

# SELECTED ASPECTS OF MARTIAL ARTS FOR HEALTH UNDERLYING THEIR PRO-ACTIVE INFLUENCE IN THE CONTEXT OF CENTRAL NERVOUS SYSTEM PLASTICITY

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**Abstract.** *The aim of this study is to extend the knowledge of selected aspect of of taekwon-do (martial art) for health in the context of central nervous system plasticity. This paper aims at presenting the results of the research and concepts that contribute to the understanding of the value of development and teaching of taekwon-do and other martial arts in the context of the notion of contact. The research data indicate that there are substantial arguments that allow us to state that participation in martial arts is strictly connected with an integrated activity in different fields of child's and adolescent's development. In the case of adults (included patients with musculoskeletal chronic pain) it supports the functioning of the nervous system. Based on the research approach specified as neuroscience, one can interpret the research reports present in literature, that indicate positive changes in particular brain structures, involved, among others, in the ability to concentrate, as a result of this training.*

**Keywords:** *taekwon-do, martial arts, stimulating factor, health psychology.*

## Introduction

Academic approach to the realization of specified tasks connected with taekwon-do and other martial arts is related to the analysis of multidimensional situation that spreads from the dimension specified by conditionings and the rules of biomechanics, kinematics as well as the psychological and social dimension (Wąsik & Góra, 2016). Various martial arts that differ from one another are characterised of one common feature that is *contact*. It assumes different forms, from only signalling the touch of a rival, other competitor, or sparring partner (that is the form that does not endanger life and health) to full contact (Wasik & Gora, 2016; King & Williams, 1997).

From the neurobiological perspective, the notion of contact indicated the form of mutual influence that stresses the participation of a sensorimotor aspect (Wąsik & Góra, 2016; Ortenburger et al., 2015; Kalina, 2010). From a different perspective, this can be considered on the basis of the mechanisms underlying

the interaction of matter and energy (Tsos et al., 2017; Leite, 2014). During taekwon-do, judo, aikido and other trainings, the areas and structures of a nervous system such as, among others: somatosensory cortex, premotor cortex, motor cortex, prefrontal cortex, visual cortex and auditory cortex, are intensively engaged. Recognising the rival while competing during the fight is, first of all, based on immediate experience that engages, to a large extent, the sense of touch and kinaesthetic sense.

Leading towards the examination of phenomena, due to their complicated character, the researchers reveal tendency to make reductionist divisions, so that, concentrating on smaller parts, they try to understand the whole (Edelglass et al., 2011; Spalek et al., 2017; Amen, 2005).

The notion of *contact* is used in various contexts. Referring to social connotations of the notion of *contact*, we can observe that in the social psychology and in the common version of this field of science (e.g. in the so-called common everyday wisdom, common knowledge) there are many synonyms to the word *contact*: it is someone open, direct, who does not escape from contact, communicative, easily initiating contacts, interactive, approachable, and unpretentious. Thus, when we speak about someone that he is open, that he is not distant, it may mean that it is easier to touch this person, in the psychological understanding of this word, speaking in other words, aim at his weak spot (Ortenburger et al., 2017a; Ortenburger et al., 2017b). In this paper we concentrate on the notion of *contact* with reference to martial arts, trying to perform the analysis from the perspective of biomechanics, psychology, with the inclusion of neurobiological approach. This paper aims at presenting the concepts that contribute to the understanding of the value of development and teaching of taekwon-do and other martial arts (with emphasis on the role of contact) for biological and psychological health. Therefore, the aim is theoretical and empirical argumentation regarding selected possibilities of taekwon-do application in an area of broadly understood support for particular brain structures.

In normal situations (conditions) the steering system of a man and muscle system do not function independently from one another and the whole is integrated through psychological feeling of own identity. It is followed by an individual feeling of distinctness as a feeling and thinking individual (person) and, in the physical aspect, as a body that has particular borders (Amen, 2015; Spalek et al., 2017; Richman & Rehberg, 1986)

In the literature of the subject within the last two decades there have been many works that concern the perspective of a biopsychosocial model in the role of mental sphere, emotions - based on the corresponding research (Amen, 2005).

Immediate contact, though touch, constitutes our distinctness as, due to it, we experience the physical aspect of our physical sphere of functioning in the

world we are the fully involved participants of which, not only as viewers (as it happens e.g. in dreams when we rather remember images than voice). The sense of touch increases the topological awareness referring to the borders of one's own body and to the fact of possessing the receptive surface. Touch, besides the sense of kinaesthetic, that is important for the understanding of space, in the most immediate manner stresses the fact of distinctness of one's own internal reality from the external reality that allows to recognise what is specified by researchers as the basic territory of one's own life (Edelglass et al., 2011; Szerla et al., 2017).

The aspect of protection against violating own borders (understood through the prisms of psychology) is under scientific analysis and interpretation with transferring the interest towards identity of oneself as it is the case in e.g. research over solving by taekwon-do athletes the situations connected with difficult emotions and anger (Ortenburger, 2017a). The programs, supporting the development of the models of human behaviour, are still being searched. That is why, the aim of those research was the knowledge concerning the impact of taekwon-do training on the development of different social skills. Ortenburger et al. (2017) argued that taekwon-do training ITF facilitates the development of social contacts due to common interest and positive emotion. The research covered 31 people practising taekwon-do 17 men and 14 women (age:  $18.83 \pm 3.49$  years old; range: 16-28 years old) in taekwon-do clubs ITF (International Taekwon-do Federation). The used questionnaires covered 2 aspects of social contacts: the ability of staying calm and high self-esteem in the situation of social exposure.

What is more interesting, all the participants of the research claimed that, due to taekwon-do training, the changes in their everyday functioning had taken place. They indicated that they had considerably bigger freedom while experiencing social exposure (90 %), they became more effective in dealing with difficult conflict situations and negative emotions (61,3 %), faster came back to the balance after difficult situations (67.7 %). Similar findings were obtained in other studies (Richman Rehberg, 1986).

### **Selected benefits from taekwon-do exercise that includes social functioning**

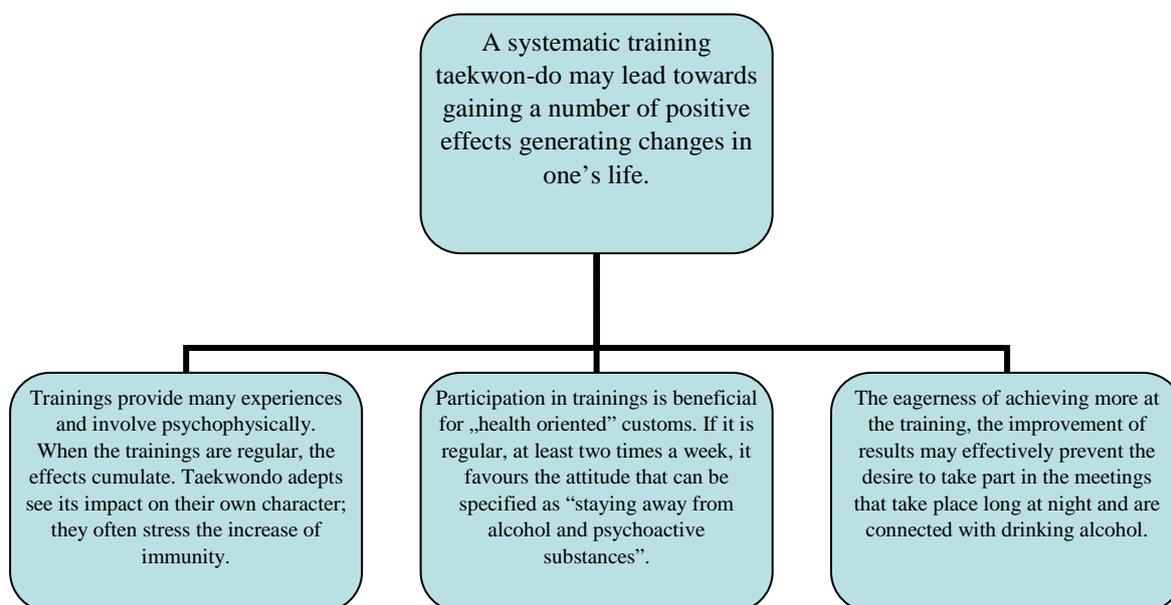
Taekwon-do training gives the big chance to strengthen in mind as well as body (Kim, 2015; Cho, 2017). It is a Korean martial art, the name of which is composed of three words: tae- meaning a foot, kick, kwon- fist, fist hit, do- i.e. road, philosophy of life. In order to obtain proper effects appropriate duration of trainings, intensity and frequency are necessary (Wąsik & Góra, 2016).

It encompasses not just the physical aspect of the sport, but emotional and mental lessons as well. In high performance martial arts (eg. taekwon-do, aikido) is important aspects: honesty, pro-active, loyalty, fair play.

**Table 1 Taekwon-do training and social functioning. Mean values of indexes related to psychological variables connected with social functioning (Ortenburger et al., 2017a)**

Gender	Self-esteem in the situation of social exposure			Satisfaction with an increase of the number of social			The level of the feeling of competence		
	Mean	SD	p	Mean	SD	p	Mean	SD	p
Men	8.94	1.14	0.00	8.76	0.75	0.65	36.35	7.04	0.00
Women	6.00	2.60		8.64	0.74		31.86	8.47	
Together	7.61	2.41		8.71	0.74		34.32	7.92	

Findings show that children who participate in Taekwondo classes have positive interaction with children of their own age thus developing good social skills. The conducted analysis indicated that there is a difference regarding the level of the feeling of own competence with respect to sex: at men it was higher than at women. Both women and men in a similar way assess the degree of a beneficial impact on the feeling of possibilities of fulfilling passion among the persons sharing it.



**Figure 1. There are circumstances that allow for answering positively to the questions if taekwondo is the lifestyle element - taekwon-do effects on different fields of activity**

The practitioners feel a beneficial effect on taekwon-do practising in many areas of social character: an increase of the number of contacts based on sharing interests and passions, larger freedom during experiencing social exposure, and more effective dealing with conflict situations etc. (Ortenburger et al., 2017a).

A systematic training taekwon-do may lead towards gaining a number of positive effects (among others physical abilities), generating changes in one's life, e.g. sport success, making friends of similar interests.

Building the status of science about martial arts, connected with effective solving of the methodological problems is visible in scientists' works who, on one hand, represent an objective approach and, on the other, are highly qualified practitioners of martial arts. The definition of science martial arts as a separate scientific is rather not very easy Science of martial arts is still emerging research field (sub-disciplines) (Kalina, 2014).

The research data indicate that there are substantial arguments that allow us to state that participation in martial arts such as taekwon-do, judo and aikido is strictly connected with an integrated activity in different fields of child's and adolescent's development. In the case of adults it supports the functioning of the nervous system (Burke et al., 2007; Richman & Rehberg, 1986). The following study was performed to assess the development of self-esteem through training in the martial arts. Richman & Rehberg (1986) conducted a study in which 60 martial artists were tested one day before the largest tournament in the United States, the 1985 Battle of Atlanta, in which they were going to compete against one another. This study found that people with higher self-esteem display greater ability in their sport (Richman & Rehberg, 1986). Researchers stress that kinaesthetic sense is important for the development of the feeling of space and it causes that a man may experience himself not only as some form, closed with the surface of skin, but also builds the experience of body in movement. It has the developmental aspect that attracted the attention of an educator, who described the situation in which his daughter, seeing a watch that she was not allowed to touch, wanted to see it with her hands and stretched them to take the watch. In order to be in a full, dynamic contact with the object, she wanted to initiate an immediate contact with it, obtaining information it concerned: distinctiveness (sense of touch), shape (kinaesthetic sense), weight (somatic sense) (Edelglass et al., 2011).

At present no one questions the existence of neurogenesis in different phases of a human life from birth to maturity. As a consequence of this research, the researchers concentrate on what can stimulate neurogenesis, increasing the skills of functioning in the process of optimisation (Amen, 2005; Brodani & Zuskova, 2015; Leite, 2014; Sogabe, 2013).

There are substantial arguments to conclude that the participation in martial arts such as taekwon-do, judo and aikido may constitute an effective form of

integrated activity in different fields of child's and adolescent's development (Ortenburger et al., 2017a; Richman & Rehberg, 1986; Tsos et al., 2017). In the case of adults such an activity supports the nervous system functioning (of course only when the benefits overcome losses that result from the injuries covering the nervous system). Judo teaches the ability of falling down, limiting the consequences of accidents as a result of stumbling.

Through the choice of activities and the quantity of techniques performed in the air, taekwon-do training contributes to the improvement of the sense of balance that is known to have a significant importance while falling down and, in a wider extent, when safety is considered. This is important because if aging were simply a matter of wearing out, we would expect all centenarians to be in poor health, trapped in bodies with many deteriorated working parts. Actually, standards of health are high among numerous centenarians. Those who study centenarians been taken aback by their strong attachment to freedom and independence (Uher & Švedová, 2013).

These findings have been strengthened by research evidence. Discussions on the value of various activity systems for physical and mental health are underway (for example yoga contra kickboksing). E.g the influence of physical exercises on health components of the quality of life of students is discussed. It is found that physical and mental component indicators of the quality of life of students who do yoga are much lower than those of students practicing kickboxing. The level of mental health component is lower than the level of physical health component. Interestingly, the men who do kickboxing report 19.5 points higher indicators of role - emotional functioning than the men who practice yoga. Similarly, female kickboxers report 19.4 points higher indicators in social functioning level compared with the women doing yoga (Tsos et al., 2017). Overall, the students who practice kickboxing on regular basis indicate significantly higher values of the physical and the mental components of health than the students who practice yoga.

In taekwon-do very often there are also many kicks that involve jumping before their execution. Often jumping kicks involve pulling up the back leg to help gain height during the jump and then performing the kick itself with the front leg (Wąsik & Góra 2016). It's a big challenge for body awareness. Human awareness of a three-dimensional space, the one in which, besides us, there are and move around other objects, is connected with the need of constant balance, in contrast to gravitation force acting in the space. Thanks to the sense of touch, we become aware of the basis on which we stand and the experience of movement, that is necessary to raise, is conveyed by the kinaesthetic sense (Edelglass et al., 2011).

### Summary

From the perspective of the modern language of health psychology it is rightful interpretation, that taekwon-do deserves to be recognised as a specific method having a complementary impact on mental and somatic aspects of health. From the neurobiological perspective *contact* in martial arts have a mutual multidimensional sensorimotor, social and psychological aspects. *Contact* (biological, physical, social) is important experience the crucial aspects of mental and physical sphere of functioning. Also, *contact* in martial arts it's a big challenge for body awareness and for a sense that one's skills are adequate to cope with the challenges in a goal directed.

People have practiced variety martial arts for many centuries. Martial arts in a proper dose and form constitutes a remedy, acting against physical and psychical degradation of an organism. Coordination, precision, velocity and accuracy are important factors that help in achieving victory. We express our hope that to some extent this work will support the development of knowledge within taekwon-do and other martial arts. The positive influence also concerns cerebellum, the sense of balance and coordination. The impact of taekwon-do on the effect of science is revealed in the results of research conducted with the use of medical diagnostic techniques and bases on the reports of teachers indicating how the behaviour of pupils practising taekwon-do changes (Wąsik & Góra, 2016). An immediate contact between sparring partners, that is fit in the training form, is connected with an immediate, most frequently mutual interaction, where a very important role is played by the sensorimotor sphere of functioning. Contrary to the typical "school" education, where listening and reading activate only some selected brain structures, during taekwon-do trainings that involve contact, the activation of other senses takes place with the involvement of somatosensory sphere, premotor cortex, motor cortex, and pre-cortical cortex.

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