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Influence of Tai Chi exercises on relaxation of healthy individuals

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Summary

Introduction. Stress has been an integral part of our life. Its negative influence can be reduced by various relaxation techniques. These techniques often include systems of exercises used in Oriental martial arts. The work concentrates on evaluation of the influence of Tai Chi and Chi Kung systems on relaxation of healthy individuals.

Material and methods. the research group were 48 people regularly exercising Tai Chi. The control group were 48 people not doing such exercises. The research was done by using a questionnaire which included demographic data and subjective responses of the subjects, as well as a device to measure the level of relaxation. Statistic methods were used to validate the results: chi-square test with definition of statistic validity of the results.

Results. Level I of relaxation obtained 60.4% people in the research group and 33.3% in the sample group. The value of $p = 0.0078$ has high statistic significance.

Conclusions. Tai Chi exercises influence the relaxation ability of healthy individuals. These exercises can be done regardless of age, physical fitness, health condition. They do not demand any special equipment. The exercises can be also done by disabled people.

Introduction

Modern conceptions of human health are insistently appealing to the potential inside a human being. Almost every process of change in the world surrounding us in fact starts from us. Social shifts, changes in culture or politics are the consequences of changes made inside social units. A contemporary human being must increasingly rely on ones own resources which give a feeling of control over stressful situations. Ancient philosophers and mentors such as Plato, Socrates and Buda advocated the motto: "Learn about yourself" [1]. Anti stress techniques based on meditation and relaxation have always been an integral part of the cultural tradition in both East and West. First samples and sources of different forms of relaxation and meditation exercises inspired by the Oriental systems should be sought in ancient China and India. Relaxation techniques were introduced to the Western culture in the 20s of the XXth century by the German psychiatrist and neurologist Johanes St. Schultz, who designed his own system of exercises known as autogenic training [2,3]. He paid attention to psycho-somatic correlations occurring in the human body. The psychology of health, including psycho-somatic medicine, starts using meditation as a stress reducing technique, while behavioral psychotherapy understands meditation as practice of attention and it has been listed as clinical treatment. The connections between relaxation techniques and meditation on the one hand and emotional reactivity on the other, including their clinical application, are currently the subject of extensive research. In the post-war period such Oriental methods as yoga, shiatsu, transcendental meditation, Zen-meditation, Tai-Chi and Chi-Kung (being meditation in movement).

The description of different aspects of meditation is aimed at facilitating the research process leading to more profound understanding of the processes related to meditation exercises. Many research works concentrate on the short-term effects of meditation. However, the purpose of meditation exercises should be permanent changes of cognitive and emotional nature felt also after the end of the exercises.

Material and methods

Material: The research covers a group of 96 people qualified to research and control groups. The research group (group I) was 48 people doing Tai Chi. The control group (group II) was 48 people not doing Tai Chi.

Criteria qualifying for the research were:

1. Period of practicing Tai Chi 1 year plus;
2. Frequency of exercises twice a week plus;
3. Agreement to participate in the research.

Elimination criteria:

1. People not practicing Tai Chi
2. No participation agreement.

The research group consisted of 34 women and 14 men with the age span 19-52 years old. The age group 19-40 years old was 40% of the whole, the group 41-52 years old was 60%.

The research was carried out in April 2012 among people practising Tai Chi regularly, with the consent of the Committee for Bioethics of the University of Rzeszow.

The educational background of the research group is: 37 people (77%) higher education, 9 people (19%) secondary education, 2 people (4%) primary education. Their exercise experiences are: 26 people (55%) practice Tai Chi of the Yang style, 13 people (27%) – Chen style, 4 people (8%) – both Yang and Chen style, 5 people (10%) – Yang, Chen and Wu style. The length of exercising: 27 people (56%) practiced Tai Chi for one to three years, 18 people (38%) practiced Tai Chi 4 to 9 years, and 3 people (6%) practiced for 10 years plus.

In the research group 19 people (39%) practiced for 4 hours a week, 17 people (35%) for 3 hours a week, 6 people (13%) for 2 hours a week. The rest 6 people (13%) did Tai Chi for 7 to 10 hours a week.

The exercises were led by the same person according to the methodology of the styles Yang, Chen and Wu [4,5,6,7,8]. Practice was preceded by a warm up supported by stimulation and rubbing the selected body areas (e.g. round the face, kidneys). The main exercises were preceded by static preparation exercises aimed at strengthening the muscles responsible for proper posture. The first stage of the training consisted in taking and keeping the proper position without undesirable tensions. After the initial stage more complicated sequences of movements were introduced. Attention was paid to dispersed eye movement, position of the tongue, breathing, keeping the corrected posture, initiation of movement from "the core of the body" (Tan Tien), smooth shift of body weight from one leg to the other (distinction between "emptiness and fullness"), positioning of the pelvis to open the Ming Men point. Special attention was paid to the smoothness of movement and relaxation ("non-blocking" of joints). The subject was requested to keep ones thinking and concentration processes while breathing deeply, rhythmically and quietly in harmony with the exercised movement, which corresponds to the Tai Chi theory. Attention was paid to initiating the movement from the legs, its control in the waist area, and releasing it through arms. Palms, feet, waist and eyes were moving in coordination. The movements were made very slowly, in circles and spirals in smooth sequences. Breathing phases were to be deepened, which positively influences relaxation and inner peace leading to relaxation of the exercised groups of muscles [9]. To improve the diaphragm activity the subjects were advised to breathe through the nose, as it facilitates the work of the diaphragm. By the end of the exercises the feet returned to their initial position on the floor.

A questionnaire was used in the research to cover the health aspects (physical, intellectual, emotional), as well as painful ailments – allergies, infections, posture problems, etc). The questionnaire was completed independently. A modified VAS (*Visual Analogue Scale*) was also applied in the research. The modification was made by reducing the line scale to 5, instead of the original 10 degrees [10]. Definition of the strength of selected parameters was made by pointing a value between 0 and 5, where 0 was minimal, 5 maximal intensity of the parameter. Evaluation of relaxation was made by using a Blue Watcher device with biofeedback system produced by the Polish firm Biotech, which enabled measuring GSR (Galvanic Skin Response) [11].

Methodology of research

The Blue Watcher device was used with disposable jelly electrodes EK-S 30 PSG, commonly used in ECG, which due to their small size and elasticity can be accurately applied to small and varied body surfaces. Examination was made with eyes closed to eliminate visual distortions of the relaxation condition. Ears were closed by headphones to eliminate the surrounding sounds which might affect the level of relaxation. Examination lasted for 15 minutes and the subject was placed in a lying or sitting position. This examination is based on measuring the ratio between galvanic skin response and level of relaxation (resistance decreases with increase in the level of relaxation). This device works with a computer equipped with a proper sound card. The Viewer function allows to save, view and compare specific records of the relaxation process. It also has an option of exercising based on the biofeedback principle, which was not used in this research. Blue Watcher is a microprocessor device designed to determine presence or absence of relaxation. An optional application of the device is „user statistics" showing the best results statistically, averages of the sessions and time lapses of each session. User statistics enables to trace the changes in relaxation both for each subject and the whole group showing the average of relaxation. The basic part of the device is the interface linking two devices (in our case the pc and electrodes), which cannot be linked directly. The interface is connected to the pc by interference proof cable and to a pair of electrodes fixed on two fingers of one hand (e.g. index and ring ones). The skin resistance is measured between these two electrodes. Conductivity is increased with the increase in the level of activation in the emotional sphere (non-differentiated emotions, what kind of emotional state is meant: scare, unrest, fright or anger). In the applied research method we used a continuous (with 1-2 sec delay) reading of information about the changes of physiological state (emotional sphere).

The chi-square test, Sperman coefficient, descriptive statistics and arithmetic average were used to process the results.

Results

The results of the questionnaire were based on experiences and subjective observations of the subjects concentrating on specific aspects of health which they admitted to be the effect of Tai Chi exercises.

The question concerning physical benefits gained from the training the subjects of the research group could answer in a few different ways. Most frequent answers were: improvement of general fitness – 47 people, improvement of kines-

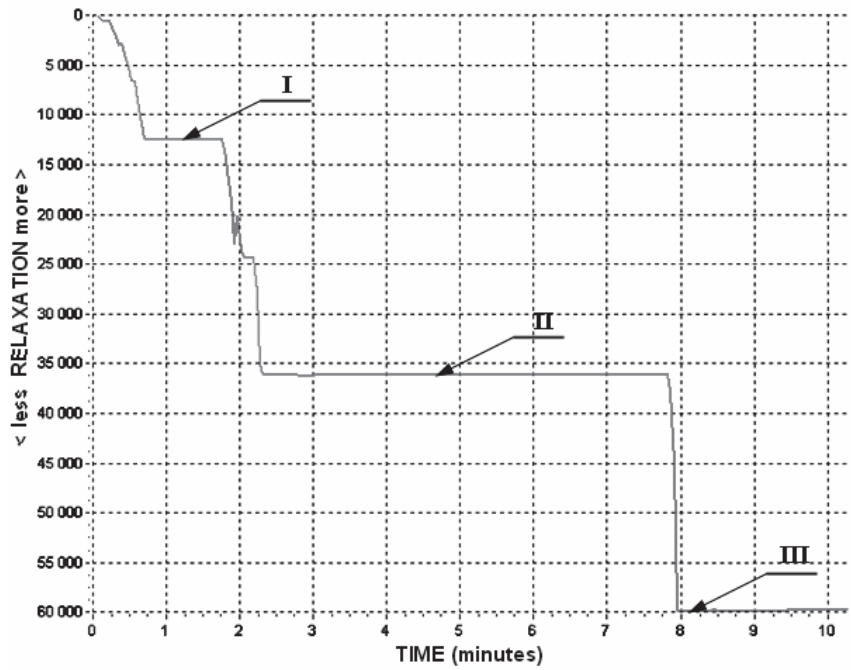
thetic coordination – 42 people, improvement of general condition – 39 people and improvement of flexibility – 36 people.

Emotional benefits of the training concerning the states of unwinding, relaxation, concentration, attention, increase of patience and decrease of depression states were marked in five-grade scale, where 0 was lack of influence of exercise on the state of the emotional feature, and 5 meant max positive influence of exercise on the state of the emotional feature. Positive influence of Tai Chi exercises on the emotional states the subjects graded as 4.11 in a five-grade scale. The lowest mark was obtained for benefits in lowering the depression, with 3.5 in a five-grade scale, and the highest for benefits in unwinding, relaxation, concentration, attention and increase in patience with the average 4.5 in a five-grade scale. There was no medical evidence for the subjects' depression, it was only their subjective opinion. 39% of the subjects claimed elimination of pain in knee circuits and backbone joints. None of the subjects claimed additional pain effects after exercising Tai Chi. Two people, which is 4%, claimed lack of any positive effects of exercising.

Table 1 and Figure 1 show relaxation levels taken by the Blue Watcher device on the basis of analysis of relaxation graphs of all the subjects. It was stated that a new level of relaxation appears when relaxation on level I becomes stable, then there is a constant deepening and stabilization on the new level, which is defined as relaxation level II. In the same way, using conventional units (j.u.), was defined the value of relaxation level III. None of the subjects showed relaxation level above III, while there were people whose level did not exceed level I or II.

Table 1. Levels of relaxation

Level	Values
0 level	below 11000 j.u.
I level	11000 to 12000 j.u.
II level	about 36000 j.u.
III level	58000 – 62000 j.u.



vertical axle – depth of relaxation in j.u.
horizontal axle – relaxation time (in minutes)
the depth defines the relaxation state (level of relaxation)

Figure 1. Levels of relaxation and depth of relaxation

In Figure 1 levels of relaxation are shown with dotted horizontal lines. The horizontal axle shows the time of relaxation (in minutes). The vertical axle shows the relaxation level expressed in conventional units (j.u.). This value depends on initial skin resistance and changes during relaxation.

The lowest relaxation level 0 (below 11000 j.u.) was achieved by all subjects both in the research group of people exercising Tai Chi and the control group. Out of the research group 7 people (14.3%) stayed at this level and 25 people (52.1%) from the control group. Values between 11000-12000 the manufacturer of Blue Watcher defines as a deeper state alfa. Such values were shown in the research by Zielinski during sleep or meditation [12]. They are level I of relaxation (level of the first stabilization of the record). This value was achieved by 29 subjects (60.4%) practicing Tai Chi, and 16 people (33.3%) from the control group. Relaxation level II (36000 j.u.) showed 8 people practicing Tai Chi (16.7%) and 6 people (12.5%) in the control group. Finally, level III was achieved by 4 people (8.3%) from the research group and 1 person (1%) from the sample group.

The research results of relaxation measured by the Blue Watcher device are shown as graphs in Fig 1 and Fig 2. Graphs in Fig 2 and 3 represent, respectively, the research and the control group. They show max values of each subject, average values of the relaxation process, and the time of relaxation for each subject. Each level of relaxation is marked on every graph. Due to practical reasons and peculiarities of the device, units on the horizontal line in Fig 1 differ in value

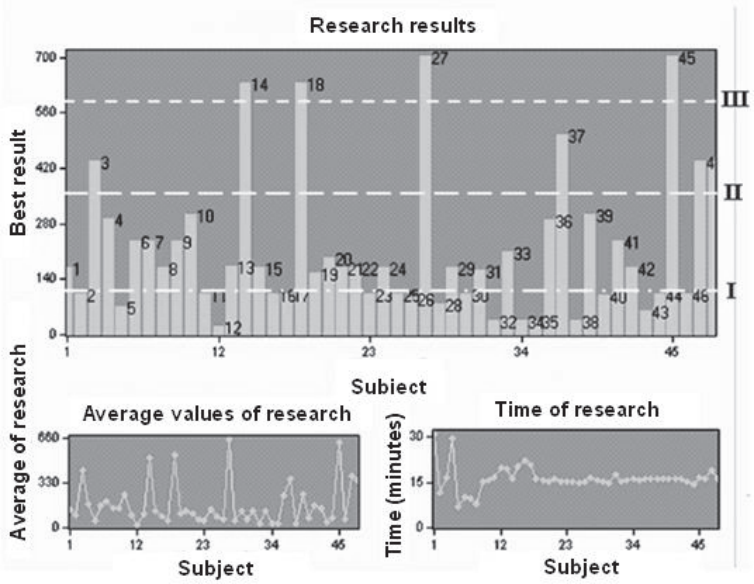


Figure 2. Research group. Max values of each subject. Average values of relaxation process. Time of relaxation

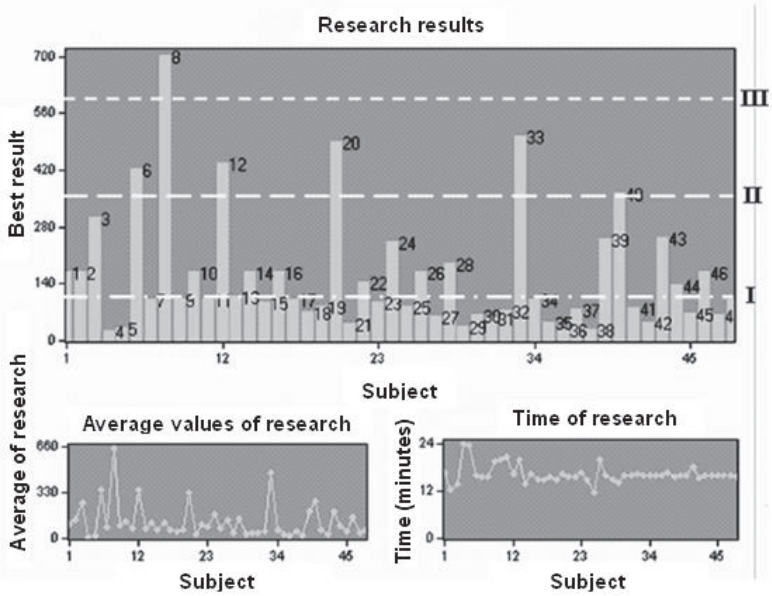


Figure 3. Control group. Max values of each subject. Average values of relaxation process. Time of relaxation

Table 2. Relaxation levels

Relaxation level	Group				*p*
	Research		Control		
	N	%	*N*	%	
Level 0	48	100.0%	48	100.0%	1.0000
Level I	29	60.4%	16	33.3%	0.0078
Level II	8	16.7%	6	12.5%	0.5630
Level III	4	8.3%	1	2.1%	0.1682

from those in Fig 2 and 3. Values on the vertical line should be multiplied by 1000.

To compare the frequency of each level of relaxation the chi-square test was used each time. Relaxation level I was achieved by 29 subjects (60.4%) in the research group and 16 subjects (33.3%) in the control group. The obtained result $p = 0.0078$ is statistically highly significant. Results on levels II and III are better for the research group but have no statistic significance (Table 2).

There was also made a comparison of the relaxation level achieved after Tai Chi exercises and registered by the Blue Watcher device with the subjective evaluation made on a five grade scale.

Considering the nature of both features under comparison, the most adequate research method here was to determine the range correlation coefficient by Spearman.

An increase in the subjective evaluation tendency along with the achieved state of relaxation was discovered in this collection of data. The measure of this correlation, i.e. the Spearman coefficient, is $R = 0.25$ which means a weak correlation. The value of test probability $p = 0.0907$. The value p is relatively low, which suggests doing a research with a bigger group.

Comparison of the subjective results of the research (questionnaire) and objective (Blue Watcher device) does not present a holistic picture of the research aspect under analysis. In the questionnaire subjects practicing Tai Chi express their subjective attitude and evaluate selected aspects of the exercise influence. They do it, to some extent, considering the overall influence on their body, hence the values in the questionnaire may be overrated.

Discussion

An increased interest in theory and practice of the Chinese health systems in the West European societies which are daily threatened by stress results also from the fact that commonly practiced forms of physical activity (jogging, stretching, aerobic, callanetics) become undoable for elderly people, and in some cases caused iatrogenic injuries of the kinesthetic systems not leading to relaxation. Hence the interest in low-effort exercises available regardless of age, gender or physical state. Such form of movement are the Tai Chi exercises, which are a part of TCM (Traditional Chinese Medicine), aimed at, among others, improvement of the flow of Chi energy in the patient's body. Considering a potential therapeutic influence of Tai Chi it has been acknowledged as one of alternative medical treatments satisfying an increasing demand in non-pharmacological ways of regaining bio-psycho-social health for patients suffering scares, stress or nervous breakdowns.

Jay M. Griffith applied Chi Kung exercises among hospital personnel to reduce stress. The research group was exercising for 6 weeks. To analyze the presence of stress a PSS -10 (Perceived Stress Scale) was applied, additionally a questionnaire of life quality SF-36 (Short Form 36) was used, as well as VAS (Visual Analogue Scale) to define the changes in pain. The researcher obtained statistically significant reduction of stress felt by subjects compared to the control group (p=0.02). Based on the SF-36 questionnaire analysis he claimed that the group practicing Chi Kung showed a higher improvement in the quality of life (p=0.04) and stated a significant reduction of pain (p=0.03). The results show that even the exercises done for a relatively short period efficiently cause a reduction of stress among the hospital personnel. They also positively influenced the reduction of pain and improvement of the quality of life [13].

Michael A. Grodin et al applied Chi Kung and Tai Chi exercises as therapeutic treatment of PTSD – *posttraumatic stress disorder* to refugees who had been tortured and subjected to stress. Observations of the subjects showed good results and outlined new approaches in solving this type of problems using Chi Kung and Tai Chi exercises [14].

Hector W. H. Tsang , Kelvin M. T. Fung, Ashley S. M. Chan, Grace Lee, Fong Chan in 2009 published a report in the Journal of Geriatric Psychiatry of a randomized control research in Hong Kong aimed at understanding of psycho-social effects of Chi Kung exercises on elderly people suffering depression. 82 people with recognized depression or depression complex were studied. They were randomly divided into research and control group. The research group participated in a 16 week Chi Kung course. The control group were reading newspapers at the same time. The final report showed that regular Chi Kung practices can efficiently reduce the effects of depression and improve the mood among elderly people with chronic diseases [15].

Hector W. H. Tsang in a randomized research analyzed etiological factors and effects of depression among elderly people having at the same time chronic kinesthetic system diseases. The research question was a possibility of improvement in bio-psycho-social condition among people exercising Chi Kung. 50 elderly people with sub-acute and chronic stages of a disease were studied. They were randomly divided into research and control group. The research group were practicing Chi Kung for 12 weeks. The control group were given rehabili-

tation treatment. ADL (Activity of Daily Living) questionnaire was applied in this research. Subjects in the research group showed a clear improvement in the physical and mental spheres, and in social relations [16].

Blake H, Batson M., from the Medical Department of Health Studies of the University of Nottingham studied the influence of Tai Chi and Chi Kung exercises on the improvement of mood and self esteem in people suffering brain damage. The research group was 20 people exercising Chi Kung one hour a week for eight weeks. The control group had uncontrolled recreation at the same time. The results were evaluated at the start of the research and after it applying General Health Questionnaire-12 (GHQ). The measuring scale covered perception of the mood, self esteem, elasticity, coordination, physical activity and social activity. After the exercises there was observed the improvement of mood in the research group compared to the control group (p=0.02) and improvement of the self-esteem (p=0.01). There were no considerable differences in physical functions between the groups. Considering the scale of the experiment these results are not clearly defined [17].

Many research works concern the positive influence of Tai Chi systems on the plasticity of the nervous system, which indirectly influences relaxation in young people and those past 60 years old [18,19,20]

The Physiological Research Group of Shanghai First Medical College published a profound report concerning the physical effects of Chi Kung exercises. The researchers observed a considerable reduction of stress reaction and weakening of nervous impulses in the sensory system indicating the state of relaxation and causing reduction of blood pressure, cell metabolism, amount of blood sugar and reduction of muscle tension [6,21,22].

Comparing our results to those presented in other publications [23] we can see that they are comparable. The questionnaire results prove the subjects' conviction about the positive influence of Tai Chi exercises on their body. Basing on our research we claim that Tai Chi influences the achievement of balance in stress tensions, that is relaxation, and indirectly the physical and mental condition. Tai Chi exercises can be treated as preventive training aimed at sustaining physical and mental health, especially of elderly and physically weak people. In some medical cases they can be efficient treatment.

This art, which can be practiced in any age and regardless of health or fitness conditions, is worth more attention; it can also become an alternative way of spending ones free time. These exercises can be done in any environment without using special equipment, which makes them more attractive. Tai Chi exercises influence positively both physical and mental states, which is a certain psycho-physical hygiene in accordance with the Chinese wisdom which does not separate body and mind. Only by considering both of these aspects during a treatment we can mean complete health. This Oriental art of relaxation, meditation and combat is considered to be one of the most perfect works of Chinese philosophy and culture. According to ancient Chinese wisdom Tai Chi exercise gives us tranquility of the wise, strength of a woodcutter and gentleness of a child.

Conclusions

1. Tai Chi exercises have a considerable influence on the relaxation ability of healthy individuals;
2. Tai Chi exercises do not demand any special equipment, they can be done by disabled people;
3. Tai Chi exercises should be popularized as a good system for people with emotional disorders.

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