1. Introduction

Metabolic syndrome refers to cluster of several cardio metabolic risk factors including abdominal obesity, hyperglycemia, dyslipidemia and elevated blood pressure that likely linked to insulin resistance[1]. The clinical relevance of metabolic syndrome is that it defines people who are at increased long-term risk of cardiovascular and type 2 diabetes mellitus. Metabolic syndrome becomes more prevalent with increase in age; the affected half of adults aged 60 years and over [2-4]. Accumulating research suggests that circulating concentrations of vitamin D may be inversely related to the prevalence of diabetes[5-9], the concentrations of glucose[7,10,14], and to insulin resistance[7,10,12,13]. Vitamin D deficiency is related to impairments in insulin secretion and impaired insulin synthesis. Calcium regulates insulin synthesis within pancreatic β-cells, as well as insulin secretion; and plasma calcium levels are mediated by vitamin D [16, 17]. In addition vitamin D deficiency may be a risk factor for the metabolic syndrome [10, 15]. Vitamin D insufficiency has long been suspected as a risk factor for type 1 diabetes based on animal and human observational studies [18]. There is accumulating evidence to suggest that altered vitamin D and calcium homeostasis may also play a role in the development of type 2 diabetes mellitus.
Laboratory measurements

Total cholesterol (TC), high density lipoprotein (HDL) and triglyceride (TG) levels were determined by enzymatic methods. Dyslipidemia was defined as the presence of at least one of the reported lipid abnormalities. The metabolic syndrome was defined according to WHO criteria. Based on WHO criteria MS diagnosed if glycemia was abnormal and the further criteria were present. These criteria were glucose intolerance or type 2 diabetes or BMI ≥ 30 kg/m², TG ≥ 150 mg/dl or HDL < 35 in men and < 39 in women, on hypertension treatment or blood pressure > 160/90 mmHg, microalbuminuria ≥ 20 mcg/min.

Serum vitamin D (25-hydroxy vitamin D) was measured via radioimmunoassay using an IDS kit (England immunodiagnostic systems limited) with intra-assay CV 8.1% and 5.49% respectively. Serum levels of 25(OH) was classified into two groups of deficiency status (vitamin D ≤ 50 nmol/L) as insufficient, and vitamin D ≥ 50 nmol/L (as sufficient).

Blood pressures were measured two times using a standard calibrated mercury sphygmomanometer on the right hand of the participants remained seated for 15 minutes. The mean of two measurements was recorded as blood pressure. According to the JNC VII criteria, hypertension (HTN) was defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg or both.

3. Results:

Of the total 101 participants who had no personal history of diabetes mellitus, 30% population are 40 years or older. The baseline characteristics of the participants are summarized in table 1 and the strength of association of components with metabolic syndrome were summarized in table 2 the prevalence of the constituents of the metabolic syndrome based on WHO criteria shown in table 3.

| Table No: 1 characteristics of the population under study. |
|------------------|------------------|------------------|
| Variables | Non obese (controls)=40 | Obese (cases)=61 |
| Age(years) | | |
| BMI (kg/m²) | 26.63± 2.785 | 30.5±1.472 |
| FBS mg/dl | 100.625± 11.53 | 125.016±9.74 |
| TGLmg/dl | 15.66±15.37 | 170.311±15.63 |
| HDLmg/dl | 39±3.97 | 34.049±3.18 |
| Vitamin D | 53.08±10.8 | 37.9±6.04 |
| HTN | 130.627±11.08 | 143.3±8.82 |

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>Confidential interval</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin D</td>
<td>4.695</td>
<td>2.560-10.227</td>
<td>0.0001</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>5.7928</td>
<td>3.138-10.693</td>
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<tr>
<td>Vitamin D</td>
<td>2.7924</td>
<td>1.528-5.1002</td>
<td>0.0007</td>
</tr>
</tbody>
</table>

Using WHO criteria, the unadjusted prevalence of the metabolic syndrome was 19.80% (22.72% in males and 8.57% in females).

Among the components, dyslipidemia had the highest prevalence which was 80.3% in men and 77.14% in women. The male participants showed higher frequencies of central obesity and dyslipidemia then females. Where as in females there are higher frequencies of hyperglycemia and hypertension then male participants. In the total subjects the mean concentrations of 25(OH) D was 44.09±11.24 (53.53±10.80 in non obese patients and 37.9±6.04 in obese) with regard to vitamin D deficiency, the total prevalence of vitamin D deficiency (≤ 50 nmol/L) was 76.23% (60.60% in males and 77.14% in females).

The prevalence of metabolic syndrome in vitamin D deficient group was higher then in the normal vitamin D group (23.37% Vs 8.3%), p=0.001.

In the men with vitamin D deficiency, the prevalence of metabolic syndrome was higher than normal vitamin D group (33.33% Vs 11.76). Among the components, only dyslipidemia showed significant higher prevalence in men compared to women (80.3% Vs 77.14%).

With regard to low vitamin D concentration the unadjusted odds ratio for metabolic syndrome relative to components such as BMI, TGL, FBS and HTN are 4.695 (95% of CI 2.560-10.227), 5.792 (95% of CI 3.138-10.693), 5.792 (95% of CI 3.138-10.693) and 2.792 (CI 1.528-5.1002) respectively. Among the components, significant inverse associations were present for the concentrations of 25(OH) D with abdominal obesity, hypertriglyceridemia, hypertension and hyperglycemia.
4. Discussion

There are increasing evidences about the relationship between vitamin D metabolism and occurrence of diabetes mellitus. Vitamin D has a role in the secretion, and possible action of insulin [10] and modulates lipolysis [23, 24] and might therefore contribute to the development of the metabolic syndrome.

In this study prevalence of metabolic syndrome among men and women of 30 years with low vitamin D concentration were significantly higher. Similar studies have shown an inverse association between serum vitamin D and the prevalence of metabolic syndrome [15, 25].

From a clinical study of 126 participants it has been reported that, those with hypovitaminosis were nearly three times as likely to have the metabolic syndrome compared with participants with normal vitamin D. In our study also shows three times risk of metabolic syndrome compared to normal vitamin D participants [23.37% Vs8.3%, p > 0.001].

Among the components of the MS in this study, obesity was associated with vitamin D deficiency without dependence on age and sex. Data of NHANES which is the largest cross-sectional study up to present time [25] shown that, the components of metabolic syndrome independently associated with low vitamin D were abdominal obesity and hyperglycemia. Results of this study show that, vitamin D deficiency independently predicted the metabolic syndrome [7, 26].

In a Meta analysis by Pitts et al., through combining data from all studies on the association between vitamin D level and the prevalence of type 2 DM [7, 8, 27, 28]. It was found that the summary odds ratio (OR) was 0.54 (95% Cl 0.23-1.27) for the highest Vs the lowest vitamin D concentration (25-38nmol/L Vs 10-23nmol/L, respectively) but with significant heterogeneity among studies. In most [5, 6, 8, 12] case-control studies, patients with type2 DM or glucose intolerance were found to have lower serum vitamin D concentrations compared to normal vitamin D participants.

The limitation of our study was based on a single measurement of vitamin D and parathyroid hormone status was not measured.

5. Conclusion:

In conclusion vitamin D deficiency and the metabolic syndrome have a high prevalence among urban population and may have an important role in metabolic syndrome and its components. It is therefore important to make efforts to recognize individuals with metabolic syndrome early, so they may be targeted for intensive life style and risk management to reduce cardio-metabolic risk.

6. References


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