

## MOVEMENT ACTIVITY – PHYSICAL ACTIVITY – THE PHENOMENON OF BIOLOGICAL CONTROL

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The article, as suggested by its title, presents two core issues – movement activity and physical activity. The goal of this paper is to explain these two terms. We believe that this explanation will justify using these terms to describe the types of physical activity. In Poland they are used interchangeably as they both pertain to physical aspects of the human body. Is this, however a good reason for replacing one term by another?

Activity involves the readiness to act, taking initiatives and active participation in any undertaking [1]. Activity is a manifestation of the dynamics of a given phenomenon, and as such, is a manifestation of life in the organic world. The life of the human body involves activity of every cell, organ and system. Activity is the factor that allows to subdivide the world into living and non-living things. The former are active at every level of a given body structure. The disturbance of one structure's activity results in the disturbance of another structure's activity (e.g. cell – organ – brain). Activity of the human body is manifested by movement and physical activity.

*Physical activity is a planned movement activity of men, determined by biological and social factors including the need to maintain body homeostasis, and to provide adequate morphological, physiological, biomechanical and psychological conditions for genetic and socio-cultural development during the process of ontogenesis* [2].

The first part of the definition presented above is essential. Unlike movement activity, which involves mechanical, automatic [3] and also thoughtless actions, physical activity is a planned and goal-oriented activity. Nowadays, physical activity is undertaken most often for health reasons – to restore, maintain and improve health, and more rarely for participation in sports. In the science of physical culture, physical activity is mainly health-oriented and only occasionally performed to achieve results in a given sport discipline.

Given the presented differences between the types of human activity, it seems that the definition of physical activity, often cited in world literature should be open to discussion. It says that “physical activity is any body movement that works your muscles and uses more energy than you use when you are resting” [4]. This definition may pertain to any movement activity including thoughtless, accidental and sometimes deliberate movements. The activities are, however, not goal-oriented. Even when we scratch our backs or take a seat, the energy expenditure can be greater than under rest conditions as the energy expenditure level under rest conditions involves only assuming a recumbent position. Thus, the definition cited above pertains both to physical and movement activity. Movement is the attribute of both forms of activity. It is of note, however, that the simplest organisms and plants perform movements as well.

When defining physical activity in physical culture, it is not enough to mention energy expenditure, which is greater than under rest conditions. The energy expenditure should have a beneficial effect on health as this is the fundamental task of physical culture and thus, physical activity. In this context, it is difficult to define *physical activity as energy expenditure* [5]. Energy is also released under rest conditions with expenditure amounting to 1 MET (*metabolic*) – 3.5 mlO<sub>2</sub>/kg/min, which is equal to 0.017 kcal/kg/min [6].

Another definition pertains to the medical aspects of physical activity. It says that “*physical exertion involves the work of skeletal muscles with multiple associated functional changes within the body*” [7]. We do not know, however, what kind of activity the definition describes. It can refer both to physical and to movement activity as both types of activity involve the same functional changes, mentioned in the definition. Such changes, although slight or even minimal, occur during baby's movements while playing, car washing,

gardening or the already mentioned scratching one's back. Apart from this doubt, there are no other queries concerning physical exertion, defined this way. Conversely, physical culture may involve physical activity (not movement activity) defined as "*a planned and repeated muscle work involving health-oriented energy expenditure, greater than under rest conditions or resulting in fatigue*". Obviously, the extent of fatigue may be different and should be properly defined. Physical activity understood this way comprises wood cutting, ground digging, snow plough using a spade, march, run, ball game, etc.. Defining physical activity in physical culture, which also involves competitive sport, often having little to do with health, the definition would be the following: "*physical activity is the work of skeletal muscles, characterised by specifically directed and effective energy expenditure*" [8]. Physical activity in all fields of physical culture differs only in goal specificity, volume, intensity, type, form and psychological context [9]. Physical activity, however, is more than movement activity. The former is oriented to achieve a specific goal, connected with health or sport and requires conscious performance while the latter does not necessarily involve consciousness. American theorists developed another definition of physical activity [10], namely: *the work of skeletal muscles increasing energy expenditure above the basic level (not only under conditions of rest- J.D.)*. Effort involving basic levels of energy expenditure may be made during such activities as standing, slow walk, lifting light objects, climbing a few stairs or other episodes of moderate effort. The individuals with such levels of activity are regarded physically inactive and, according to Kayser [1963 (after: 11)], judged as being of lesser value, with symptoms of degeneration, in contrast with the individuals whose energy expenditure exceeds the basic level. This energy expenditure is achieved through the activities having a beneficial effect on health (e.g. A quick march, team games, exercises with a skipping rope, climbing, running, etc.). Physical activity brings about more health benefits than movement activity alone. For this reason, a theoretical and practical paradigm is required to transform movement activity into physical activity, e.g. 5x30min x150 beats per minute. These numbers reflect how health-oriented philosophy changes movement activity into its more sublime form – physical activity. The transformation process involves not only physical measures, but also fulfillment of the goals which are specific for physical culture. A totally different paradigm is required for sports training [8]. Physical activity is usually assessed using physical units, such as time, length, or energy. It is difficult to use these units for evaluation of movement activity. The latter would involve the features of movements performed – flexibility, speed, range and rhythm. Do we ever evaluate them? No, never. A baby

is very active while performing movements – waves its arms, rolls from one side to another, sits and crawls. Is a baby physically active? It is as regards the involvement of physical aspects. Every day the man performs a lot of movements including accidental, thoughtless, physiological movements. The mentioned back scratching is also regarded movement activity. Is this scratching activity measurable? Can we measure activity level of catching a ball or hitting a ball with one's head, etc., etc.? We would like to know how active we are and how this variable is related to other variables, associated with our health. Does physical culture involve this type of activity? Was the development of this type of activity in the society the primary goal of the Polish National Health Program (1996-2005)?

Physical activity involves movement activity, but movement activity does not always involve physical activity. Movement activity will become physical activity when it includes performance of physical exercises, systematically repeated and planned, having a proper structure and oriented to specific goals. All physical exercises are forms of physical activity, however, not all movement activities of our body are physical exercises. In all fields of physical culture (not movement culture) the activity is directed and usually evaluated using physical measures. Baby's crawling is not assessed using these units. Physical activity, translated into physical measurement units is rather evaluated than measured. It would be difficult to measure the amount of heat produced using calorimetric chambers [12]. We can measure distance in kilometers, but we will never be able to measure the human body involvement (including mental involvement) in effort required to cover this distance. Even sports testers (not to mention pulse rate as a peripheral measure) do not reflect all the effort put in this activity.

In conclusion, we should assume that movement activity and physical activity are not equivalent terms. Each of these terms depends on specific movement tasks performed by an individual. They differ in the underlying psycho-social factors (motivation, consciousness, thinking) and the structure of movement performance (physical exercise vs movement episodes, which are not planned and have a chaotic, even incidental structure of load components); they have a common biological background (energetic processes, energy sources). They have another common feature – neither of them is a manifestation of motor activity. Using other words, the latter may be a form of movement activity or physical activity. If we regard motorics as the aggregate of movement behaviours [13], we may conclude that there are more such behaviours, conditionings and needs for movement (a more complete understanding of human motorics according to item 15) than in movement activity, e.g. scratching one's back, moving one's fingers, mimics,

etc. The last examples also involve motor activity. This term has been recently discussed in Polish scientific literature [13, 14]. However, it is unlikely to be widely understood. Conversely, it seems to be unclear and it will probably remain unclear for some recipients since it includes the word “motorics”. If it remains unclear, it will be difficult to expect this activity to be widely promoted among the society. The promotion of motor activity causes only additional confusion.

The definitions known worldwide describes *physical activity*, both in the context of public health and sport (although here the term *exercise* is more often used, instead of *movement activity* or *motor activity*).

In Poland, we learn about physical culture, not movement culture, and they are recognised specialists in this science, not in movement or motor culture.

Human mind – the product of human brain – is the element controlling the whole body activity and utilizing its life potential including motor activity. Then, physical activity refers to the physical body, which is created by all systems of the human organism. Physical activity denotes an increased activity of all body systems. The failure of one system results in the failure of other systems and, in consequence, the failure of the whole body.

This phenomenon generally determines biological factors and determinants of motor and physical activity. To be more precise, it is likely than the brain regulates body temperature, hunger, sexual excitement, arterial blood pressure, blood glucose level, etc., there is also a separate “centre”, analogical to other brain centres, regulating movement activity [15]. This centre controls daily energy expenditure to maintain energetic homeostasis. This requires continuous regulation of energy to maintain energetic balance and prevent using all energy reserves. The changing energy expenditure due to movement and physical activity, parallel to the changes in calorie intake with food and the rate of rest metabolism is the basic mechanism of energy balance.

The disturbance of the movement activity control system may result in energy balance disturbance and contribute to obesity as well [15]. Metabolic rate decreases with limited food consumption. We may assume that the volume and intensity of daily movement activity is connected with energy uptake and the rate of rest energy metabolism. The leptin hormone (discovered in 1994) regulates appetite in animals and influences energy expenditure [15]. It was proved in the study on mice, since their movement activity improved after leptin administration [16] and the study on 5 year old children of Pima Indians – the higher plasma leptin concentration was significantly ( $p < 0.01$ ) correlated with movement activity [17]. This finding indicates that leptin regulates energy expenditure [17]. The age-related decrease in movement activity is accompanied by the changes in rest and basic me-

tabolism rate [18]. This is suggestive of common metabolism – the „centre” of rest metabolism and activity [15], including movement and physical activity.

One may wonder why children choose to play. This phenomenon may be due to biological factors – playing is the way to maintain optimal stimulation of the central nervous system (CNS). The human and animal bodies need to be stimulated by external factors, especially when they are young; adults are stimulated by e.g. reading [after: 15]. The readiness to play, however, decreases with limited food consumption. Thus, we can assume that play is the manifestation of stimulated movement activity, which is higher in young and lower in older individuals.

Saltina et al. [19] in their famous study found that 21-day lack of motion resulted in physiological changes and, additionally, in visual hallucinations, thinking disorders, decrease in intellectual performance, the factors indicating the relations with some “centre” at the CNS level.

The biological “centre” of movement activity regulation may be also stimulated by the changes due to CNS impairment and pharmacological agents. Amphetamine is given to the children with ADHD to decrease their movement activity. Nicotine has the same effect (the physical capacity of tobacco smokers is lower due to their decreased physical activity) and e.g. deficiency of iron (necessary for CNS neurotransmitters). Conversely, low doses of morphine [15] also stimulate movement activity (after: 15). Genetic studies also indicate that physical activity is biologically controlled. According to Kaprio et al. [after: ], the value of movement activity genetic coefficient is 0.62. It is estimated that genetic, cultural and environmental (not inherited) factors influence habitual (everyday routine) movement activity in 20-30%, 12% and 59% respectively [20]. The influence of genotype does not concern increased activity (in terms of volume and intensity), oriented to health benefits or sports results. So far, numerous genes influencing directly or indirectly energy expenditure and thus, movement and physical activity, have been described [21]. The differences in activity levels in different ethnic groups provide further evidence for the correlation between the discussed activity and genetic factors [12].

In conclusion, the following factors suggest that movement activity is controlled by the biological centre:

- genetics,
- biological motivation to movement activity in children and animals,
- hyperactivity of some individuals, related to CNS function disorders,
- injuries of specific CNS areas in animals, which affect predictable changes in their movement activity.

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