Abstract

This habilitation thesis consists of two parts. First part presents some of the scientific results obtained starting from 2009 and the second part is assigned to the development of professional, scientific and academic career.

For me, the focus point was to research the adaptation of the body to effort and different factors that might/could have influence on the physical performance.

First of all, when we refer to the relationship between water and physical effort we are thinking to dehydration in physical effort.

During the physical effort, especially the endurance effort, the water elimination increases. Dehydration due to effort, calculated on the basis of athlete weight loss varies depending on: the effort type (aerobic, anaerobic or mixed effort), the effort intensity and its duration; the level of training; the environmental factors (temperature and humidity).

Rehydration during effort is extremely important. The balance between dehydration/rehydration on athletes is influenced by the water and electrolytes (Na^+ and mainly K^+) losses during effort and their counterbalance through the exogenous intake, considering that the negative results of the hydroelectrolytic balance are detrimental to the body.

The acute dehydration induced by effort can be associated with heat dehydration. The studies revealed the water volume intake should be approx. 150% bigger than the deficit in order to compensate the losses. For endurance athletes fluids containing carbohydrates and electrolytes are recommended. Ingested carbohydrates (30-60 g) are rapidly absorbed.

In the attempts to induce rehydration, recent data revealed the beneficial effects of glycerol oral administration, as well.

Biorhythms or biological rhythms are phenomena characterized by cyclical, periodical and systematic variations of different durations, amplitude and frequency of certain biological functions, caused by the periodical fluctuations of some environmental factors.

The biorhythmic qualities of human body represent the combined result of adaptation to the natural factors from the surrounding telluric environment (light, humidity, pressure, magnetic field, gravity, airstreams, etc.) or cosmic environment (moon phases, cosmic radiation, sunspots, planetary relationships etc.).

Most biorhythms, especially circadian rhythms, have influence upon physical activity and sport performance. From the sportive point of view, the physical cycles is the most important, since it determines the physical comfort state and physical performance; the emotional cycles has influence on the physical comfort state; the intellectual cycle plays a secondary role in the physical performances.

When we refer to physical effort, especially the agonistic one, diet is of major importance for achieving high performances. The intake for athletes varies depending on: the profile of sport discipline; the effort degree and intensity; the effort phases, training period; number of training hours / day; gender; age; weight; anthropometric biotype.

The athletes' food intake should provide: capacity to withstand effort under quantitative aspect or global caloric need (basal need, effort variable need, consumption occurred due to thermoregulation, capacity to withstand effort under qualitative aspect; post effort recovery; health maintenance.

Current opinion is that the immune system response to training is dual: the acute and moderate physical effort decreases or has no influence on susceptibility; physical repetitive vigorous effort increases the susceptibility to infections in athletes by inhibition of the immune system.

Mechanisms through which physical effort has beneficial effects on reducing the susceptibility to infections are: setting up an unfavourable environment for pathogenic agents by increasing the temperature in effort; modification of the balance between the activator and suppressor factors of immune system during effort; body's response to stress and hormones influence: cortisone, adrenaline, body fat reduction; favorable changes in the immune system components through increasing the body's resistance by boosting the immune system.

Physical effort represent a limiting factor for the human performances in underwater environment. Decrease of the effort capacity in underwater environment, in elevated ambient pressure is caused by several factors, such as: the increased strength of thoracic walls; hypercapnia and hyperlactacidemia; thermoregulatory disorders; changes in circulatory system; nitrogen narcosis; oxidative stress during effort.

Detrimental effects of physical effort in hyperbaric conditions are determined by: the saturation of different tissues taking place at different velocities; it is estimated that after 12 hours the saturation is complete, and the partial pressure gradients between the dissolved gases and those in the lung alveoli disappear; potentiation of nitrogen narcosis; favorization of certain

symptoms of dysbarism (e.g. decompression illnes); the increase of pCO_2; hyberbaric oxygen toxicity.

Deprivation of the body to receive enough oxygen (O_2) at a certain moment, for a certain reason is called hypoxia. *Hypoxia* is therefore defined as the O_2 deficit in tissues. *Hypoxaemia* is the decreased O_2 in arterial blood. *Anoxia* is the absence of O_2 reaching the tissue.

Hypobaric hypoxia has several forms: a) According to the decrease of pO_2 in different conditions of atmospheric pressure the following forms of hypoxia occur: *hypobaric hypoxia*, which is the decrease of pO_2 at low atmospheric pressure (less than one atmosphere = 1 ATA or bellow 760 mmHg); *normobaric hypoxia* , which is the decrease of pO_2 at normal atmospheric pressure (of 1 ATA); *hypoxia hiperbară,* which is the decrease of pO_2 at high atmospheric pressure (over 1 ATA) and b) hypoxia occurred in hypobaric conditions which are divided in *acute and chronic,* depending on their duration.

The high interest currently manifested for nutritional and non-nutritional exogenous antioxidants for maintaining the redox homeostasis in physiological and pathological conditions, and my personal activity developed in the field of physical education and sport convinced me to study the administration of Q_{10}, coenzyme, which is a vitamin-like non-enzymatic antioxidant, in the oxidative stress caused by physical effort.

Regardless of the manner in which CoQ is used, as a stimulating agent for the immune system, as a protective agent against aging, as a weight loss agent, or for decreasing arterial tension or healing periodontal diseases, its efficacy is now generally acknowledged by the researchers and scientists.

Due to its impact on increasing sport performance, CoQ_{10} is a dietary supplement used by the endurance athletes for energy production in the mithocondria at the level of skeleton muscles or at the heart level (Snider IP, Bazzarre TL, Murdoch SD et al1,1992, Braun B, Clarkson P, Freedson P et al,1991). This affirmation is supported by the corroborations regarding the decrease in CoQ_{10} deficiencies, enhancing the level of CoQ_{10} in blood and the improvement of mitochondrial bioenergetics as a result of administration of CoQ_{10} supplements in patients with muscle or cardiac pathology (Folkers K, Vadhanavikit S, Mortensen SA, 1985, Ogasahara S, Nishikawa SY, Yorifuji S et al,1986, Bendahan D, Desnuelle C, Vanuxem D, et al, 1992). There are evidences proving that CoQ_{10} acts like an antioxidant destroying free radicals and diminishes lipid peroxidation. Furthermore, ist has been proved (Koyama T, Keatisuwan W, Kinjo M et al, 1992) that CoQ_{10} has a

protective role against excessive reduction of phospholipids in mitochondrial membrane during long duration physical exercises.

Our researches on human subjects, based on non-invasive methods, reveal the presence of certain modifications which are noticeable even on salivary and urinary level and which haven't been explored by other authors.

These modifications might be caused by both the variations in general redox homeostasis and the implications of O/AO oral, salivary (Alexa C, 2006) and renal (Tache S, 2002) balance in effort.

Use of CoQ_{10} supplement and physical training help to increase the aerobic capacity in effort and the antioxidative defense in athletes. The supplementation effects have been studied on young athletes, who have the level of CoQ_{10} in blood within the normal limits, the physiological decrease occurring after 30 years. Salivary findings are useful and can be recommended in the non-invasive study of oxidative stress in physical effort.

The part assigned to the professional, scientific and academic career development plan shows in detail the proposed objectives for the academic teaching career development: implication in institutional development; improving the effectiveness of didactic activity; efficient implication in teaching students as well as the activity of scientific research, the factor that makes the difference between performance and visibility in institutions for higher education, contribution to knowledge by means of scientific research influencing all other activities. However, the main goal is to improve and increase the efficiency of scientific activity.