THE ROLE OF GENE VARIANTS IN DETERMINATION OF INDIVIDUAL DIFFERENCES IN AEROBIC PERFORMANCE

Ahmetov Ildus¹, Popov Daniil, Astratenkova Irina, Mozhayaskaya Irina, Hakimullina Albina, Shikhova Julia, Missina Svetlana, Vinogradova Olga, Rogozkin Victor
(St Petersburg Research Institute of Physical Culture, St Petersburg, Russia)

A considerable amount of data confirming the influence of genes on human physical performance and health-related fitness has been accumulated in the recent years. In part, several family, twin, case-control and cross-sectional studies suggested an important role of genetics in individual differences in aerobic performance. The purpose of the study was to investigate gene polymorphisms for association with aerobic performance in athletes. One thousand three hundred and twelve male and female Russian athletes of regional or national competitive standard were recruited from endurance and power sports. Genotypic data of athletes were compared to 1,277 controls. Aerobic and anaerobic performance parameters in 90 rowers were evaluated by PM 3 Rower Ergometer and Max 3B Gas Analyzer. CNB (calcineurin B) 5I/5D, HIF1A (hypoxia-inducible factor 1, alpha) Pro582Ser, NFATC4 (nuclear factor of activated T-cells, calcineurin-dependent 4) Ala160Gly, PPARA (peroxisome proliferator-activated receptor alpha) intron 7 G/C, PPARD (PPARdelta) +294T/C, PPARG (PPARgamma) Pro12Ala, PGC1A (PPARgamma coactivator-1-alpha) Gly482Ser, PGC1B (PPARgamma coactivator-1-beta) Ala203Pro, TFAM (transcription factor A, mitochondrial) Thr12Ser, VEGF (vascular endothelial growth factor) 1057;-2578A, UCP2 (uncoupling protein 2) Ala55Val, UCP3 (uncoupling protein 3) -55C/T gene polymorphisms were determined by PCR-RLFP. We found significant association of gene variants with maximum values of VO2max (NFATC4 Gly, TFAM Thr, UCP2 Val alleles), oxygen pulse (PPARA G, PGC1B Pro alleles), aerobic power (CNB 5D, VEGF C alleles), maximum power output (PGC1A Gly, PGC1B Pro, TFAM Thr alleles), anaerobic threshold (%) of VO2max (PGC1A Gly, NFATC4 Gly, HIF1A Pro alleles). To determine whether these allelic variants are overrepresented in endurance-oriented athletes, and therefore may be advantageous for aerobic performance, allelic frequencies of genes were compared between athletes (n=1,312) and controls (n=1,277). As expected, the frequencies of PPARA G (87.2% vs. 83.2%; P=0.01), PPARD C (18.3% vs. 12.3%; P<0.0001), PGC1A Gly (71.5% vs. 66.2%; P=0.018), TFAM Thr (16.1% vs. 12.5%, P=0.05), UCP2 Val (44.2% vs. 33.9%; P=0.014) alleles were significantly higher in endurance-oriented athletes than in controls, but no difference was observed in allelic distribution between power-oriented athletes and controls, indicating that these gene variants may play an important role in determination of individual differences in aerobic performance of athletes.

Keywords: Genetics, Aerobic Power, Genotype