Job Stress, Gene Polymorphism of β_2-AR, and Prevalence of Hypertension[1]

SHAN-FA YU[#,+], WEN-HUI ZHOU[+], KAI-YOU JIANG[+], GUI-ZHENG GU[+], AND SHENG WANG[#,2]

[#]Department of Occupational and Environment Health, School of Public Health, Peking University, Beijing 100083, China; [+]Henan Provincial Institute of Occupational Medicine, Zhengzhou 450052, Henan, China

Objective To study the interactive effect of job stress and genetic susceptibility (or gene polymorphism) on hypertension. **Methods** A cross-sectional epidemiological study was conducted in 452 workers from a thermal power plant in China. Extrinsic effort, occupational reward, and over-commitment were measured. Hypertensive patients were defined by three phases of screening, reexamination, and final diagnosis. β_2-AR genotypes and allele frequencies at amino acid positions 16 (β_2-AR-16: Arg→Gly) and 27 (β_2-AR-27: Gln→Glu) were identified by PCR-RFLP. **Results** Job stress was related with the prevalence of hypertension in males ($P<0.05$), whereas no significant relationship was found in females ($P>0.05$). Differences in genotypes and allele frequencies of the β_2-AR-16 were statistically significant between the hypertension and control groups ($P<0.05$), whereas those of β_2-AR-27 were not ($P>0.05$). The prevalence of hypertension was higher in individuals carrying Gly16 allele than in those carrying Arg16 allele of the high job stress group ($P<0.01$ or 0.05). **Conclusion** High job stress and polymorphism of β_2-AR-16 have an interactive effect on the prevalence of hypertension in male workers.

Key words: Job stress; Hypertension; β_2-AR; Gene polymorphism

REFERENCES

1. Cartwright S, Cooper C L (1994). No hassle! taking the stress out of work. United Kingdom. Century Limited, pp. 3-12.
2. Snieder H, Harshfield G A, Barbeau P, *et al*. (2002). Dissecting the genetic architecture of the cardiovascular and renal stress response. *Biol Psychol* **61**, 73-95.
3. Khvorostova Iu V, Filipenko M L, Dymshits G M, *et al*. (2001). Expression of the proopiomelanocortin gene in the hypophysis of NICAG-line hypertensive rats. *Genetics* **37**, 643-648.
4. Redina O E, Khvorostova Iu V, Dymshits G M, *et al*. (2003). A search for genetic loci responsible for emotional stress-induced arterial hypertension in the ISIAH rats. *Genetika* **39**, 813-818.
5. Ge D L, Zhu H D, Huang Y, *et al*. (2007). Multilocus analyses of Renin- Angiotensin -aldosterone system gene variants on blood pressure at rest and during behavioral stress in young normotensive subjects. *Hypertension* **49**, 107-112.
6. Siegrist J (1996). Adverse health effect of high-effort/low-reward conditions. *Journal of Occupational Health Psychology* **1**, 27-41.
7. Siegrist J (2004). Psychosocial work environment and health: new evidence. *Journal of Epidemiology and Community Health* **58**, 888.
8. Siegrist J, Starke D., Chandola T, *et al*. (2004). The measurement of effort-reward imbalance at work: European comparisons. *Social Science & Medicine* **58**, 1483-1499.
9. Niedhammer I, Siegrist J (1998). Psychosocial factors at work and cardiovascular diseases: Contribution of the effort–reward imbalance model. *Rev Epidemiol Sante Publique* **46**, 398-410.
10. Siegrist J, Peter R, Georg W, *et al*. (1991). Psychosocial and biobehavioral characteristics of hypertensive men with elevated atherogenic lipids. *Atherosclerosis* **86**, 211-218.
11. Bosma H, Peter R, Siegrist J, *et al*. (1998). Two alternative job stress models and the risk of coronary heart disease. *American Journal of Public Health* **88**, 68-74.
12. Peter R, Alfredsson L, Hammar N, *et al*. (1998). High effort, low reward, and cardiovascular risk factors in employed Swedishmen and women: Baseline results from the wolf study. *Journal of Epidemiology and Community Health* **52**, 540-547.
13. Kuper H, Singh-Manoux A, Siegrist J, *et al*. (2002). When reciprocity fails: effort-reward imbalance in relation to coronary heart disease and health functioning within the Whitehall II study. *Occup Environ Med* **59**, 777-784.
14. de Jonge J, Bosma H, Peter R, *et al*. (2000). Job strain, effort–reward imbalance and employee well-being: A large-scale cross-sectional study. *Social Science & Medicine* **50**, 1317-1327.
15. Peter R, Siegrist J, Hallqvist J, *et al*. (2002). Psychosocial work environment and myocardial infarction: Improving risk estimation by combining two complementary job stress models in the SHEEP Study. *Journal of Epidemiology and Community Health* **56**, 294-300.
16. Lee S, Colditz G, Berkman L, *et al*. (2002). A prospective study of job strain and coronary heart disease in US women. *Int J Epidemiol* **31**, 1147-1153.
17. Hallman T, Perski A, Burell G, *et al*. (2002). Perspectives on

[1]This research was supported by the Funds of Health Science & Technology Innovation Project of Henan Province.
[2]Correspondence should be addressed to Sheng WANG. Tel: 010-83131533. Fax: 010-83131533. E-mail: chinastress@sina.com
Biographical note of the first author: Shan-Fa YU, male, born in 1964, chief physician, majoring in job stress.

0895-3988/2008
CN 11-2816/Q

differences in perceived external stress: a study of women and men with coronary heart disease. *Stress and Health* **18**, 105-118.
18. Reihsaus E, Innis M, MacIntyre N, *et al*. (1993). Mutations in the gene encoding for the beta 2- adrenergic receptor in normal and asthmatic subjects. *Am J Respir Cell Mol Biol* **8**, 334-339.
19. Green S A, Turki J, Innis M, *et al*. (1994). Amino-terminal polymorphism of the human beta 2-adrenergic receptor impart distinct agonist-promoted regulatory properties. *Biochemistry* **33**, 9414-9419.
20. Krushkal J, Ferrell R, Mockrin S C, *et al*. (1999). Genome-wide linkage analysis of systolic blood pressure using highly discordant siblings. *Circulation* **99**, 1407-1410.
21. Bray M S, Krushkal J, Li L, *et al*. (2000). Positional genomic analysis identifies the beta2-adrenergic receptor gene as a susceptibility locus for human hypertension. *Circulation* **101**, 2877-2882.
22. Ranade K, Shue W H, Hung Y J, *et al*. (2001). The glycine allele of a glycine/arginine polymorghism in the beta2-adrenergic receptor gene is associated with essential hypertension in a population of Chinese origin. *Am J Hypertens* **14**, 1196-1200.
23. Candy G, Samani N, Norton G, *et al*. (2000). Association analysis of beta2 adrenmoceptor polymorphism with hypertension in a black African population. *J Hypertens* **18**, 167-172.

(*Received August* 17, 2007 *Accepted January* 28, 2008)