E.L.Ⅰ Hypothalamic regulation of energy metabolism

Tetsuya SHIUCHI
Department of Integrative Physiology, Institute of Health Bioscience, The University of Tokushima Graduate School.

Energy metabolism is precisely regulated by communication between peripheral tissues and brain. Hypothalamus is the main conductor in brain for whole body energy metabolism. Almost all energy signals are sent to hypothalamus from peripheral through blood and/or neuronal afferent pathway. Accumulated information of whole body energy state is integrated in hypothalamus, thereby maintaining whole body energy homeostasis via autonomic nervous system and endocrine system.

We also found central regulation of energy metabolism and exercise activity as follows;

1) Anticipated response for feeding followed by expected (sweet) taste stimulation activates orexin neurons with increase of sympathetic nerve activity and glucose metabolism in skeletal muscle selectively via ventromedial hypothalamus and β2-adrenergic receptor.

2) Hypothalamic leptin-induced glucose uptake in skeletal muscle does not need the AMPK activation, which is required for glucose uptake in skeletal muscle by exercise or muscle contraction.

3) ICV injection of ghrelin reduces wheel running activity of spontaneous high running active rat via independent pathway of feeding regulation.

Taken together, brain including mainly hypothalamus is an important area for regulation of peripheral energy metabolism. Future studies dealing with energy metabolism may think about the relationship with brain even in exercised condition.

E.L.Ⅱ The genetic factors in the adaptation by exercise training or physical activity and the exercise behavior.

Haruka MURAKAMI
National Institute of Health and Nutrition

Purpose: The goal is to provide readers with an overview of genetics in exercise science.

Basics of the human genome and polymorphisms: Our genetic information is comprised of DNA located in both the nucleus and the mitochondria. Specific sequences of just four nucleotide bases: A, G, C, and T, provide the genetic information. The sequences in nucleotide bases show slight differences in each individual and contribute to each individual's unique anatomy, physiology, and disease predisposition.

Exercise genomics: It was begun to investigate genetic differences that may affect fitness or performance at the DNA level in the 1990s. Recently the study of exercise genomics becomes very large. The polymorphisms of FTO gene, which is a strong candidate gene for obesity-related phenotypes, have been reported to be associated with body fat responses to exercise training. In addition, it has been reported that the increased risk of obesity owing to genetic susceptibility by polymorphism of FTO gene can be blunted through physical activity. We also have reported the interaction between MTHFR genotype and intensity of physical activity on plasma homocysteine level as a risk factor for vascular disease. Now, progress in exercise genomics is being made. However, in order to apply successful exercise intervention that employs the use of genetic information to elicit the best response possible from each individual, high-quality research designs and replication studies with large sample sizes are needed.

Key Word: the individual difference, polymorphisms, physical activity