcium (mmol/L)	2.3±0.14	2.28±0.12	2.29±0.15	2.26±0.13	0.307
Cholesterol (mmol/L)	4.3±0.9	4.4±0.96	4.5±1.2	4.5±1	0.464
Triglycerides (mmol/L)	1.28±0.65	1.38±1.1	1.45±0.7	1.53±0.9	0.304
TSH (mIU/L)	2.2±1.6	3.9±8.9	3.8±10.2	7.1±17.8	0.081
ALP (IU/L)	82.4±45.1	89.6±57.8	99.3±63.4	105±84	0.049
Glucose (mmol/L)	7.2±3.2	7.7±3.7	8.2±5.1	9.5±5	0.005
HbA_{1c} (%)	7.05±1.5	7.3±1.4	7.2±1.8	8±1.9	0.034
LDL (mmol/L)	2.5±0.73	2.6±0.8	2.7±1	2.8±0.8	0.133
eGFR (ml/minute)	55.3±8.5	47.9±18.1	56.1±6.7	50±17.3	0.432
T4 (ng/L)	18±17.5	16±6.8	13.6±2	12.9±2.8	0.381
Phosphorus (mmol/L)	1.17±0.2	1.2±0.4	1.15±0.3	1.05±0.27	0.118
Parathormone (pmol/L)	96.8±124.3	108.5±105.3	161±164	130.2±104.7	0.212
Hemoglobin (g/dl)	12.1±1.6	12±1.8	12.1±1.9	12.07±1.7	0.959
HDL-C (mmol/L)	1.4±0.9	1.3±0.3	1.2±0.4	1.1±0.4	0.040
Ejection Fraction (%)	51.9±11.4	54.4±5.5	53.4±9.6	52.8±8.2	0.916
Albumin (mmol/L)	38.4±6.1	38.5±4.5	38.2±9.9	36.7±5.2	0.344
Follow-up					
Vitamin-D(ng/ml) (2) International Unit)	38.2±15.9	26.9±9.4	25.6±11.5	22.3±13.8	0.001

Figure 1: Correlation between HDL-C and vitamin D levels in geriatric patients

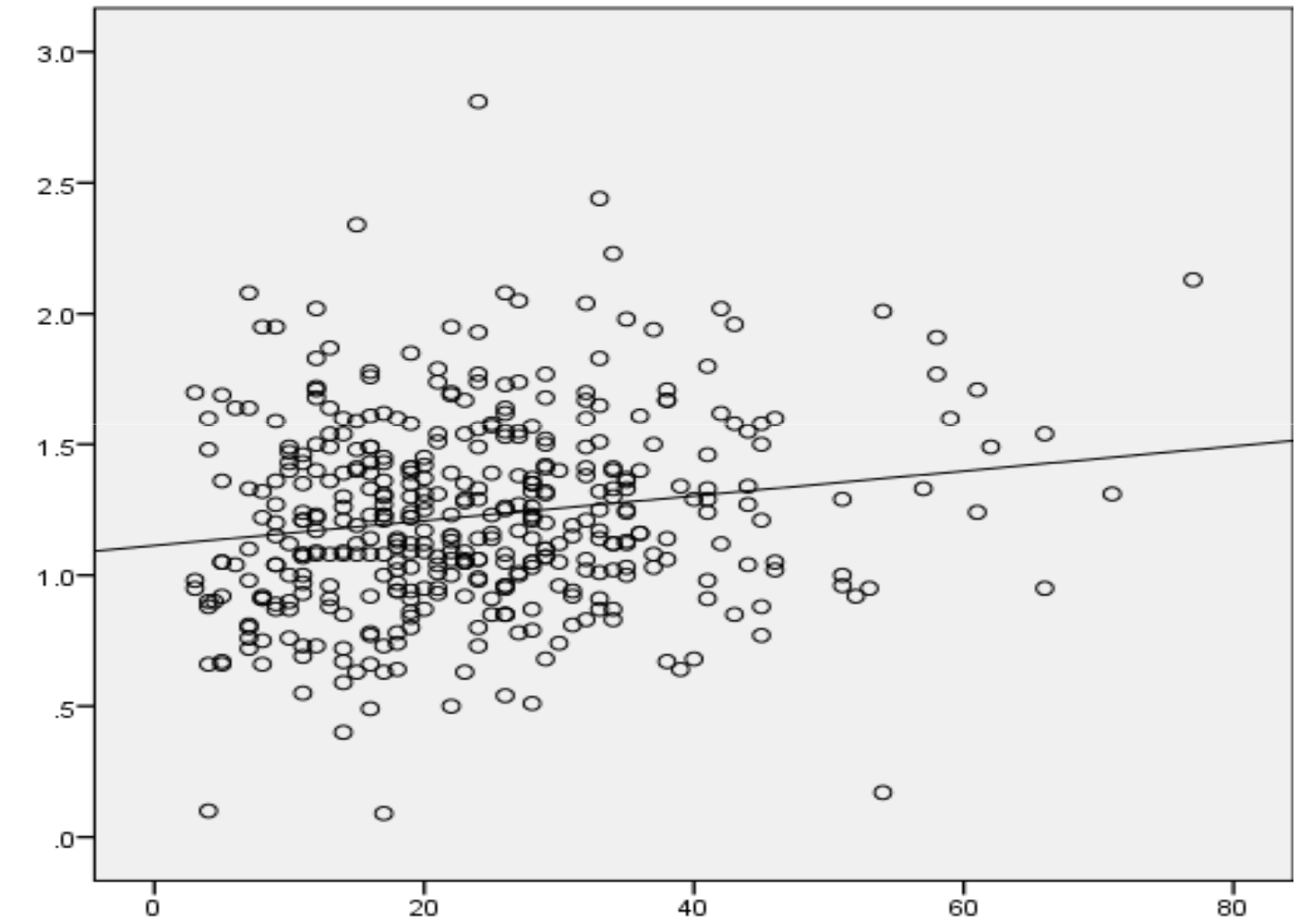
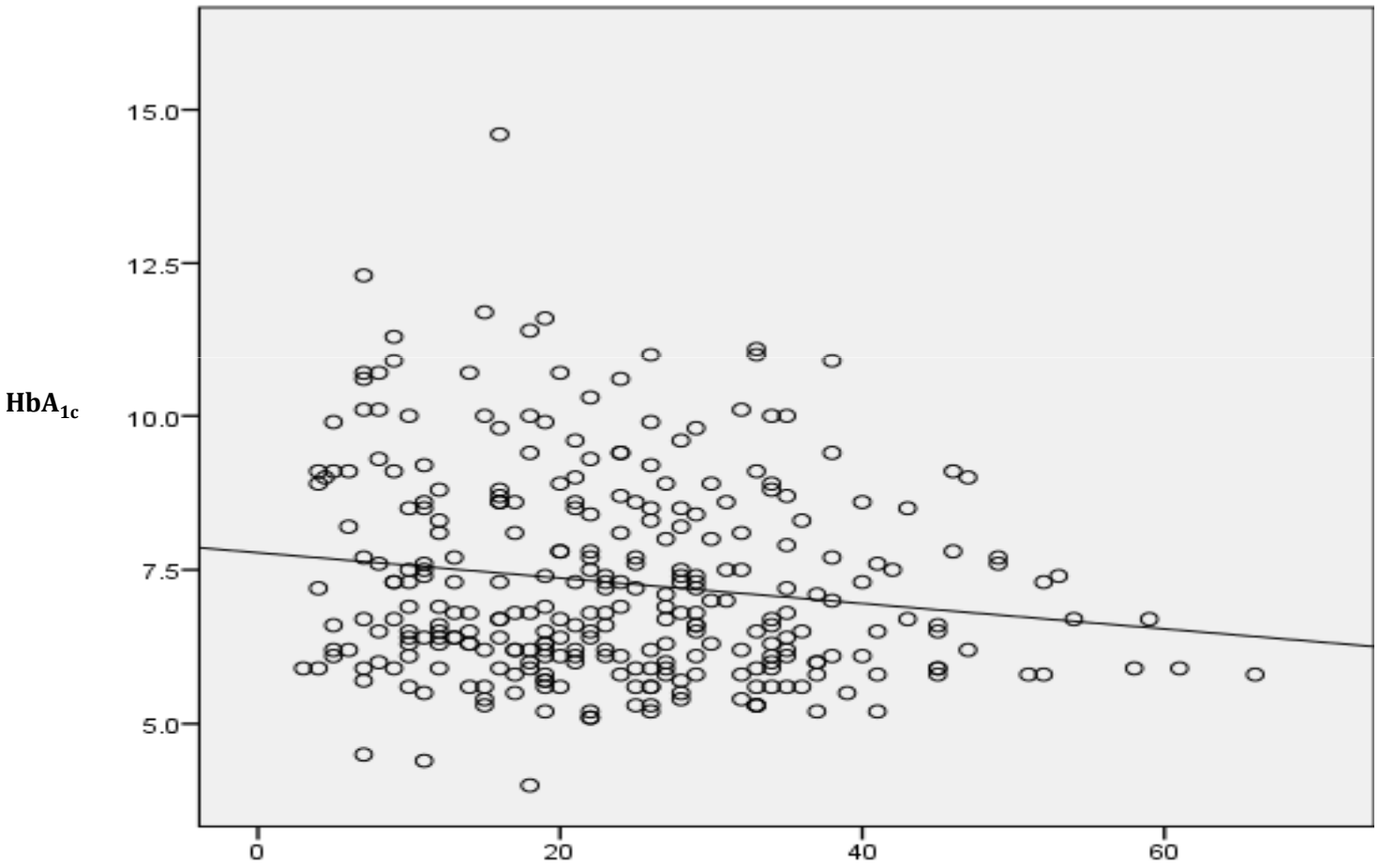


Figure 2: Correlation between HbA_{1c} and vitamin D levels in geriatric patients



Discussion

Discussion

- A high prevalence of VitD deficiency has been reported among the young in Qatar, which could be related to lifestyle and socio-cultural practices [10].
- This is a unique study from our region that addresses the influence of age, diabetic status, and hyperlipidaemia on Vit D among a geriatric population.
- The present study shows a high prevalence of Vit D deficiency (71.8%) among the elderly in Qatar, which might be explained by limited sunlight exposure with increasing age, usually due to sedentary lifestyle, clothing, extreme summers and minimal outdoor activity.

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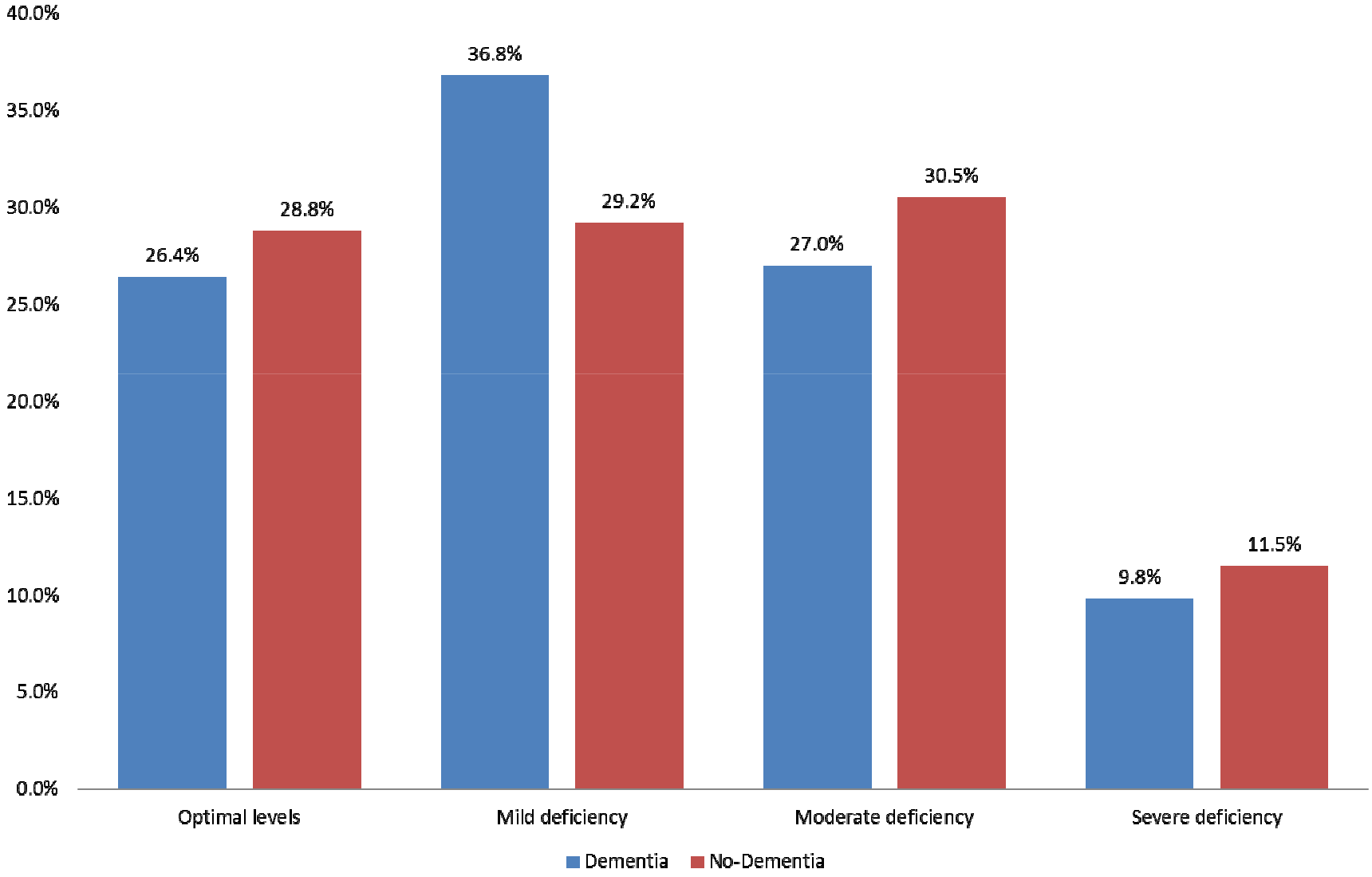
- In the present study, markers of T2DM (high fasting blood glucose levels and raised HbA_{1c}) had a negative correlation with levels of circulating vitamin D3.
- It has been observed that significantly higher levels of blood glucose ($P = 0.005$) and HbA_{1c} ($P = 0.03$) were associated with severe VitD deficiency.
- Fraser et al [16]; found a positive association between HDL-C and 25(OH)D levels.
- In this study, HDL-C level and Vit D deficiency had significant inverse relationship, as patients with lower level of HDL-C had severe Vit D deficiency.
- LDL-C and triglyceride were non-significantly higher in patients with severe Vit D deficiency compared with those with optimal levels.

Dementia and Vitamin D:

- This study contributes to the mounting data suggesting a relationship between 25(OH)D levels and advanced vascular dementia
- Out of 889 patients, 233(26.2%) patients with advanced vascular dementia enrolled in this study didn't show any relationship with severe Vit D deficiency; P value = 0.39 (**Figure 3**).
- However it has been retrospectively difficult to evaluate the relationship between Vascular Dementia related cognitive change and vit D deficiency because of many potential confounders, different tests used for measuring cognition by various neurologist and improper documentation of modified mini mental examination(MMSE)in the file.

Figure 3: Correlation between Dementia and vitamin D levels



Limitation of our study:

- Cause-specific mortality as well as on Vit D supplementation during follow-up were not available.
- We have not taken into consideration the influence of seasons in our analyses.
- The retrospective nature of the study is another limitation.
- Despite these limitations, our study with a large sample size represents the geriatric population of our region. The present study gives an insight into the prevalence of VitD deficiency and its associated factors among the elderly in Qatar.

Conclusion:

- A high incidence of Vit D deficiency was observed in the elderly.
- Lower serum Vit D level were inversely correlated with HbA_{1c} and HDL-C levels.
- The follow-up showed significant improvement in Vit D level after Vit D supplementation. Therefore, further intervention studies are warranted to evaluate whether Vit D supplementation improves low HDL-C levels and/or glycaemic control in T2DM .
- Prospective study is require to evaluate the relationship between Dementia related cognitive changes and vit D deficiency.

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THANK YOU