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Association between Genetic Variations of Angiotensin I-Converting Enzyme (ACE) Gene on Blood Pressure in High School Teachers in Yogyakarta, Indonesia

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Objectives: Teaching is considered to be a significantly stressful occupation. The occurrence of occupational stress has been suggested as an important factor in the development of various causes of morbidity and mortality. Teachers' workload and limit access to being physically active can trigger the occurrence of hypertension. Hypertension is caused by the presence of risk factors; one of them is genetic factors. The aim of this study is to determine the association between genetic variations of the ACE gene on blood pressure in high school teachers in Yogyakarta.

Methods: A cross-sectional study design involving 89 high school teachers in Yogyakarta by cluster sampling. The inclusion criteria of participants' selection were 18-55 years old and willing to be subject of the study by completing the informed consent. The exclusion criteria were pregnant, breastfeed, and under medication of cardiovascular disease. Body weight, height, body mass index, blood pressure, and waist circumference of the subjects were measured. Genetic variations of the ACE gene were measured using PCR and electrophoresis procedures. The data were analyzed statistically used chi-square and logistic regression Backward Stepwise (Likelihood Ratio) method with the SPSS program.

Results: The subjects were dominated by female (73.03%) and aged ≥40 y.o. (71.91%). There were three genotypes of genetic variation of the ACE gene in 89 subjects, II, ID, and DD. The chi-square analysis results show no significant association between genetic variation of the ACE gene on blood pressure ($p = 0.153$). The logistic regression analysis results showed a significant association between gender on blood pressure ($p = 0.00$; 95% CI 1.476-2.598).

Conclusions: There is no difference in genetic variations of ACE gene II, ID, and DD genotype on blood pressure. Therefore, II genotype tends to 2.3 times can affect blood pressure and DD genotype tends to 1.5 times can affect blood pressure compared with ID genotype.

Figure 1. PCR and Electrophoresis Results of ACE Gene

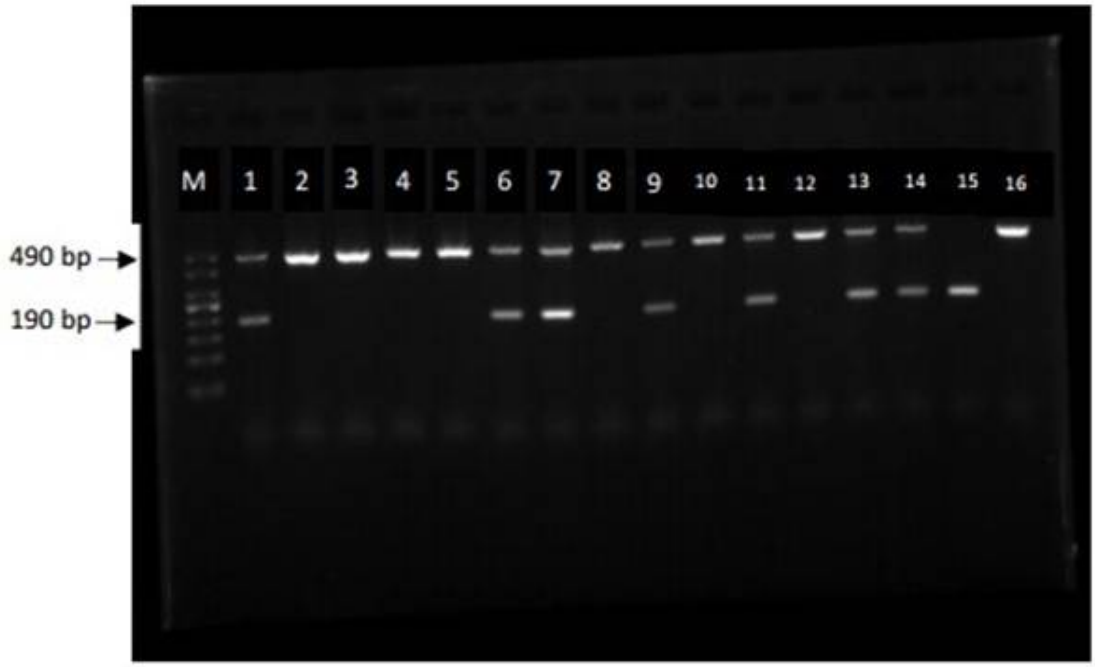

Figure 1. PCR and Electrophoresis Results of ACE Gene

**M: marker; II=2, 3, 4, 5, 8, 10, 12, 16; ID=1, 6, 7, 9, 11, 13, 14; DD=15*

Table 1 & 2. Association and multivariate analysis between genetic variation of ACE gene and blood pressure

Table 1. Association between genetic variation of ACE gene and blood pressure

Genetic Variation	Blood Pressure				p
	Normal	Pre-Hypertension	Hypertension Type I	Hypertension Type II	
DD	1 (25.0%)	1 (25.0%)	2 (50.0%)	0 (0.0%)	
ID	8 (26.7%)	0 (0.0%)	15 (50.0%)	7 (23.3%)	0.1,53
II	10 (18.2%)	3 (5.5%)	36 (65.5%)	6 (10.9%)	

**Chi square, p<0.05 is considered significant*

Table 2. Multivariate analysis of logistic regression between sex, age, nutritional status and genetic variation with blood pressure

Variable	p	Exp(B)	95% CI	
			Lower	Upper
Model 1				
Genetic variation	0.198			
Genetic variation	0.073	2.608	0.915	7.348
Genetic variation[b]	0.777	1.424	0.124	16.386
Age	0.433	0.628	0.197	2.008
Sex	0.052	2.107	0.995	4.461
Nutritional status	0.927	0.956	0.366	2.497
Model 2				
Genetic variation	0.165			
Genetic variation[a]	0.058	2.561	0.969	6.773
Genetic variation[b]	0.786	1.391	0.128	15.179
Age	0.283	0.608	0.244	1.510
Sex	0.049*	2.091	1.005	4.353
Model 3				
Genetic variation	0.232			
Genetic variation[a]	0.088	2.288	0.885	5.914
Genetic variation[b]	0.744	1.484	0.138	15.902
Sex	0.047*	1.502	1.006	2.242
Model 4				
Sex	0.000*	1.958	1.476	2.598

**p<0.05 is considered significant; [a]genetic variation of ACE gene (II genotype compared to ID genotype); [b] genetic variation of ACE gene (DD genotype compared to ID genotype)*