



Futuristics “OMICS” in Sports Medicine

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Basic aim of “omics” in sports medicine is to improve performance and reduce the risk of injury in athletes. The performance of athletes is affected by genomic profile, diet, training, drug intake etc. Genomics hold the key for the future of sports medicine. Various studies have reported on futuristic role of omics and monitoring system in sports and existing evidences propose a scope of integrative research in biochemistry and sports medicine.

Omics has an important link with sports medicine at molecular level mechanisms and pathways for reducing the risk of sports injury, faster rehabilitation and performance enhancements. Athlete status itself is a highly heritable trait, with between 66% and 70% of the variance due to environmental factors that include training, nutrition and motivation. Many physiological and performance related parameters have a substantial genetic component.

Human physical performance traits depend upon interaction of multiple intrinsic and extrinsic factors: namely, environmental, genetic, physiological and psychological factors.

Various ‘omics’ in sports include sports genomics, athleteome, sports nutrigenomics

- **Sports genomics:** Aims to develop molecular methods that will be used for medical practices, personalised exercise training, nutrition prescription and prevention of sports related injury.

This scientific discipline focuses on the organisation and function of the genome and aims to develop molecular methods that may be used for medical practices, personalised exercise training, nutrition prescription and prevention of sports related injury [1,2].

- **Genome wide association studies (GWAS):** GWAS platforms can screen one million DNA loci simultaneously. The athlete genes of interest can be identified using this technique [1]. ATHLOME.
- **Project consortium:** focuses on training, underlying exercise related injuries and epigenetic alterations [1].

- Some DNA single nucleotide polymorphisms (SNP) can be associated with athlete performance and level.
- **Sports nutrigenomics:** An interest is seen in researchers regarding gene diet interactions on biomarker of nutritional status of athletes [2]. An athlete is exposed to food, beverage, nutrient or bio active. Genetic variant such as SNP associated with a nutrient component modifies the individual’s response to that component. The spread of nutrigenomics could be of massive help for the athletes to find the right diet.
- **Epigenomics:** A new class of epigenetic markers known as the chromosome conformational signature is promising to investigate changes in organizational genome investigations in regulating exercise responsiveness. Plays important role in sports and exercise training, these include DNA methylations, histone modifications, microRNAs. Epigenetic mechanisms underpin an intrinsic ability of the human body to “memorize” training adaptations and epigenetic markers of training adaptation are retained in skeletal muscle even after periods of detraining.
- **Sports genomics:** Potential to maximise athletic performance and prevent injuries by specific dietary intake tailored to athlete’s micro biome. Genes like IGF1, GH g, ACE, EPO, PPARGC1A and B, PPAR, VEGFA, HIF1A, GDF8, ACTN3, have been identified for increasing muscle strength, endurance and muscle mass. Adverse effects like metabolic disorders, cardiovascular and renal disorders are associated with them [1].
- **Other ‘-omes’ include:** Microbiome, genome, epigenome, transcriptome, metabolome, nutrigenomics, and proteome.

Gene doping

- **Gene doping:** is non-therapeutic use of gene therapy by healthy athletes to improve physical performance in sporting competition and it used by athletes to enhance physical performance.

Various exogenous genes utilized for gene doping practices include erythropoietin (EPO), vascular endothelial growth factor, growth hormone, insulin-like growth factor 1, phosphoenolpyruvate carboxykinase 1, myostatin etc.

- **Genome editing:** CRISPR/ Cas system is the tool used for gene editing. And used in gene doping. World Anti-Doping Agency (WADA) has prohibited gene doping in 2003 to stop illegal use of gene doping in sports [1].

The advancing field of lab medicine has an important link with sports medicine to implicate various cellular level mechanisms and pathways for reducing chances of sports injury or faster rehabilitation after sport injury.

With recent advances discovery of new biomarker for sports and exercise using microbiome, genome, epigenome and other omics such as transcriptome, metabolome and proteome that would affect human performance. This would form the basis for formulating training programs and disciplined lifestyle habits for training and management of athletes based on the molecular data.

Bibliography

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