

Biomarkers in Physical Activity and Sport – recent developments

¹Prof. Dr. Dhurata Bozo

¹*Institute of Sport Research, Department of Research in Applied Movement. Tirana, Sports University of Tirana, Albania. Tirana, Albania*

Contact: dhbozo@ust.edu.al

Field of study: Biology of exercise

Type of study: Review

Type of presentation. Oral presentation. ISR. 08.05.2019

Abstract

Biological, biochemical and genetic indicators such as proteins, metabolites, electrolytes, enzymes, nucleic acids and other molecules are widely used as biomarkers for athletes and recreationally active individuals. Their utilizations covers different purposes and areas: assessment and monitoring of the health status of individual who exercise for different purposes and or athletes in the context of their sport performance; assessment of fitness and performance along generic or programmed physical activity for population and athletes, the effects of such activity for health and sport performance, including particular physiological and or pathological conditions. For the athletes, use of biomarkers for the assessment and monitoring of the biological and physiological recovery following competition is of particular importance. The types of markers that are used in the context of physical activity and sports are many and varied. The biomarkers used for these purposes are of a biological, biochemical, physiological and genetic type, or a combination thereof. By chemical composition, they may be protein molecules, metabolites, electrolytes, DNA-RNA and / or other. The manner and context of the use of biomarkers is very important. Specific and individual biomarkers seem to have little value in assessing the complexities or physiological changes associated with physical activity and sport: for example, overall health, post-exercise recovery effects of exercise on cardio-respiratory capacity, muscular efficacy, etc. Values and changes of individual markers may occur because of causes other than exercise; health condition, exercise itself, injuries caused by exercise or otherwise.

On the other hand, different biomarkers do not have the same value in detecting, for example, injuries to athletes and athletes in general. Lack of well-defined standards for sports discipline or sub-discipline to be used as a reference, renders their individual use less informative and misleading. In addition to the above, the characteristics that biomarkers cover represent a very large degree of inter-individual diversity, making it difficult to compare relative changes. In conclusion, biomarkers are always used in combination, specially selected and in a context appropriate to the purpose of their use for the assessment of health status, sport performance, physical / sports impairment and post-exercise recovery process in the appropriate individual / group / population context, taking into account the natural, cultural and socio-economic variability of individuals, races, populations, communities. The timing, duration and frequency of biomarker evaluation in the context of various sports activities is as important as the evaluation and analysis itself. Biomarker scorecards are determined ad hoc and depending on the type, intensity of exercise / sport and the purpose / context of their use. In general, it is recommended to perform more frequent baseline tests (2-3), away from training / competitions moments; individual reference values 1-2 before and after group workouts or mid-season training; data on optimal and comparable baseline performance and identification of the most

significant individual indicators for further monitoring. There are also recommended testing between competitions (but not immediately before and after them), acute and ongoing injury testing to monitor recovery mechanisms at the biochemical and physiological level. In all cases, the analysis of data from biomarkers should be combined with those of a geographical, psychological, ethological nature, etc. according to the context.

Biomarkers assess a wide range of individual or group population characteristics. These include evaluation of Nutritional and Metabolic Status, Macro and Micronutrient Metabolism, Various Food Allergies, Body Hydration Condition; Haematological and urinary markers; Biomarkers of muscle and cardiac health in particular; Markers that evaluate the hormonal response to exercise and vice versa; Whole amino acids / proteins and those associated with exercise; Post-exercise Recovery Markers; Cardiovascular Performance and Stability Biomarkers; Damage and Risk Biomarkers; General and / or Local Inflammatory Biomarkers; Genetic markers directly related to fitness and Performance that respond to exercise-dependent biochemical, physiological markers.

Recently, the use of genetic markers or candidate genes related to physical activity, fitness / health and sports performance is gaining ground. Although studies are numerous and there are controversial opinions about some of the genetic markers of fatigue in the context of their use in the field of fitness and sport, they are used to evaluate, predict and inherit a range of parameters such as: endurance and strength exercises; muscle strength and anaerobic capacity; genes responsible for hemodynamic indicators influenced by acute and chronic exercise and hemodynamic gene-marker interactions as a result of exercise; genes responsible for exercise intolerance such as inherited arrhythmias influenced by exercise; interactions between genes responsible for biochemical indicators and response to exercise; candidate genes responsible for response to exercise on physical body markers such as BMI, body composition, fat distribution, and the dynamics of their variation depending on the type, regularity, and intensity of exercise; genetics of the regulation of glucose, insulin, fat and lipoprotein metabolism and their interconversion pathways in response to various forms of physical activity; genetic factors in attachment and adherence to exercise; the genetic basis of obesity; and others.

Key words: *biomarkers, physical Activity, sport performance, bio-chemical indicators, sport-related markers, genetic basis of fitness*