

Research Article

The role of exercise genomics in preventive medicine

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Dear Editor

Regular exercise and physical activity are effective preventative measures for over 25 chronic medical conditions, including cardiovascular disease and premature death. According to the World Health Organization, physical inactivity is the fourth leading risk factor for death, killing about 3.2 million people annually (1). It is accepted that an individual's behavior is due to three factors: biological/genetic influences, environmental influences, and/or the interaction between biological and environmental factors. There are biological/genetic differences in sexual activity that are distinct from environmental influences on activity (2). Today, the development of genetic evaluation methods throughout the human genome has made it possible for sports scientists and physicians to study genetic factors that play a role in regular physical activity and exercise in preventing chronic diseases. Studies have shown that there is an interaction of the gene × physical activity in reducing the risk factors for type 2 diabetes, obesity, and cardiovascular disease. In the following, we will review several studies in this regard.

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Diabetes

According to the American Diabetes Association, the risk of T2D is associated with age (increased risk in people over 45), overweight, obesity, and lack of physical activity (3). Studies show that aerobic exercise increases insulin function and glucose metabolism in healthy people and people at risk for type 2 diabetes. Exercise often normalizes plasma glucose levels by improving insulin sensitivity and glucose transport (4). Several preliminary studies on the interaction of gene × physical activity have focused on adrenergic beta-2 receptor (ADRB2) variants. One of the first interaction studies was conducted in French men and focused on obesity (BMI and waist circumference) in which Meirhaeghe et al. Reported a strong association between the ADRB2 Gln27Glu and the body mass index in inactive men (5). In another study, Corbalan et al. found that recreational physical activity modulated the effect of the Gln27Glu single-nucleotide polymorphism of the ADRB2 on the risk of obesity in Hispanic women (6). A number of studies have investigated the interaction between the peroxisome proliferator-activated receptor gamma (PPARG) and physical activity on risk factors for type 2 diabetes.

Franks et al reported that physical activity and dietary fat composition (ratio of unsaturated to saturated fatty acids) had an increasing effect on fasting insulin levels in homozygous PPARG Pro12Pro individuals (7).

Obesity and cardiovascular risk factors

A variety of factors caused obesity, including environmental, biological, social, nutritional, psychological, and genetic influences. Obesity is primarily the result of an imbalance between energy intake and energy consumption. One of the main reasons for this energy imbalance in obesity is low levels of physical activity or excessive calorie consumption (8). Obesity and body mass phenotypes have long been known as clusters in families. Obesity is a complex disease in which multiple genes may be responsible for genetic susceptibility. Recent years have been an exciting time in obesity research with the discovery of several genes in which mutations that disrupt or greatly reduce the function of their protein products cause forms of obesity syndrome in humans (9). In addition to identifying the genetic diversity associated with obesity and the response to exercise, great strides have been made in establishing the relationship between genes, physical activity, and their interactions in determining how these factors affect body composition. Since 2000, which is updated annually, Bouchard et al. Began compiling reports of gene-exercise interactions and related physiological outcomes in a document entitled “The human gene map for performance and health-related fitness phenotypes” (10). In the final update of that report, the authors described 71 autosomal genes that significantly interacted with physical activity or exercise to influence body composition.

There is ample evidence that physical activity and exercise have beneficial effects on disease prevention. As highlighted in this brief study, individual differences in response to physical activity and exercise play an important role in the benefits of physical activity. And has regular exercise. Given the significant advances that have been made in the acquisition of technologies and individual differences in response to physical activity, it seems that the study of genomic features and metabolic pathways and systems responsible for individualization with adaptations to exercise is essential. The challenge of using gene-specific interaction information × exercise and how to do it remains. Several recommendations have been made for using genetic information to improve intervention strategies, including physical activity or exercise (11). First, genetic markers that are highly reproducible and strongly predict the body's response to exercise must be identified. This requires prospective sports intervention by genotype studies, which focuses primarily on changing body composition to identify potential genetic markers. Second, the ability to quantify genetic markers that must be accurate, cost-effective, and functional. Genomic information evaluation technology is becoming faster and less expensive every day, so it will be possible to quickly evaluate a person's specific genetic information in the future.

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