Association Vitamin D Receptor (TaqI) Gene Polymorphism with Anthropometric Parameters and Blood Pressure of College Students in Faculty of Medicine, University of Sumatera Utara

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Abstract—Epidemiological studies suggest several genes from the vitamin D receptor have been implicated in obesity and cardiovascular disease. However, the findings were inconsistent.

The aim of this study was to evaluate TaqI polymorphism of the vitamin D receptor (VDR) gene are associated with anthropometric parameters and blood pressure on college students in Faculty of Medicine, Sumatera Utara University.

This was a cross-sectional study. Measurements of anthropometric parameters were carried out. Blood pressure measurement using a mercury sphygmomanometer. TaqI polymorphisms of VDR gene were geno-typed by PCR and FRLP. Statistical analysis were calculated using SPPS software (version 14.0).

The prevalence of TaqI genotypes were 117 (84%) TT and 22 (16%) Tt. Homozygous tt was not found in the subjects. There were no significant differences in anthropometric parameters (BMI and WHR) and blood pressure between TaqI polymorphism of the VDR gene (p=0.321; p=0.607; p=0.278)

The results suggest that TaqI VDR polymorphism are not related with the obesity and not risk factor of cardiovascular disease on college students in Faculty of Medicine, University of Sumatera Utara.

Keywords—TaqI VDR polymorphism, anthropometric parameters, blood pressure

I. INTRODUCTION

It has been argued that vitamin D deficiency as a global health issue may contribute to the pathogenesis of obesity, cardiovascular disease (CVD), the metabolic syndrome and type 2 diabetes [1].

Clinical and epidemiological studies show that obese individuals tend to have low vitamin D status [2]. The present data are in accordance with Lender et [3] have also reported a relationship between vitamin D status of someone with body fat distribution. Vitamin D increases calcium absorption through the intestine and reduce the excretion of calcium through the kidneys. So, Vitamin D is very important to maintain calcium balance. Low calcium increases kalsitropik hormone and parathyroid hormone synthesis.

Parathyroid hormone in the body can improve the process of lipogenesis (fat synthesis), inhibits lipolysis (fat degradation) and modulate adipogenesis. Adipogenesis process is the process of morphological changes, cell development, and accumulation of fat [4].

Calcium with vitamin D is known to suppress appetite, extend the distance between meals and reduce food intake the next day [5].

Research on teenagers in Korea found a significant negative correlation between serum 25 hydroxyvitamin D levels and body mass index (BMI) [6], Fish et al [7] reported a significant correlation between serum vitamin D levels and obesity.

Low vitamin D levels were also associated with an increased prevalence of hypertension, high systolic blood pressure (SBP) and diastolic blood pressure (DBP). Clinical studies demonstrated an inverse, dose-response relationship between plasma 1,25(OH)2D3 concentration and blood pressure or renin activity in both normotensive and hypertensive patients [8], [9].

Vitamin D activity mediated by vitamin D receptor (VDR). Some research suggests that the VDR gene polymorphism may be a genetic and genotype component that affect the degree or VDR function. VDR polymorphisms will reduce the activity of vitamin D.

Studies have found associations between vitamin D pathway gene polymorphisms and circulating 25(OH) D level [10], [11].
Santos et al showed [12] association with lower vitamin D levels, suggesting that VDR gene polymorphisms could be linked to higher susceptibility to vitamin D deficiency. This is the underlying pathogenesis of the onset of disorders such as obesity, cardiovascular disease and other diseases associated with a polymorphism of the VDR gene. Thus VDR gene polymorphisms may correlate with different diseases.


Even though, association studies of genetic variants in vitamin D pathway genes with obesity and blood pressure are limited and inconsistent [16], [17], [18].

The aim of this study was to evaluate Taq1 polymorphisms of the vitamin D receptor (VDR) gene are associated with anthropometric parameters, BMI and waist hip ratio (WHR) and blood pressure on college students in Faculty of Medicine, University of Sumatera Utara.

II. METHODS

This study was a cross sectional study, conducted at the Integrated Laboratory of the Faculty of Medicine, University of Sumatera Utara. This study was conducted after obtaining approval from the Ethics Commission. The subjects were students of the Faculty of Medicine, University of Sumatera Utara in 2016, and aged 16-23 years. They were asked to fill out and sign an informed consent after being given an explanation about the purpose and benefits of the research.

Anthropometric measurements of body mass and body height were made, both measured on subjects without top clothing and shoes. BMI as body mass divided by the square of height (kg/m2). We used body mass index (BMI) >25 kg/m² or BMI > 95th percentile (according to age and sex of Centre for Disease Control/ CDC Growth Chart) to estimate obesity. WC was measured to the nearest 0.1 cm over the unclothed abdomen at the smallest diameter between the costal margin and the iliac crest (the hip), at the end of a normal expiration. WHR was calculated by dividing the WC by that of the hip.

Systolic Blood Pressure (SBP) and diastolic Blood Pressure (DBP) were measured in seated subjects after rest for at least 15 min using a mercury tensiometer.

Genomic DNA was extracted from peripheral blood leukocytes. ApoA5 polymorphism genotyping is done by polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP). PCR product using Primer Forward in Intron 8: 5'- AGA GCA TGG ACA GGC AAG -3' and Reverse in Exon 9: 5'-GCA ACT CCT CAT GGC TGA GGT CTC A-3'. PCR conditions were as follows: denaturation at 94°C for 5 min, followed by 40 cycles of PCR at 94°C (30 sec), 61°C (30 sec), and 72°C (30 sec). Identified by ethidium bromide staining of fragments separated in a 2% agarose gel. Result: 745 bp spanning Taq1 site.

Amplicon digestion then was done using TaqI restriction enzyme. Enzyme digestion reaction was completed with 17 μl water, 2 μl 10X Fast digestGreen buffer,10 μl PCR product and 1 μl enzyme, incubated at 65°C for 2 h. The digested DNA with taq1 resulted in three fragments of 293, 251 and 201 bp in presence of taq1 polymorphic site, and in fragments of 496 bp and 249 bp in its absence, visualized using 2% agarose gel using gel documentation system. The polymorphism are presented as TT, Tt and tt.

All the data were obtained, clustered and statistically analyzed analyzed univariately, and bivariately use SPSS program version 14.

III. RESULTS AND DISCUSSION

<table>
<thead>
<tr>
<th>Characteristics of the Studied Subject</th>
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<tbody>
<tr>
<td>Anthropometry</td>
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<tr>
<td>Body Weight (kg)</td>
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<tr>
<td>Height (cm)</td>
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<tr>
<td>BMI (kg/m²)</td>
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<tr>
<td>Waist circumference (cm)</td>
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<tr>
<td>Hip circumference (cm)</td>
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<tr>
<td>WHR</td>
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<tr>
<td>Normal n(%)</td>
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<tr>
<td>High n(%)</td>
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<tr>
<td>Obese n(%)</td>
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<td>Non Obese n(%)</td>
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In this study obtained 117 subjects with the variant Taq1 TT (84%) and 22 (16%) subjects with Tt. Homozygous tt was not found in the subjects. The polymorphism of this study population were consistent with the results of populations of China [19] and Thailand [20], were also not found the tt genotype in their study population the different results were found in the population in the American Countries. In Mexican was found tt and Tt genotype frequencies more than TT genotype there are several [21]. Research conducted by Haddad [22] showed in Syrian population was found Tt genotype frequencies more than TT genotype but tt genotype less than TT and tt genotypes.

Polymorphisms have been identified in VDR gene, mostly identified by variation biallel on enzymes restriction method Restriction fragment length polymorphisms (RFLPs), one of them is the VDR gene TaqI polymorphism. TaqI RFLP lies between exon 8 and 9 consist of TT, TC and CC, presented as TT, Tt and tt. [23]. VDR gene polymorphism in population arises from the differences between genotypes and alleles according to the ethnicity. These effects could be occurred by the differences in race and diet [22]

![Table II: Association VDR Taq1 Genotype with Anthropometric Parameters and Blood Pressure](image)

<table>
<thead>
<tr>
<th>Genotype</th>
<th>p</th>
<th>OR (95% CI)</th>
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<tbody>
<tr>
<td>TT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non obese</td>
<td>56</td>
<td>81</td>
</tr>
<tr>
<td>Obese</td>
<td>61</td>
<td>14</td>
</tr>
<tr>
<td>WHR Normal</td>
<td>31</td>
<td>7</td>
</tr>
<tr>
<td>High</td>
<td>86</td>
<td>15</td>
</tr>
<tr>
<td>BP Non</td>
<td>111</td>
<td>0</td>
</tr>
<tr>
<td>Hypertension</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>0.278</td>
<td>-</td>
</tr>
</tbody>
</table>

Based on the chi square test is found no association between VDR Taq1 gene polymorphism with BMI. The prevalence of TaqI genotypes were 87% TT, 13% Tt, in non obese subject, and 81% TT, 19% Tt, in obese subject (TT vs Tt, p=0.321, OR 1.60, 95% CI 0.62–4.11) (Table 2). In this study also showed no association between VDR Taq1 gene polymorphism with WHR and BP. The prevalence of TaqI genotypes were 87% TT, 13% Tt, in normal WHR subject, and 82% TT, 18% Tt, in high WHR (TT vs Tt, p=0.607, OR 0.77, 95% CI 0.28–2.07) and 83% TT, 17% Tt, in non hypertension subject, and 100% TT, in hypertension (TT vs Tt P=0.278)

The results are consistent with research from Bid et [24] which states no association between VDR Taq1 gene polymorphism with BMI, SBP and DBP in type 2 of diabetes mellitus in north Indians. Research conducted by Hajj et all [14] in young Lebanese women was found no association between VDR Taq1 gene polymorphism with WHR and BP. BM, WC, SBP and DBP. The different results were found in the group of young Lebanese Men. In this group was showed no relationship between VDR Taq1 gene polymorphism with BMI and WC but not with SBP and DBP.

Vitamin D is a generic name of two molecules, ie ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3). Precursors of vitamin D is present in a fraction of sterol in animal tissue (under the skin) and herbs in the form of 7-dehydrocholesterol and ergosterol. Both require ultraviolet radiation to convert it into a form of provitamin D3 (cholecalciferol) and D2 (ergocalciferol). Both

![Image](image)
Calcium and vitamin D supplementation is associated with the metabolic syndrome in morbid obesity. Clin Nutr. 26, 573–580. 2007


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