Short Communication

The Sport Genes and Athlete’s Performance

Narges Baratinezhad¹ and Mahdi Esmaeilzadeh²

1. Bs Student of Physical Education, Payame Noor University, Bojnourd, Iran
2. Young Researchers and Elite Club, Shirvan Branch, Islamic Azad University, Shirvan, Iran

Corresponding author email: mehdi_dna@yahoo.com

Key words: Sport, Gene, Athlete’s Performance

Abstract

Genes are heritable units, made of a sequence of deoxyribonucleic acid (DNA) contained in every cell of body. They act as codes to produce all the proteins and determine all characteristics. Research has found that genetics may determine 20-80% of an athlete’s performance. Genes also account for half the variation in the response to physical training. Genes are probably even more important than training in explaining differences in performance between athletes.

Introduction

Researchers have found that our abilities to perform strenuous physical activities is dependent on a number of our genes (Yang et al., 2003). We all have two copies of each gene, one inherited from our dad and the other from our mom. Not only a particular gene, but also a specific variant of the gene is found more commonly in athletes, depending on what type of sports they perform, power or endurance type.

In 2003, a group of scientists from Australia demonstrated that ATCN-3 gene is closely related to athletic performance (Roth et al., 2008). ATCN-3 gene produces the protein α-actinin-3 expressed in fast-twitch muscle fibers and is responsible for generating force for high-velocity movement that is important for power sports. Two alleles of ACTN-3 have been found - R allele, producing the most active form of the protein and X allele, producing the less active form of the protein. The scientists found that male elite sprinters have a much higher frequency of RR alleles of ATCN-3 gene than male endurance athletes and non-athletes. Elite endurance athletes predominantly possess the RX alleles. Studies by other research groups confirmed that there is extremely low to no frequency of XX alleles in most elite power athletes and this result is consistent in different racial groups accounted for in the studies.

Another potential ‘sports’ gene with distinct allelic drifts between power and endurance athletes is the ACE (Angiotensin converting enzyme) gene (Gaygay et al., 1998). ACE activates a hormone angiotensin that regulates constriction of your blood vessels, which in turn, controls the rate of blood flow through the circulatory system of your body. Thus, ACE activity regulates blood pressure and has an effect on cardiac health. ACE also helps retain salt-water in your body that allows cells to stay healthy and metabolize better to produce lots of energy (Meyerson et al., 1999). The two most common variants of ACE are I and D (Nazarov et al., 2001). The I allele produces the enzyme with lower activity and the D allele produces the enzyme with increased activity. Scientists have found that endurance athletes like rowers and triathletes have a higher frequency of the I variant while the power athletes like elite swimmers and sprinters tend to possess the D allele (Woods et al., 2001). Many other genes related to respiratory capacity and cardiac health are being widely studied as associated with improved athletic capabilities. One such gene NRF1 is found more active in endurance athletes. And there are many more to add to this list that help determine an athlete’s potential or limitation (Ostrander et al., 2009).

So far, researchers have shown that apart from behavioral and environmental factors like rigorous training and exercise that are mostly accounted for contributing to athletic excellence, genetic predisposition also steers one’s chance towards being the star athlete. Some national team coaches even think it is beneficial to have genetic testing done on the candidates during selection of national team members. It will help them choose the handful who have the right genetic variant and thereby providing them with rigorous training, they can build a ‘superpower’ team.

Perspective

It is beneficial if the athletes have a basic knowledge of genes that relate to one’s athletic abilities. A detailed knowledge of those complex pathways by which these genes work is, however, not necessary. It is sufficient to know about...
the genetic variants and how they affect the physiology with respect to better athletic performance. It is, of course, not expected that every athlete has the right combinations. But, if they have the basic genetic knowledge that build up their ‘athletic’ physiology, it will be useful for them to customize their diet or training accordingly to promote better health and performance. Consider the example of the kid carrying one good copy of the gene regulating oxygen-carrying capacity of the blood. To supplement his genetic build-up, a diet rich in iron would make up for his inherent less oxygen-carrying capacity. He can also join specific yoga classes to help him be trained to be able to hold more oxygen volumes in his lungs.

It can become a matter of debate if the genetic information of the elite athletes would be made public. With genetic testing made widely available, it may happen that an athlete’s genetic information is made available on trading cards just like their height and weight. On top of this, the exposure of their genetic information to the public will leave them with almost no privacy. Alarmingly enough, the public exposure of their genetic information may even lead to viewing of the athlete’s successes to be generated not only from how well they perform based on years of perseverance but also from just their inherent traits.

However, it is not wise to consider one’s athletic abilities to be dependent on only the variations of a single or a couple of genes. The way our physiology is maintained in response to a network of genes and genetic pathways is far more complex than we can imagine. Gene expression is an entire field of study that investigates all those factors that help the expression of a gene to produce the functional protein. There are instances where you have the correct gene variant on your DNA strand, but it does not get expressed. It can be based on several factors like the effect of neighboring stretches of highly silent DNA regions that eclipse the gene expression, presence of other silencer proteins inhibiting gene expression or absence of the helper proteins called transcription factors to induce gene expression. Thus, it seems less likely that all of the best athletes on this planet have the exact combination and proportionate expression of all the ‘superpower’ genes. Studies of the ATCN3 in a famous Olympic long jumper show that he has no copies of the R variant, but still he is the star. There are lots of environmental factors like nutrition, coaching, careful planning and a disciplined lifestyle that play a major part (Ostrander et al., 2009).

Conclusion
The knowledge of genetics would help to know more about what body needs more or it already has sufficiently. This will help training and diet planned better to suit needs. Have a positive mental attitude and keep working out harder, there is no reason why a person can’t be a great athlete.

References