

## PHYSICAL EXERCISE AS COMPLEX BIOPSYCHOSOCIAL STRAIN

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**ABSTRACT.** The theme of this article covers the benefits of exercise for society. Physical exercise is complex psychophysiological strain on the body, which determines adaptive changes in the functional neuromuscular, cardiovascular, respiratory, endocrine systems, as well as in metabolism, immunity and mental functions. Roles of physical exercise are sanogenetic, anti-aging, diagnostic, and therapeutic. Implications of physical exercise are psychological, social, economic-financial, legal, political and educational. Physical activity through exercise, physical education and sport has an antistress effect and represents a sanogenetic therapeutic strategy in preventive medicine and public health.

**Keywords:** physical exercise, health, stress.

**REZUMAT.** *Efortul fizic ca solicitare complexă biopsihosocială.* Tema acestui articol se referă la beneficiile efortului fizic pentru societate. Efortul fizic este o solicitare psihofiziologică complexă a organismului, care determină modificări adaptative ale sistemelor funcționale: neuromuscular, cardiovascular, respirator, endocrin, ale metabolismului, imunității și ale funcțiilor psihice. Efortul fizic are rol sanogenetic, antiîmbătrânire, diagnostic și terapeutic. Implicațiile efortului fizic sunt psihologice, sociale, economico-financiare, juridice, politice și educative. Activitatea fizică prin mișcare, educație fizică și sport constituie pilonul sanogenetic antistres și reprezintă o strategie terapeutică sanogenetică în medicina preventivă și sănătatea publică.

**Cuvinte cheie:** efort fizic, sănătate, stres.

### General considerations

Physical exercise is complex psychophysiological strain on the body, which determines adaptive changes in the functional neuromuscular, cardiovascular, respiratory, endocrine systems, as well as in metabolism, immunity and mental functions (Derevenco 1992, Foss and Keteyian 1998, Tache and Staicu 2010; Staicu and Tache 2011).

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## **Roles of physical exercise**

### *a. The sanogenetic role*

Exercise is life itself. Physical exercise contributes to the improvement of the major functions of the body:

- in non-athletes, for maintaining the physical health of the body through adaptive cardiorespiratory, immunological and metabolic changes, with the reduction of the risk of diabetes, hypertension, colon cancer; the maintenance of the health of muscles, bones and joints; weight control and prevention of obesity; prevention of sedentary behavior; reduction of stress; reduction of the risk of premature and cardiac disease death (Tache and Staicu 2010; Staicu and Tache 2011).

Studies on physical exercise and its sanogenetic effect in non-athletes have been carried out, for anaerobic exercise (workout on the weight lifting machine) or aerobic exercise (running on the track or on the treadmill; walking at a brisk pace; training on the cycle ergometer; jogging; stair climbing on a machine or on an actual flight of stairs; swimming).

The recommended type of exercise should be moderate in intensity and duration, and constant.

- in athletes, for obtaining physical fitness, with a high sanogenetic degree, a high psychophysiological capacity, a balanced behavior, in order to obtain high performance sports results through scientific training (Drăgan 2002).

### *b. The anti-aging prolongevity and active longevity role*

Physical activity decreases after 30-45 years of age, particularly in women, but the moderate practice of physical exercise is recommended for the increase of survival (Foss and Keteyian 1998, van den Heuvelvi 2006).

### *c. The diagnostic role*

The physical exercise tests performed by non-athletes and athletes allow to assess physical fitness and adaptation limits based on: the determination of exercise capacity – depending on intensity, duration, mechanical efficiency and the balance or imbalance between the requirements and consumption of O<sub>2</sub>, the energy source; neuromuscular, respiratory, cardiovascular, endocrine metabolic adaptation to exercise; fatigue and overtraining (Derevenco 1992, Foss and Keteyian 1998).

*d. The therapeutic role*

The beneficial effects of moderate exercise on immunity have been evidenced: in young subjects compared to elderly subjects; in HIV infected patients; in patients with certain types of cancer; in chronic fatigue syndrome; in space flight (Tache and Boboş 2011).

Physical exercise has beneficial effects of normalizing glycemia in type 2 diabetic patients; beneficial effects of stimulating antioxidant mechanisms in case of moderate intensity and duration exercise; it plays a role in functional recovery after sports traumas and other injuries; in locomotor disorders (kinesitherapy); the treatment of mental diseases, neuroses (depression, schizophrenia, anxiety), diabetes, coagulation and fibrinolysis disorders, dyslipidemia, cardiovascular diseases (coronary disease, hypertension) (Sbenghe 1999).

*e. Economic benefits*

Physical exercise contributes to the reduction of drug therapy costs, through the promotion and implementation of physical activity (Gettman 1996).

**Implications of physical exercise**

Through its economic, financial, legal, political, cultural, physical and mental health consequences, sport is a major biopsychosocial phenomenon (Thomas 2002; Grosu 2008).

*a. Psychological implications*

Physical exercise has favorable effects on mental health through: development of self-confidence, independence; stimulation of courage, perseverance, overcoming of failures; wish for self-improvement; wish to control the aesthetic shape of the body; wish to acquire biomotor skills; wish for recreation in the natural environment; aspiration towards a sports hero model (Thomas 2002; Murphy et al. 2006).

*b. Social implications*

The benefits for physical health indirectly contribute to social well-being. The implications are as follows: micro- and macrosocial integration; acquisition of civilization values; development of mass sport; social mobility; the wish for social affirmation through sport (Murphy et al. 2006).

*c. Economic-financial implications*

Professional sport economically and financially contributes to: the development of sport equipment industry; development of sport technology; development of mass-media; reduction of expensive medical treatments; circulation, accumulation and handling of amounts of money (Gettman 1996).

Although certain sports are expensive (skiing, tennis), some physical activities (running, jogging, fitness) are not costly and are beneficial for health (Grosu 2008).

*d. Legal implications*

Professional sport requires in the case of competitions the respect of national and international regulations.

*e. Political implications* can manifest in international sports competitions.

*f. Educational implications* have a role in the formation of personality, cognitive behavior and function, starting with the primary and secondary selection of children and juniors for sport (Drăgan 2002).

**Physical exercise and stress**

Physical exercise can be considered complex stress: neuromuscular, systemic cardiorespiratory, endocrine metabolic, biochemical – oxidative stress, psychoemotional, which is influenced by environmental conditions (temperature, pressure, radiation, humidity, polluting agents), which in turn have a stressing effect.

*Stages of stress*

Stress includes four interconnecting stages: the physical or psychological strain of the environment; the favorable or unfavorable individual perception of the strain; the response to stress, which can be favorable (eustress) or unfavorable (distress); the behavioral consequences (Weinberger and Gould 2003).

*Limiting factors of physical exercise*

Physical activity, exercise triggers protective mechanisms against stress, favorable mechanisms for the maintenance of mental fitness and mechanisms dependent on physical fitness.

The limiting factors of physical exercise include: automation; professional problems; lack of time; marriage, children; change of domicile; loss of the team or the partner; accidents; age; health state; financial state; health risk factors: smoking, alcohol consumption, drug use, irrational nutrition; pollution (Resch 2010).

*Eustress* has favorable effects on the body, determining adaptive changes in the cardiovascular, respiratory, endocrine, muscular, nervous systems.

Eustress designates the level of moderate, optimal psychoneuroendocrine stimulation, which maintains the physical and mental balance and tone of a person, the health state, and induces a positive adaptation to the environment. Eustress, stimulating or tonifying stress is indispensable for life and for the maintenance of mental and physical functions, necessary for human activity. It increases the resistance of the body to strain (Derevenco ș.c. 1992).

Eustress is defined as a desirable phenomenon, as positive stress, with beneficial, energizing effects on the body, vitalizing, favorable for age (Tache 2006) (Table 1).

*Distress*

Distress is stress that exceeds a critical intensity, whose values vary largely from one individual to another. It is caused by intense and prolonged negative overloads, overstrains that exceed personal physiological and psychological resources, which results in decreased performance, dissatisfaction, psychosomatic and physical disorders (Derevenco et al. 1992). It may be equivalent to strain.

Distress is defined as an undesirable phenomenon, as negative, destructive stress, harmful for life, or an acute and/or chronic aggression that disturbs the command, regulation and defense systems of the body: the psychic, nervous, endocrine and immune systems (Riga and Riga 2008) (Table 1).

A particular form of distress is posttraumatic stress disorder syndrome, caused by exceptional collective or individual psychotraumatizing events: participation in conflicts, catastrophes, natural disasters, detention in camps, nuclear accidents, rape, sexual abuse experienced in childhood. The syndrome manifests by hyperemotivity, reliving of the psychic trauma, sleep disorders, somatic disorders, and requires adequate psychological/psychiatric treatment.

**Table 1.** Characteristics of eustress and distress

(adapted from Derevenco et al. 1992, Hayward 1999, Tache 2006, Riga et al. 2008, Tache and Staicu 2010, Boroş-Balint 2012, Jurcău et al. 2012, Tache and Ciocoi-Pop 2013)

Characteristics	Eustress	Distress
Quality of response to stress	- favorable, beneficial, pleasant effects - mild or moderate stress	- unfavorable, harmful, destructive effects - intense or prolonged stress
Influence on psychophysiological homeostasis	- pro-homeostatic effects - maintenance of psychophysiological tone	- anti-homeostatic effects - disturbance of psychophysiological tone
Causes	- critical life events, with a positive effect - moderate, short duration stressing agents (eustressors)	- critical life events, with a negative effect - intense, long duration stressing agents (distressors)
Physiological mechanisms  - the sympatho-adrenal system	- the alarm stage according to the general adaptation syndrome (Selye) - intense activation, with increased catecholamine secretion - moderate activation of CRF, ACTH, cortisol secretion	- the exhaustion stage according to the general adaptation syndrome (Selye) - deactivation, with increased adrenaline secretion - predominance with highly increased cortisol secretion

Characteristics	Eustress	Distress
- the hypothalamic-pituitary-adrenocortical axis - other mechanisms	- moderate increase of endorphin, serotonin, dopamine secretion - humoral immune (IgA, interferon) and cell immune (NK cells) activation - activation of some brain areas	- decrease or suppression of humoral and cell immunity - dysfunction of some brain areas
Biochemical mechanisms - redox homeostasis	- activation of antioxidant defense	- activation of oxi-nitrosative stress
Psychosocial characteristics - mental tone (cognitive, affective, volitional) - anxiety - emotivity - manifestation - reactions - social support - requirements/possibilities - performance	- increase - absent - positive emotions, euthymia - active and positive adaptation - self-control - present - balance - increase	- disturbance - present - apathy - passive and maladaptation - loss of control - poor/absent - imbalance - decrease
Correlations with the health state	- sanogenetic effect	- increase of vulnerability to disease - pathogenetic effect – diseases (e.g.: arterial hypertension, myocardial infarction, decreased resistance to infections, cancer)
Treatment	-	- psychotherapy - medication - behavioral therapies
Influence on athletes - physical performance - physical training - fatigue	- increase - favored - physiological	- decrease - overtraining - pathological

## Conclusions

Physical activity through exercise, physical education and sport has an antistress effect and represents a sanogenetic therapeutic strategy in preventive medicine and public health (Riga et al. 2013).

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