

COMPARATIVE ANALYSIS OF THE BODY'S ADAPTATION MECHANISMS

Author(s)¹ Mihai Constantinescu

Institutional affiliation ¹ Ștefan cel Mare University of Suceava, Romania

Email adress ¹ mihai.constantinescu@usm.ro

Keywords: deconditioning, health, effort, disease, mechanisms

Abstract This study presents the analysis of the mechanisms of adaptation or deconditioning of the organism in conditions of stress/immobilization. It is also, intended to present some specific aspects of these mechanisms in order to be able to predict the future of the evolution of health. In this sense, we will present the two directions that can influence the state of health, well-being or illness.

Introduction

In order to understand the mechanisms of physiological adaptation that can influence health, the factors that can create changes in the body's metabolic processes must be identified. Therefore, we will present some theoretical aspects of the literature on physiological adaptation and the concept of adaptation.

Physiological adaptation - all the processes that allow the maintenance of physiological activities and the survival of the body when the living environment changes. (Exchanges can be: physical, chemical, biological, social.)

The concept of adaptation - the body is said to be an open biological system. The environment, as a factor of existence, causes adaptation reactions on the part of the body. Thus, an interdependence is created between the organism and the environment, which is the basis of a growing science called ecology (from the Greek words "oikos" = house and "logos" = science). Prosser (1964) defined physiological adaptation as the totality of processes that allow the maintenance of physiological activity and survival when the living environment changes due to one or more factors. In the same context, the "concept of stress" is presented as a trigger for adaptation mechanisms. "Constant of the internal environment" (Cl. Bernard) and "homeostasis" (W. Cannon) are considered the basic mechanisms of the existence, adaptation and evolution of biological organisms. Some of them subject the body to "borderline" demands between normal and pathological, which has two possibilities to react: a) adaptation to the new situation or b) exhaustion (illness).

General adaptation syndrome.

The stressors acting on the body trigger two categories of defense and adaptation reactions:

a) "specific reactions", specific to each of the stressors (for example, the action of a microbe triggers specific immunological adaptive mechanisms against it "antibodies" increasing its resistance to a new infection)

b) "non-specific reactions", common to various agents (physical, chemical, biological), of the neuro-endocrine-metabolic type (for example, tachycardia can be found even after a burn. excess, or, another example: leukocytosis is also found after an infection, but also after a hemorrhagic shock or after an intense physical exertion, etc.).

All of these non-specific reactions of the body triggered to deal with any susceptible agent? to compromise its balance, was called by H. Selye "general adaptation syndrome". Cannon described them as "emergency reactions" and Laborit described them as "post-aggressive oscillating reactions" (1955). [7] Both the natural and the social environment can be favorable to human life and activity, as sanogenic factors, but they can also be harmful, as pathogenic factors: for the natural environment they are: alcoholism, irrational food, chemical and physical microbial pollution (radioactive, thermal, sound), etc. and for the social environment are: excessive industrialization, population agglomerations, new social relations: dissatisfaction, fear, disgust, emotions, etc.

These factors of contemporary life as a whole constitute the "stress of everyday life" (according to Selye). or "psychosocial stress" (according to Levi) or "psychobehavioral risk factors" underlying the pathology of adaptation (failure to adapt). In conclusion, depending on all these factors, neuroendocrine reactions may be conducive to adaptation, a situation called eustress, or unfavorable to adaptation. a situation called distress.

The Swedish School of Exercise Physiology, which identified these reactions, thus makes valuable contributions to the clarification of stress in sanogenesis and pathogenesis.

Physical effort - stress factor, is the stimulus (stimulant) that acts on the body in order to increase its ability to adapt to increasing demands. In order for physical exertion to be able to trigger adaptive reactions in the body, certain conditions are necessary, because not every effort initiates them. The essential condition is that this biological stimulus (effort) enters the group of stressors.

Physical exercise can be considered such a factor because it has two stressful possibilities:

- one is physical as a result of intense, unusual muscle activity (the "somatic component of stress")

- the second, no less important is the psychic, emotional one, as a result of the conditions in which the sports activity takes place (competitions with great emotional load) and called "the psychic component of stress".[2; 3; 6; 10]

In the same context, we can specify that stress as a stressor can lead to imbalances between the individual's ability and the task assigned to him, this can lead to trauma or the installation of pathological conditions. Imbalances in the body's adaptive mechanisms can also be triggered by reduced movement to long-term immobilization.

The body's reaction to the conditions of reduced movement. Movement is an integral part of the human body that appears since intrauterine life. In certain pathological conditions there is a limitation of movement to the situation of immobilization. Lack of movement for short / long periods of time is accompanied by temporary motor problems, sometimes leading to permanent sequelae. [1; 5]

The adverse effects on the body go in 3 directions:

- change in metabolic activity and resting muscle hypertrophy;
- bone demineralization;
- disruption of major functions.

Modification of metabolic activity and resting muscle hypertrophy, metabolic changes will be characterized by increased catabolism and decreased oxygen demand. Resting muscle hypertrophy is a reversible change. In severe cases, especially in neurological phenomena, atrophy can occur - the change is irreversible due to the phenomenon of degeneration.

Bone demineralization - it is accompanied by 2 phenomena which are in contradiction with each other and which imply the impossibility of therapeutic administration of calcium. It's about osteoporosis, on the one hand, and hypercalcemia, on the other.[4; 8; 9 p.571; 12] Hypercalcemia - calcium is immobilized in the bones and reaches the bloodstream, then eliminated by the kidneys. The presence of large amounts of calcium in the blood contributes to blood clotting by catalyzing the conversion of prothrombin to thrombin. To this is added venous stasis and dehydration, forming conditions for thrombi (blood clots). [9 p.528; 11] Disruption of major functions: it affects the whole body, most problems on the cardiovascular and respiratory, but there are also problems with the kidneys, digestive and skin.

Purpose and objectives of the study:

Aim of the work is to present for analysis the mechanisms of physiological adaptation of the body in conditions of effort but also in conditions of reduced movement.

Research objectives:

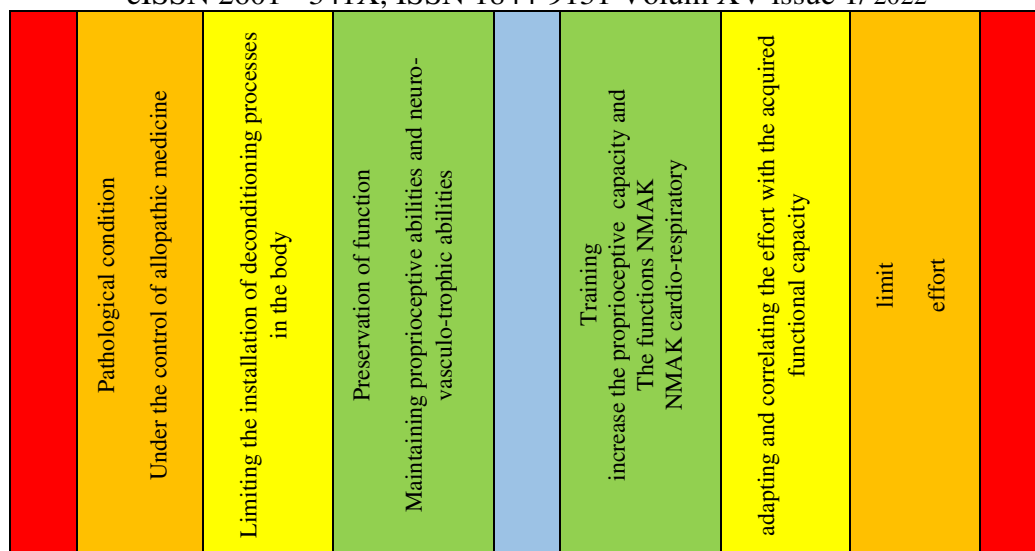
- analysis of the specialized literature regarding to the mechanisms of adaptation of the organism in conditions of stress / immobilization;
- identification of target factors that produce imbalances in maintaining homeostasis and the ability to precede the future of health.

Materials and methods: in order to present a general analysis of the body's adaptation mechanisms, we made a table based on the information gathered from the specialized literature but also from the current medical recovery practice.

Two possibilities have been considered, one of which is the effects that the body has on the condition of reducing movement to total immobilization, and the second direction is presented the effects that the body endures in conditions of increased effort. Also at the extremity of the results of the analysis is the state of pathogenic collapse, where the situation is critical.

Table no.1 Comparative analysis of the body's adaptation mechanisms

Rest/immobilization/reduction of movement				Health condition	Physical effort - stressor			
Pathogenic	Risk 2 pathogen	Risk 1 pathogen	Buffer zone		Buffer zone	Risk 1 pathogen	Risk 2 pathogen	Pathogenic collapse
			Mechanisms of physiological adaptation	Mechanisms of physiological adaptation				



Results and discussions:

It starts with the analysis from the state of health of the subject and then gradually goes through 3 phases to the state of pathology. The first stage is called the buffer zone, where the body meets the conditions for the establishment of physiological adaptation mechanisms. The second phase is called "Pathogenic Risk 1" where the body in case of immobilization is subjected to processes of morpho-functional deconditioning. In this stage it is necessary to put in place measures to combat these processes which may be evolutionary and irreversible. The third phase is called "Pathogenic Risk 2" where the disease is established, chronic and is the responsibility of allopathic medicine. Regarding the phases that are presented in the case of the effort, we will be able to notice that the effort can be managed more easily. It can be identified and managed in both phase one and phase two of "Pathogenic Risk" by adapting or reducing the effort.

Conclusions:

- it can be considered that the reduction of movement is a destabilizing factor of the homeostasis of the organism and represents an essential factor in the installation of the deconditioning mechanisms;
- it can also be found that the deprivation of the body of movement causes the gradual installation of the pathological condition and requires the intervention of a specialist;

The Annals of the “Ștefan cel Mare” University of Suceava.
Physical Education and Sport Section. The Science and Art of Movement
eISSN 2601 - 341X, ISSN 1844-9131 Volum XV issue 1/ 2022

- Stress as a stressor can influence the body's mechanisms for adapting to health when used as training;
- And in case of overload it can lead to imbalances of the adaptation mechanisms.

Bibliography:

- [1]. Clement Baci, (1981), Aparatul Locomotor, Ed. Medicală București, p. 70,71 ;
- [2]. Constantinescu, Mihai, and Elena Vizitiu. (2021), "A comparative approach on the impact of diet and physical activity on young people between 19 and 26 years." Balneo and PRM Research Journal <http://dx.doi.org/10.12680/balneo.12.3.p.265-269>;
- [3]. Corneliu Borundel, (1995), Manual de medicină internă, pentru cadre medii, Ed. ALL, București, p. 786;
- [4]. <https://www.physio-pedia.com/Osteoporosis>;
- [5]. https://www.physio-pedia.com/Physical_Inactivity;
- [6]. Ioan Drăgan, (2002), Medicina Sportivă, Ed. Medicală, București p. 157-166;
- [7]. Ion Apostol (2003), Fiziologie clinică și performanță umană, Ed. Gr. T. Popa Iași p. 8-24;
- [8]. L. Macovei, ȘT. Șuțeanu, (2011), Bolile reumatice pe înțelesul tuturor, Ed. M.A.S.T. București p. 150-160;
- [9]. Leonard Domnișoru, Dumitru Cristea, Nicolae Bacalbașa, Gheorghe Buceag, (2004) Compendiu medicină internă, editura NAȚIONAL, p. 528, 571;
- [10]. Silisteanu, Sinziana Calina, and Andrei Emanuel Silisteanu.(2018) "The importance of physical exercise-bone mass density correlation in reducing the risk of vertebral and non-vertebral fracture in patients with osteoporosis." Balneo Research Journal 9.2 p. 64-68;
- [11]. V.Ciobanu, I.Urseanu, I Stroescu, (1991) Semiologie și diagnostic în reumatologie, Ed. Medicală București p. 56;
- [12]. V.N. Pârvulescu, Rodica Traistaru, (2003) Semiologie și noțiuni de patologie medical pentru kinetoterapeuți, Ed. Universitaria Craiova p. 28.