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Prevalence of Vitamin D Deficiency and the Association between Vitamin D and Waist Circumference and the Framingham Risk Stratifications

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Abstract Over the past decade, numerous non-skeletal diseases have been reported to be associated with vitamin D deficiency including coronary artery disease (CAD). CAD is a major public health problem worldwide. The aim of this study is to determine the prevalence of vitamin D deficiency and CAD among male University populations. 125 patients attending the Taif University Outpatient Clinic (TUOC) aged 20-63 years were included. Body weight, height, blood pressure, and waist circumferences (WC) were measured. Laboratory data including; total cholesterol (TC), triglycerides (TG), high and low density lipoproteins (HDL, LDL), fasting blood glucose (FBG), high sensitivity C reactive protein (CRP) and vitamin D were done. Framingham risk score (FRS) was calculated. 70.3% of the screened patients had vitamin D level < 20 ng/dl. The mean calculated FRS is 3.53. The mean age of 35.35±11.75 years, mean weight of 81.2±16.3 kg, mean body mass index (BMI) of 28.1±5.3 kg/m^2, mean WC 94.9±21.5 cm, mean systolic blood pressure (SBP) of 131.6±14.2 mmHg, and mean diastolic blood pressure (DBP) of 75.8±9.9 mmHg. 7.2 % have hyperlipidemia, 6.4% have hypertension (HTN), 9.6% of the patients were type 2 diabetics (T2D) and 32.4% report family history of T2D. A significant positive correlation between FRS and age (r=0.6124), WC (r= 1998), DBP (r=0.2281), FBG (r= 0.3315), TC level (r=0.3814), TG level (r=0.4079), LDL level (r=0.2240), Non HDL level (r=0.3923) with a significant negative correlation between FRS and vitamin D level (r= -0.9473), HDL (r= -0.0091) and CRP (r= -0.0910). The overall prevalence of vitamin D insufficiency was high. There was no difference between the low and the optimal vitamin D groups. Wide screen program for early detection of vitamin D deficiency among University population both male and female and application of WC in detection of overweight/obesity and early detection of person of high CAD is recommended with application of intervention and educational programs for those at higher risk. A future wide scale study is needed to confirm our findings.

Keywords: *vitamin D, waist circumference, coronary artery disease, Framingham risk scores*

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1. Introduction

Vitamin D in its active form, 1,25-(OH)2 is a lipophilic molecule essential to calcium and phosphate balance and osteo-metabolic system regulation. Vitamin D comes from diet and dietary supplements as well as synthesized endogenously from 7-dehydrocholesterol following exposure to ultraviolet, then it is metabolized to its active 1,25 (OH)2 form through two consecutive hydroxylations exerted by kidney and liver, respectively [1]. Vitamin D has been reported to control over 200 genes in a direct or indirect way as genes regulating angiogenesis, apoptosis, cell growth, proliferation and differentiation [2], reducing cell proliferation and inducing terminal differentiation [2,4]. The main dietary source of vitamin D is fatty ocean fish and other marine foods. In area at high latitude, very little pre-vitamin D is formed during the winter months [4].

It is estimated that one billion people worldwide are vitamin D deficient or insufficient [5]. In the adult population, the prevalence of hypovitaminosis D is from 5% to 30%, but it reaches a peak of 75% in patients with metabolic syndrome (MS) [6]. Older populations have deficient 7-dehydrocholesterol concentration in the human skin [7]). Paired with possible reductions in sunlight exposure [8], gastrointestinal absorption of vitamin D may decrease [9], thereby; elderly people are at increased risk of vitamin D deficiency. A range of serious diseases may be associated with Vitamin D deficiency as cardiovascular disease, infectious diseases, autoimmune diseases, T2D and cancer [4]. Several evidences have revealed a link between serum vitamin D level, calcium homeostasis and the risk for coronary heart disease CAD [10,11].

CAD is a major public health problem worldwide and the leading cause of morbidity, disability and mortality [12].

It accounted for 25-30% of deaths in most industrialized countries [13]. CAD is set to become an epidemic in developing countries, and over the next 20-years will probably become the most important global health problem [14]. Lifestyle changes result in increasing overweight and obesity, tobacco use, along with the rapid increase in diabetes that is occurring in aging population are major risk factors for CAD. Hence, its primary as well as secondary prevention was given great attention by health authorities [15].

In KSA, data on CAD prevalence is very scratchy [16]. The relationship between excess body weight and the risk of CAD is complex. Abdominal obesity is considered to play a fundamental role in the etiology of CAD through adversely affecting several established risk factors [17]. BMI has been used by public health organizations to define the degrees of overweight and obesity [18]. A recent report found increased cardiovascular disease mortality associated with BMI ≥ 30 kg/m2 [19]. However, BMI is not as good as circumference measures for the measurement of the most metabolically-active intra-abdominal fat and does not directly assess body fat distribution. Lean muscle mass also can greatly influence BMI, particularly in athletes.

The gradual decrease in lean muscle mass with aging also affects the validity of BMI as a marker of adiposity among older populations [20]. WC is more strongly correlated with intra-peritoneal adipose tissue mass, as measured by computed tomography or dual energy x-ray absorptiometry [21,22]. Furthermore, WC is easy to measure, is feasible to assess in a clinical setting, and contains relatively little measurement error.

Recently, many risk score as Framingham and Reynolds risk scores are designed to assess the risk of CAD using different anthropometric, clinical and chemical parameters [23]. Therefore, this project was designed to study the prevalence of vitamin D deficiency and CAD risk score and its major modifiable risk factors as obesity, HTN, diabetes mellitus (DM), hypercholesterolemia and smoking among Taif University male population and determined any relationship between Vitamin D and CAD risk score.

2. Methods

The study was conducted on 300 male patients attending the primary care offices in Taif University and asked to participate in the study after their consent, aged 20-63 years. Patients with known CAD, peripheral artery disease, or stroke, were excluded from the study. Doctors were advised to measure body weight, height, blood pressure, and WC according to written, standardized instructions given in a manual. Systolic and diastolic blood pressure was measured by indirect cuff sphygmomanometer after several minutes of rest in sitting position with the use of an appropriate cuff size. Weight made by digital scales without heavy clothing; height barefoot by portable stadiometer; the waist was measured at the end of a gentle expiration midway between the lowest rib and iliac crest, with the patient standing. BMI (weight in kg divided by the square of height in meters) was calculated.

2.1. After Their Consent, All Subjects were Subjected to:

1- Full history taking with particular emphasis on age, history of any systemic diseases, e.g., HTN, DM, dyslipidemia or history of any associated diseases and drug intake.

2- Thorough clinical examination.

3- Blood sampling and analysis: 6 ml venous blood sample was collected between 8-9 AM after overnight fasting. 2 ml was collected in an EDTA tube with gentile mix, and then preserved at refrigerator not more than one week for glycated hemoglobin analysis. The other 4 ml was collected in plain tube, incubated for 30 minutes at 37 °C, and then centrifuged at 3000 rpm for 10 minutes. Serum was separated in a dry clean tube and stored at -20 °C till assay time for doing the other analysis parameters. Another 2 ml of venous blood was collected in plain tube, serum separated as previous and preserved for 2 hours post prandial blood glucose analysis. At the assay time, serum samples were left to take room temperature for doing the following parameters:

a- Fasting and two hours postprandial blood glucose, according to a glucose-oxidase method using kits from UDI Diagnostic.

b- Glycated hemoglobin A1c was measured using column chromatography method by commercial Kit from Biosystem diagnostic.

c- Serum TG, TC was estimated according to (GPO-POD) method using kits from Spinreact Diagnostics.

d- Serum HDL level was estimated by "enzymatic colorimetric method using kits from Spinreact. Serum LDL level was calculated using Friedewald's formula if the triglycerides were less than 4.5 mmol/l, as following: LDL= total cholesterol – HDL-cholesterol – triglycerides/5.

e- High sensitivity CRP was done using a fully automated analyzer IMAGE from Bechman coulter Diagnostics

g- Serum 25-(OH) Vitamin D was measured by Abbott Architect i1000 Chemiflex device (kits manufactured by Abbott#3L52-25).

2.2. Statistical Analysis

Values were expressed as mean ±SD. The statistical analysis of the results was performed based on the conventional standard statistical procedures using computed statistical analysis by SPSS, version 20.0 of Microsoft windows 7. All variables were tested for normality of distribution. Paired-samples t test was applied to compare between parametric values; Pearson's correlation with correlation coefficient was applied for parametric results. The significant difference was considered at $p<0.05$ [24].

3. Result

A total of 125 male patients were included in the study with a mean age of 35.35±11.75 years (20-63 years). The mean body weight of 81.2±16.3 kg (44-130 kg), mean BMI of 28.1±5.3 kg/m^2, mean WC 94.9±21.5 cm, mean SBP of 131.6±14.2 mmHg, and mean DBP of 75.8±9.9 mmHg. 7.2 % have hyperlipidemia (HLP) but only 2/3 of them were on statin, 6.4% have HTN, 9.6% of the patients were T2D and 32.4% reports a family history of T2D. 22.4% are smokers, 22.4% were passive smokers, 33.1% reports sedentary lifestyle, 41.9% reports been active for a duration of less than 150 min/week, and 25% reports been active >150 min/week. 15.4% of the participants use the media (TV, smart phone, tablet) for less than 3 hours per day, 51.5% of the participants reports optimal sleep hours (6-8 hours/night), and 50.4% reports eating fresh fruits or vegetable at least one serving per day (Table 1).

Table 1. Baseline characteristics of the studied populations

Item	%
Age (years) M±SD	35.37±11.75
T2D	9.6
Family history of T2D	32.4
Dyslipidemia	7.2
HTN	6.4
Active smoking	22.4
Passive smoking	22.4
Optimal sleeping hours (6-8 hours/night)	51.5
Sedentary lifestyle	33.1
Active < 150 min/week	41.9
Healthy eating habits	50.4
Media consumption < 3hrs/d	15.4
Weight (Kg)	81.2±16.3
BMI (Kg/m2)	28.1±5.3
WC (cm)	94.9±21.5
SBP (mmHg)	131.6±14.2
DBP (mmHg)	75.8±9.9

Table 2. Baseline characteristics of laboratory data of the studied populations

Item	M±SD
FBG mg/dl	99.1±23.7
TC mg/dl	193.2±41.7
HDL mg/dl	43.8±7.5
LDL mg/dl	121.6±41.6
TG mg/dl	132.3±92.9
Non-HDL cholesterol mg/dl	149.3±40.7
CRP mg/L	0.42±0.52
Vitamin D ng/dl)	17.4±5.9
FRS %.	3.53±3.98

Regarding the laboratory parameters, the mean FBG was 99.1±23.7 mg/dl, mean TC was 193.2±41.7 mg/dl, mean HDL was 43.8±7.5 mg/dl, mean LDL 121.6±41.6 mg/dl, mean TG) 132.3±92.9 mg/dl, mean non-HDL cholesterol of 149.3±40.7 mg/dl, mean CRP 0.42±0.52 mg/l and mean vitamin D 17.4±5.9 ng/dl. The mean FRS % was 3.53±3.98 (Table 2).

Table 3 revealed the different grades of vitamin D deficiency, where 88 patients (70.3%) had insufficient vitamin D level (11-20 ng/ml), 30 patients (24%) have an optimal vitamin D level (> 20 ng/ml) and 7 patients (5.7%) had deficient level of vitamin D (< 10 ng/ml) [25].

To evaluate the impact of vitamin D on the patient's characteristics as well as the risk stratifications we divide patients according to their vitamin D level into 2 groups. Those with Vitamin D level < 20 were considered to be group 1 while those with Vitamin D > 20 were considered to be group 2. Compared to group 1, group 2 has a mean age of 36.9 versus 35.3 years (p 0.437), more likely to smoke 23.3% versus 22.11% (p 0.517), less likely to report passive smoking 16.7% versus 24.21% (p 0.723), as likely to reports optimal sleep hrs at night 52.1% versus 52.0% (p 0.98), more likely to reports sedentary lifestyle 40.3% versus 23.5% (p 0.143), and as likely to report healthy eating 50.7% versus 51% (p 0.97).

Table 3. Classification of Vitamin D deficiency

Deficient	(≤10 ng/mL)	7	5.7 %
Insufficient	(11-20 ng/mL)	88	70.3 %
Optimal	(>20 ng/mL)	30	24 %

Table 4 revealed a correlation between FRS and different clinical and laboratory parameters. There was a significant positive correlation between FRS and age (r=0.6124), WC (r= 1998), DBP (r=0.2281), FBG (r= 0.3315), TC level (r=0.3814), TG level (r=0.4079), LDL level (r=0.2240), Non HDL level (r=0.3923) with a significant negative correlation between FRS and vitamin D level (r= - 0.9473), HDL (r= -0091) and CRP (r= - 0.0910).

Table 4. Correlation between FRS and different parameter

FrG score (r)	**Age**	**SD**	**PA**	**MC**	**Smoking**	**Vit D**
	0.6124*	- 0.1151	- 0.0615	- 0.1485	0.0538	- 0,9473*
	BMI	**WC**	**BW**	**SBP**	**DBP**	**FBG**
	0.1263	0.1998*	0.1471	0.1816	0.2281*	0.3315*
	TG	**TC**	**non-HDL**	**HDL**	**LDL**	**CRP**
	0.4079*	0.3814*	0.3923*	- 0.0091	0.2240*	- 0.0910

* Significant (p < 0.05)
* SD (sleep duration), PS (physical activity), MC (media consumption).

Compare to group 1, group 2 have mean BMI of 27.6 versus 28.4 (p 0.409), mean WC of 96.8 versus 94.6 cm (p 0.641), mean SBP of 131.7 versus 131.5 (p 0.573), mean DBP of 76.4 versus 75.2 (p 0.428), mean vitamin D of 25.9 versus 14.9 ng/dl (p 0.0001), mean CRP of 0.36 versus 0.43 (p 0.938), mean FRS of 100.1 versus 98.8 mg/dl (p 0.080), mean non-HDL cholesterol of 135.3 versus 154 (0.075), mean TC 180.2 versus 197.5 (p 0.307), mean LDL 107.4 versus 126.2 (p 0.306), mean HDL 44.9 versus 43.3 (p 0.265), mean TG of 132.7 versus 133.1 (p 0.486), mean FRS of 3.6 versus 3.5 (p 0.930), where only significant difference detected between both groups as vitamin D level. (Table 5, Table 6).

4. Discussion

During the past decade, important advances in the study of vitamin D have been made. In addition to its important role in skeletal development and maintenance, evidence is mounting that vitamin D produces beneficial effects on extra-skeletal tissues and that the amounts needed for optimal health are probably higher than previously thought [26]. Adequate vitamin D is also important for proper muscle functioning, and controversial evidence suggests it may help prevent type 1 diabetes mellitus, HTN, and many common cancers. Numerous reports have shown that relatively high proportions of people have inadequate levels of vitamin D. The extra-skeletal health benefits of vitamin D and high prevalence of inadequate levels of vitamin D have been largely unrecognized by both physicians and patients [27]. Our study revealed that 70.3% of the patients have insufficient vitamin D level (11-20 ng/ml), 24% have an optimal vitamin D level (>20ng/ml) and 5.7% have deficient level of vitamin D (<10 ng/ml).

Table 5. Group characteristics and risk stratification based on the Vitamin D level

	Low Vit. D Group	Optimal Vit. D Group	P
Age (yrs)	35.3±11.9	36.9±11.5	0.437
Smokers (%)	22.11	23.3	0.517
Passive smoking (%)	24.21	16.7	0.723
Optimal sleeping hrs (%)	52.0	52.1	0.98
Sedentary lifestyle (%)	23.5	40.3	0.143
Healthy eating habits (%)	51	50.7	0.97
Measurement			
BMI (Kg/m2)	28.4±5.5	27.6±4.7	0.409
WC(cm)	94.6±21.7	96.8±20.6	0.641
BW (Kg)	82.4±16.9	78.6±13.1	0.465
SBP (mmHg)	131.5±13.7	131.7±16.2	0.573
DBP (mmHg)	75.2±10.3	76.4±8.7	0.428
Laboratory Data			
Vit D (ng/dl)	14.9±2.9	25.9±5.7	0.0001*
CRP	0.43±0.58	0.36±0.31	0.938
FBG (mg/dl)	98.8±23.6	100.1±24.4	0.080
Non-HDL cholesterol	154.0±42.8	135.3±28.6	0.075
TC (mg/dl)	197.5±44.1	180.2±29.9	0.307
LDL (mg/dl)	126.2±43.8	107.4±30.0	0.306
HDL (mg/dl)	43.3±7.3	44.9±7.5	0.265
TG (mg/dl)	133.1±90.8	132.7±101.1	0.486
Risk Stratifications			
FRS	3.5±4.1	3.6±3.6	0.930

* Significant ($p < 0.05$).

Table 6. Correlation between Vitamin D level and different parameter

<table>
<tr><td rowspan="4">Vitamin D (r)</td><td>Age</td><td>BW</td><td>BMI</td><td>WC</td><td>FBG</td><td>CRP</td></tr>
<tr><td>0.0258</td><td>0.0206</td><td>0.0319</td><td>0.6727</td><td>-0.0590</td><td rowspan="3">-0.1778</td></tr>
<tr><td>TG</td><td>TC</td><td>non-HDL</td><td>HDL</td><td>LDL</td></tr>
<tr><td>-0.0574</td><td>-0.1255</td><td>-0.1409</td><td>0.0801</td><td>-0.0899</td></tr>
</table>

Holick 2006 stated that, vitamin D inadequacy has been reported in approximately 36% of otherwise healthy young adults and up to 57% of general medicine inpatients in the United States of America (USA) and even higher percentages in Europe [28]. Recent epidemiological data document the high prevalence of vitamin D inadequacy among elderly patients and especially among patients with osteoporosis. Elsammak et al 2011 [29], found high prevalence of vitamin D deficiency in the sunny eastern region of Saudi Arabia. Alharbi SA et al., 2013, [30] announced that vitamin D deficiency is common among Saudi adult. Supplementation of this vitamin is recommended to prevent vitamin D deficiency complication in the future. Factors such as low sunlight exposure, age-related decreases in cutaneous synthesis, and diets low in vitamin D contribute to the high prevalence of vitamin D inadequacy. Another important factor is malabsorption of vitamin D [28]. Supplemental doses of vitamin D and sensible sun exposure could prevent deficiency in most of the general population.

CAD is a major public health problem. CAD is accounting for approximately one-third of all deaths in subjects over the age of 35 years In the United States. Hence, health authorities gave great emphasis on its primary as well as secondary prevention. CAD is gradually set to become an epidemic in developing countries. In the Kingdom of Saudi Arabia (KSA), one hospital-based study showed that CAD was the leading cause of hospitals admission [31]. CAD is representing the third most common cause of hospital-based mortality, second to accident and senility in KSA [32].

This study including 125 patients attending TUOC aged 20-63 years. The FRS is an important tool to stratify the risk for cardiovascular (CV) events and death. The mean FRS for all participants was 3.53%.

These data are much less than announced by Ibrahim et al. [33], who calculated FRS among medical student in

King Abdulaziz University, Jeddah, Saudi Arabia during the educational year 2012–2013 and found that FRS was 10.7%, 2.3% and 0.5% of mild, moderate and severe risk, respectively. Another study done in the USA found that the FRS was below 10% for all the Chicago Heart Association Detection Project in Industry-predicted risk among the 18 to 29 year old cohort [34]. Al-Nozha et al. [31], demonstrate an increasing prevalence of CAD with age ranging from 3.9% at ages 30-39 years to 4.6% at 40-49-years, 6.3% at 50-59-years, and 9.3% at 60-70-years. These results are concurring with the reported increasing prevalence of CAD with age in the USA as estimates for The FRS is an important tool to stratify the risk for men are from 7% at ages 40-49 years to 13% at 50-59-years, 16% at 60-69-years, and 22% at 70-79-years [32].

CV events and death. There was a significant positive correlation between age and FRS with an increase CAD risk score with increase patient age. Many studies have revealed that older age, over age 45 years in men and over age 55 years in women are more liable to CAD [35]. CAD risk factors, including lifestyle habits (diet, exercise, and smoking), HTN, DM and obesity in addition to dyslipidemia. About 90% of individuals with CAD have at least one risk factor as smoking, diabetes, HTN and/or hypercholesterolemia [34].

The USA National Health and Nutrition Examination Survey data among young adults aged 20-45 years (1999–2006) revealed that two-thirds have at least one CAD risk factor [36]. It is well known that BMI is independently associated with acute coronary syndromes, and the risk is increased even at mildly elevated BMI. [33] The present study revealed that most of our patients are either overweight or obese where the mean body weight of the studied population was 81.2 kg (44-130 kg) and BMI was 28.1 kg/m^2. Ibrahim et al. [33] revealed that about one-third (31.8%) of all medical students were either overweight (19.1%) or obese (12.7%). These findings are much higher than the results of Burke, et al., who reported a rate of overweight/obesity (33%) among college students in University of New Hampshire's in 2009 [37]. Similarly, a study conducted at the School of Medicine, Crete University; as their corresponding rates were 40% for males [38]. The comparable rates were also reported from two other Saudi studies one done among male medical students in Qaseem University (46.5%) [39] and the other study was done among male and female medical students in the Tibia University (44.8%) [40].

Our higher rate of overweigh and obesity may be due involvement of different group ages other than students. These alarming high rates of overweight and obesity may require rapid targeted university intervention. Our study revealed that means WC was 102.3 cm for all studied populations which is higher value and correlated without results about the increase prevalence of overweight/obesity in our study sample. Flint et al. both BMI and WC strongly predicted future risk of CAD. Furthermore, WC thresholds as low as 84.0 cm in men and 71.0 cm in women may be useful in identifying those at increased risk of developing CAD. The findings have broad implications in terms of CAD risk assessment in both clinical practice and epidemiologic studies [41].

Our study showed that the nutritional risk factor of CAD was apparent. This is apparent from low intake of healthy diet as vegetables and fruits (49.6%), due to high daily intake of fat- rich foods and fast-foods. Sabra, et al. found also that 20.1% of medical male students were consuming fast foods in a frequency of 6-10 times/week [42]. Larson, et al., found that 24% of male adolescents in Minnesota reported frequent intake of fast food (≥ 3 times/week) and these rates increased during the young adulthood [43]. Increased body weight is related to sedentary life and decreased physical activity. Our study revealed that 41.9% reports been active for duration of less than 150 min/week. Al-Nozha et al. showed that the prevalence of non-practicing physical exercise was high (57.9%) [31]. It is well known that regular practicing of physical activity provides significant benefits in reducing morbidity and mortality from CAD. Sedentary behaviors as playing computer games and watching TV are reported to be associated with increased prevalence of obesity and hence risk of CAD. 33.1% of our patients reporting sedentary lifestyle where, only 24% of the participants use the media (TV, smart phone, tablet) for less than 3 hours per day. Only 51.2 % of the participants reports optimal sleep hours. These results in agreement with results of Sabra, et al [42].

Smoking is a major risk factor of CAD. 22.4% of our patients are smokers while 22% were passive smokers. High rate of active and passive smokers is present in middle age groups. This is in agreement with Sabra, et al. who found that about 19% of male medical students were smokers [42] and much less than Al-Nozha et al. [31] who reported that the rate of smoking is low (2.8%). However, this low rate may be attributed to Al-Nozha et al. [31] study was conducted among both male and females, with a small male sample, while the other study was conducted only among male with a higher prevalence of smoking. 8.8% of the patients were T2D report family history of T2D as regard FBG with a positive correlation between FRS and FBG (r= 0.2452). The percentage of diabetes in our study is much less than Alqurashi et al., [44] who found that of 6024 Saudi subjects, DM was present in 1792 (30%) patients. This discrepancy may be due to involvement of Saudi and non Saudi person in our study. 7.2 % of study population have HLP but only 2/3 of them were on statin with TC was 192.94 mg/dl, HDL was 43.72 mg/dl, LDL 120.64 mg/dl, TG 132.45 mg/dl and non-HDL cholesterol was 149.06 mg/dl with a positive correlation between FRS and Non-HDL(r=0.1924). These results are similar to results of Burke, et al. [37] 6.4% of the patients have HTN with a positive correlation between FRS and DBP (r=0.2733).

Al-Nozha et al. [31] found that about one tenth (9.3%) of medical students in his study was diagnosed as having hypertension. The study Sabra, et al. [42] reported higher corresponding rates of systolic and diastolic HTN (13.8%% and 3.7%, respectively). This difference may be because his study was done only among males. As regards CRP it was higher in high risk person with a positive correlation between FRS and CRP however this correlation is not significant. High serum CRP level, after excluding other inflammatory sources, as proven to be a sensitive diagnostic and prognostic marker for significant coronary disease [45].

On the other hand, vitamin D level doesn't seem to play a role in our cohort of patient risk stratification. This was clear in the older group who has higher or at least similar vitamin D level of the other groups. Also, when we divided the cohort based on their vitamin D level, both low and high vitamin D groups have similar baseline characteristics, but those with higher vitamin D level have non-statically significant higher risk FRS.

5. Conclusion

The overall prevalence of vitamin D insufficiency was high (about 76%) which need much care about the causes and management. CAD in Taif University population by FRS is 3.53%, a figure much less than reported from other regions in KSA and other countries. The most important risk factors for CAD detected in this study older age, increased WC, decreased physical activity, sedentary life, smoking, HTN, DM, dyslipidemia and poor healthy habit. There was a negative correlation between vitamin D levels and the risk stratifications with a significant positive correlation between WC and FRS. WC has seemed that it plays a major role in the risk stratification especially when you have a cohort of patients with similar BMI.

5.1. Recommendation

Wide screen program for early detection of vitamin D deficiency among University population both male and female and application of WC in detection of overweight/obesity and early detection of person of high CAD is recommended with application of intervention and educational programs for those at higher risk. A future wide scale study is needed to confirm our findings.

5.2. Study Limitations

The small sample size and the male predominance.

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