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CONTRIBUTION of SCIENCE TO IMPROVE SPORTING PERFORMANCE (comments)

Sporting performances are constantly improving over the centuries. How does science improve sports capabilities?

Athletic performance is the maximum possibility of an individual in a discipline at any given time.

Different factors are taken into account in the athletic performance of an individual such as :

Biological: the biological factor or the use of physiological and muscular abilities at the service of the effort, allows to optimize the intensity, the actions but also the mental capacity of the athlete.

Technique : it concerns the mastery of gestures, techniques, postures and attitudes relating to a sport. A very thorough and indispensable technical mastery for the high level.

Techni quo-tactic: the tactic is to adapt its way of acting according to the situation and the opponent by proposing appropriate solutions.

Psychological: the psychological aspect of performance is fundamental. It is the decisive element of performance in many sports (insofar as other achievements, physical, technical and strategic are in place).

Social : the competitor is also a human being who is in a social and relational context on the day of the competition. This aspect can have an impact on performance.

Chance : this factor that can be controversial nonetheless exists. It conditions the external and non-controllable elements around the performance (example: for outdoor sports: the weather).

During sports training all these factors must be taken into account and developed in order to train the perfect sportsman. What Sciences have helped to develop these notions ?

Some Sciences allow to develop these notions such as :

The physiology of studying the functions and properties of organs and tissues of living beings; its functions.

The anatomy that is the study of the structure and shape of living beings as well as the links between their different organs.

Biochemistry which is a part of chemistry that deals with vital phenomena.

These Sciences have made it possible to have a better knowledge of the human body and contribute to technological advances conducive to performance. The great discoveries that have emerged from this research are :

- Structure and muscular functioning
- energetic metabolism of the muscle
- the nervous control of the movement
- hormonal regulation during the exercise
- energy expenditure, nutrients used during the exertion
- the cardiorespiratory system and its Control

The organ that is major in the practice of a sport is the muscle it is composed of muscle tissue and connective tissues that are the blood vessels and nerves.

The main characteristic of muscular tissue, from a functional point of view, is its ability to transform a chemical energy (in the form of ATP) into mechanical energy.

To contract the skeletal muscle needs chemical energy in the form of ATP but, in the muscle, there are few ATP reserves (the stock of ATP is exhausted in about a few seconds) so, this one must be regenerated as and when measured by different Energy pathways.

The formation of ATP is very powerful but of short duration. During a long-term effort the metabolism (body) transforms fats into ATP.

- The different energy regeneration pathways:

The muscle cell has three regeneration pathways :

- The aerobic pathway (presence of oxygen), pathway of cellular respiration. (ex: 5000m)
- The anaerobic (no oxygen) pathway, lactic fermentation pathway. (ex 400m)
- The anaerobic (in absence of oxygen) alactique route, pathway of phosphocreatine, pathway of immediate regeneration. (ex: 100m)

The muscle uses energy obtained mainly by the oxidation of fats that corresponds to lipids and carbohydrates that are carbohydrates in aerobic condition

There are three types of muscle fibers:

- type I muscle fiber, slow contraction

-Type IIa muscle fiber, fast twitch

-type IIb muscle fiber, rapid contraction

Each type of muscle fiber has its own characteristics and is suitable for a particular kind of effort. They have different contractile and metabolic properties, which class as muscle fibers with fast or slow contraction.

Type I muscle fibers are used in most of our daily activities such as endurance activity such as long distance runs. These fibers are the least voluminous. They endure muscular contractions over long periods of time but do not develop a great force. This type of muscle fiber uses oxygen to transform glycogen into ATP, so they belong to the aerobic pathway.

The type IIa muscle fibers have a higher and larger contraction speed. They are less enduring than type I muscle fibers but can produce greater strength. These muscle fibers can generate powerful movements for a short period of time, for example Rugby and handball. Their ability to use oxygen to produce energy is lower, but they use muscle glycogen to produce ATP, so they belong to the aerobic stream but both to the anaerobic pathway.

Type IIb muscle fibers are the least enduring and the most voluminous. They generate the most power thanks to their strength and their speed of contraction.

This type of muscle fibres appear during activities that require very powerful efforts over a short period of extreme time as for example a 100meter in Sprint or a 50meter in swimming. It uses only muscle glycogen to produce ATP so they are a part of the anaerobic pathway.

Each discipline requires very different efforts and in all cases, food is of paramount importance, since all share the calories and their distribution. Depending on what you bring to your body, this one will be able or not to develop these qualities. Force training requires a consequent caloric intake, as these efforts consume a great deal of ATP.

To be stronger the perfect meal should be made up of 60% carbohydrates, 30% protein and 10% lipid.

Proteins are found in white meats such as chicken, some red meats such as beef, fish and eggs are the preferred sources of protein. The amount of protein should be 25G per day.

For carbohydrates that provide energy over a long period of time without a drop in performance they are found in sweet potatoes and complete rice for example. It is advisable to consume 300g per day.

Lipids are important because they stabilize glucose levels and also provide energy. They are found in the different oils.

To be the most endurant the perfect meal consists of 40% carbohydrates or 100g per day, 40% proteins, 30g per day and 20% of lipids.

Today science allows us to know the nutrient inputs specific to each discipline in order to better improve the sporting performance but these discoveries have also led to the birth of dietary supplements specific to the athlete's needs.

Food therefore has a major and essential role in improving sporting performance.

The training is also very important and always perfected in the athletes so that it is best suited.

The notions of training and performance are complex and come from scientific studies whose basic notions are known but some details change over time. This leads to the improvement in technology.

The training represents all the processes used to improve the physical, physiological, psychological, technical and tactical qualities in order to achieve in a given time the best performance.

- Adaptation of the organism during aerobic training (in the presence of oxygen)

- use of circulating fatty acids (preferential substrate)

- adaptation of the cardiovascular function to the effort (decreased resting heart rate and resting blood pressure)

- Increase of maximum oxygen volume (VO_{2max})

- increase in muscular blood flow (better intakes of oxygenated blood to the muscle)

- Increase in the share of type I fibres

- delayed lactic threshold (best stress tolerance)

The VO_{2max} allows to determine endurance, it is today an important factor of performance. It has a support as well as heart rate to put in works adapted programs but also to realize the state of the athlete and allow him better recovery. With these new methods there is less injury because we know better the limits of each.

In conclusion science is today at the heart of sports and ways to improve athletic performance are many such as the diet that is to bring different fibers the nutrients to muscles that they need. The training is unique and now allows to be more on thanks to the VO_{2max} . We decided to be interested only in these two but the examples are many such that the equipment that continues to develop so we can ask what will be the new innovations of science to improve our performance Sports.