

Original Article

Operator of Kyokushin Karate via Kates increases synaptic efficacy in the rat Hippocampus, decreases C3-θ-rhythm SPD and HRV Vagal markers, increases virtual Chakras Energy in healthy humans as well as luminosity of distilled water in vitro. Preliminary communication

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Abstract:

Background. Mechanism obvious psycho-neurotropic effects Kyokushin Karate is unclear. We set a goal to find out the influence Kates on synaptic plasticity in the rat as well as parameters EEG and HRV in the humans. Materials and Methods. Study participants were Kyokushin Karate master (first author, who is also a psychotherapist and hypnotist), Reiki operator (fourth author as the object of comparison) and last author (a participant in a control). They were both the subjects and the objects of research. In basal conditions and during Kates and Reiki sessions we recorded EEG (“NeuroCom Standard”), HRV (“Cardiolab+VSR”) and kirlianogram (“GDV Chamber”). Synaptic plasticity evaluated in rat hippocampal slice by method extracellular recording techniques. Results. Synaptic plasticity during Kates session increased on average by $7,5 \pm 0,9\%$ ($n=32$; minimum: $-2,8\%$, maximum: $+18,6\%$). Over the next 11 minutes after the session plasticity continued to exceed the baseline to $7,2 \pm 0,8\%$ ($n=32$; min.: $-0,8\%$, max.: $+17,4\%$). Reiki session for 11 minutes did not affect significantly on plasticity: $-0,5 \pm 0,85\%$ ($n=32$; min.: $-9,8\%$, max.: $+8,8\%$). In analyzing the parameters HRV and EEG, which significantly does not change after the Reiki session, revealed that after Kates session significantly reduced spectral power density θ -rhythm in locus C3, on which is projected the left hippocampus, amplitude β -rhythm and markers vagal tone. Among the parameters of kirlianogram differences found between changes in energy of virtual the third, sixth, first and fifth chakras as well as asymmetry of seventh chakra. We found a strong canonical correlation between changes in parameters EEG, HRV and GDV. In a separate experiment showed that after Kates session increases gas discharge distilled water by an average of $71 \pm 31\%$ ($n=5$; min.: -3% , max.: $+143\%$). These changes correlated with changes in the energy of the sixth chakra ($r=0,77$), which is connected to the brain and the pituitary gland. Conclusion. Operator Kyokushin Karate compared to baseline and control Reiki manipulation causes via Kates neurotropic effects both in vivo and in vitro.

Key words: Kyokushin Karate, Reiki, synaptic plasticity, hippocampus, HRV, EEG, GDV.

Introduction

Mechanism obvious psycho-neurotropic effects Kyokushin Karate is unclear. We set a goal to find out the influence Kates on neuronal activity both in vivo and in vitro.

MATERIALS AND METHODS

Study participants were Kyokushin Karate master (first author, who is also a psychotherapist and hypnotist), Reiki operator (fourth author as the object of comparison) and last author (a participant in a control). They were both the subjects and the objects of research.

In the morning in basal conditions at first registered (GI Dubkova) in three participants in the experiment kirlianogram by the method of Gas Discharge Visualization (GDV) by the device of “GDV Chamber” (“Biotechprogress”, SPb, RF [7]).

Method of GDV, essence of which consists in registration of photoelectronic emission of skin, induced by high-frequency electromagnetic impulses, allows to estimate integrated psycho-somatic state of organism. The first base parameter of GDV is area of gas discharge image (GDI) in Right, Frontal and Left projections

registered both with and without polyethylene filter. The second base parameter is a coefficient of shape (ratio of square of length of external contour of GDI toward his area), which characterizes the measure of serration/fractality of external contour. The third base parameter of GDI is entropy, id est measure of chaos. It is considered that GDI, taken off without filter, characterizes the functional changes of organism, and with a filter characterizes organic changes. Program estimates also Energy and Asymmetry of virtual Chakras [23,24].

After 5 minutes after registration kirlianogram in a sitting position recorded (TA Korolyshyn) during 7 min electrocardiogram in II lead (by hardware-software complex "CardioLab+HRV" produced "KhAI-Medica", Kharkiv, Ukraine) to assess the parameters of HRV. For further analysis the following parameters were selected [12,20]. Temporal parameters (Time Domain Methods): the standart deviation of all NN intervals (SDNN), the square root of the mean of the sum of the squares of differences between adjacent NN intervals (RMSSD), the percent of interval differences of successive NN intervals greater then 50 ms (pNN₅₀), triangular index (HRV TI); heart rate (HR), moda (Mo), the amplitude of moda (AMo), variational sweep (MxDmN). Spectral parameters (Frequency Domain Methods): spectral power density (SPD) bands of HRV: high-frequency (HF, range 0,4÷0,15 Hz), low-frequency (LF, range 0,15÷0,04 Hz), very low-frequency (VLF, range 0,04÷0,015 Hz) and ultra low-frequency (ULF, range 0,015÷0,003 Hz).

Simultaneously with HRV recorded EEG **four times** for 25 sec using hardware-software complex "NeuroCom Standard" (KhAI Medica, Kharkiv, Ukraine) monopolar in 16 loci (Fp1, Fp2, F3, F4, F7, F8, C3, C4, T3, T4, P3, P4, T5, T6, O1, O2) by 10-20 international system, with the reference electrodes A and Ref tassels on the ears. Among the options considered the average EEG amplitude (μV), average frequency (Hz), frequency deviation (Hz), index (%), coefficient of asymmetry (%) and absolute (μV²/Hz) and relative (%) SPD of basic rhythms: β (35÷13 Hz), α (13÷8 Hz), θ (8÷4 Hz) and δ (4÷0,5 Hz) in all loci, according to the instructions of the device [32,33].

After recording the baseline HRV and EEG immediately began to re-register HRV within 7 minutes and simultaneously recorded EEG **six times** for 25 sec. Thus during the re-registration of HRV and EEG Kyokushin Karate master, after preliminary training, carried over the head of two other participants in the experiment (on different days) contactless manipulation (called Kates). Training is special breathing exercises and self-hypnosis (autosuggestion). Even after 5 minutes was recorded again kirlianogram. In two other experiments (on different days) manipulation conducted by operator Reiki (second level).

A major thrust of contemporary neuroscience represented by study of synaptic plasticity. Therefore, other object to neurotropic effects was plasticity in the rat Hippocampus. Synaptic plasticity evaluated (Artur Romanow) in rat hippocampal slice by method extracellular recording techniques [15]. Data were collected and analyzed using Pclamp 9.0 (Axon Instruments). Origin 7.5 (Microcal Software, Northampton, MA) and Mini Analysis (version 6.0.3; Synaptosoft, Decatur, GA) software. In this first recorded during 11 minutes basal level, then within the same period carried manipulation operator Reiki, and after she has influence Kyokushin Karate master; registration continued for another 11 minutes after the session.

In a separate experiment recorded (YuG Dobrovol's'kyi) by copyright discharg-optical device [17] luminosity pharmacy distilled water (in glass vials) before and after exposure to it Kates session. In parallel, in the master recorded kirlianogram before and after training.

Results and discussion

If synaptic efficacy in the rat hippocampus during manipulations expressed in % of baselines, we get the following patterns (Fig. 1).

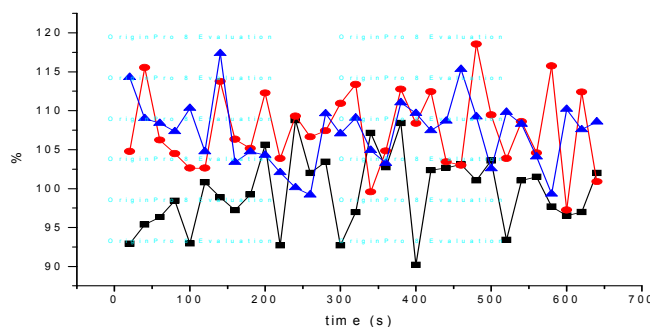


Fig. 1. Patterns of synaptic efficacy (expressed in % of baselines) in the rat hippocampus during (circles) and after (triangles) Kates and during Reiki (squares) sessions

As you can see, during Reiki session synaptic efficacy varies around the baseline and generally does not change (Table 1). However during Kates session synaptic efficacy significant increases. Over the next 11 minutes after the session plasticity continued to exceed the baseline.

Table 1. Changes in synaptic efficacy in the rat hippocampus during and after Kates and during Reiki sessions

State and Operation	N total	Change in %	SD	SE	Change in Z	SE	Minimum	Median	Maximum
During Reiki	32	-0,5	4,8	0,85	-0,10	0,17	90,2	100,0	108,8
During Kates	32	+7,5	5,1	0,90	+1,58	0,19	97,2	106,5	118,6
After Kates	32	+7,2	4,3	0,76	+1,78	0,19	99,2	107,9	117,4

Preliminary analysis of parameters of EEG and HRV showed that some of them do not respond either on Reiki, or the Kates sessions, while the other subordinate influences both operators, as equally and different, and the third cohort parameters **responds only to Kates, that behaves as as plasticity in the rat hippocampus**. Therefore, we confine detailed analysis of the changes in these parameters.

For the purpose of adequate comparative assessment changes in data EEG and HRV they are transformed into normalized parameters Id and Z, calculated by formulas [17]:

$$Id = V/B;$$

$$Z = (Id - 1)/Cv; \text{ where}$$

V is individual value of variable after influence;

B is its Mean in basal conditions;

Cv is coefficient of variation (SD/B) in basal conditions.

Among parameters of EEG found changes in SPD of θ -rhythm in left locus C3 (Table 2), while in right locus C4 changes are absent (Z-score: $-0,04 \pm 0,12$ and $0,00 \pm 0,10$ after Reiki and Kates sessions respectively). Unlike θ -rhythm SPD of β -rhythm decreases the same in all experiments: changes in Z-score makes in locus C3 $-0,35 \pm 0,07$ and $-0,28 \pm 0,07$, in locus C4 $-0,29 \pm 0,06$ and $-0,29 \pm 0,07$ after Reiki and Kates sessions respectively. We know that the locus C3 projected left hippocampus, and the hippocampus generates θ -rhythm [24]. Reducing the SPD in the left hippocampus accompanied by a decrease amplitude β -rhythm as well as number parameters HRV (Table 2, Fig. 2 and 3).

Table 2. Changes in parameters of EEG and HRV after Reiki and Kates sessions

Variables EEG and HRV	Baseline Mean $\pm$ SE	Change in % After Reiki	After Kates	Change in Z After Reiki	After Kates	Coefficient of variation
SPD C3- θ , $\mu V^2/Hz$	47 ± 11	-1,2 $\pm 13,8$	-27,4 $\pm 7,1$	-0,01 $\pm 0,17$	-0,34 $\pm 0,09$	0,811
Amplitude β -rhythm, μV	11,8 $\pm 0,8$	-1,1 $\pm 3,9$	-10,6 $\pm 3,7$	-0,03 $\pm 0,10$	-0,28 $\pm 0,10$	0,372
SPD VLF, msec ²	1429 ± 282	+3 ± 11	-31 ± 14	+0,03 $\pm 0,08$	-0,24 $\pm 0,11$	1,295
MxDMn, msec	240 ± 14	-0,3 $\pm 3,2$	-18,7 $\pm 7,8$	-0,01 $\pm 0,09$	-0,51 $\pm 0,21$	0,370
SDNN, msec	52 ± 6	-0,6 $\pm 16,8$	-18,4 $\pm 7,6$	-0,01 $\pm 0,29$	-0,32 $\pm 0,13$	0,582
RMSSD, msec	26 ± 4	-7,4 $\pm 1,7$	-14,5 $\pm 3,4$	-0,11 $\pm 0,02$	-0,21 $\pm 0,05$	0,695
HRV TI, units	13,0 $\pm 1,1$	+4,2 $\pm 4,2$	-8,4 $\pm 0,7$	+0,18 $\pm 0,18$	-0,36 $\pm 0,03$	0,232

Correlations Matrix for changes in parameters EEG, HRV and GDV (cat_rei_2.sta) n=24

	B, μV	C3- θ	DX	SDNN	RMSSD	VLF	AR	ERF	C3E	C6E	C7A	C1R	C5R	C6R
Beta, μV	1,00	,75	,22	,17	,30	,15	-,34	-,22	-,25	-,30	-,36	-,22	-,37	-,38
C3- θ	,75	1,00	,20	-,12	,74	,07	-,63	-,61	-,66	-,28	-,57	-,58	-,67	-,60
DX	,22	,20	1,00	,34	,06	,98	-,76	-,60	-,57	-,92	-,79	-,66	-,66	-,56
SDNN	,17	-,12	,34	1,00	-,05	,27	-,10	,38	,34	-,61	-,34	,33	-,23	-,48
RMSSD	,30	,74	,06	-,05	1,00	-,12	-,68	-,59	-,67	-,25	-,64	-,54	-,78	-,78
VLF	,15	,07	,98	,27	-,12	1,00	-,64	-,53	-,48	-,84	-,66	-,60	-,51	-,38
Area R	-,34	-,63	-,76	-,10	-,68	-,64	1,00	,88	,90	,79	,97	,89	,97	,86
EntrRf	-,22	-,61	-,60	,38	-,59	-,53	,88	1,00	,99	,47	,74	1,00	,78	,54

Ch3E	-,25	-,66	-,57	,34	-,67	-,48	,90	,99	1,00	,48	,77	,99	,82	,61
Ch6E	-,30	-,28	-,92	-,61	-,25	-,84	,79	,47	,48	1,00	,89	,52	,78	,78
Ch7A	-,36	-,57	-,79	-,34	-,64	-,66	,97	,74	,77	,89	1,00	,76	,98	,93
Ch1R	-,22	-,58	-,66	,33	-,54	-,60	,89	1,00	,99	,52	,76	1,00	,78	,54
Ch5R	-,37	-,67	-,66	-,23	-,78	-,51	,97	,78	,82	,78	,98	,78	1,00	,95
Ch6R	-,38	-,60	-,56	-,48	-,78	-,38	,86	,54	,61	,78	,93	,54	,95	1,00

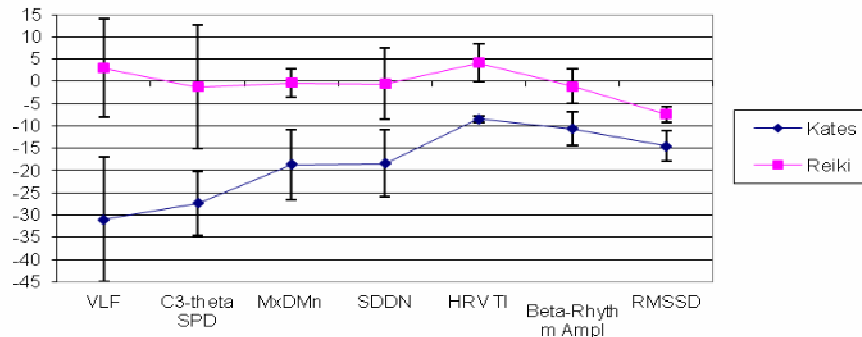


Fig. 2. Changes in % of baselines in parameters of HRV and EEG after Kates and Reiki sessions

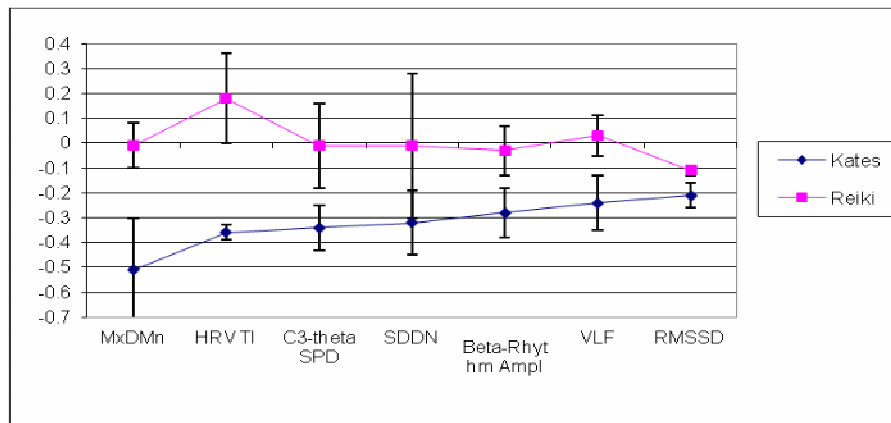


Fig. 3. Changes in σ of baselines in parameters of HRV and EEG after Kates and Reiki sessions

How is our data consistent with literature?

It is speculated that SPD VLF band ($0,04 \pm 0,015$ Hz) associated with oscillation blood levels of renin ($0,04$ Hz) and epinephrine ($0,025$ Hz), reflects thermoregulatory cycles, cerebral ergotropic and metabolotropic outflows, activation of cerebral sympathetic-adrenal system, sympathetic activity [cit. by: 12,13], while others parameters HRV, are given in Table. 2, are admitted markers of parasympathetic tone [20].

It has long been known that sigma receptors widely distributed within the hippocampal formation also over autonomic relay nuclei of brainstem, including the nucleus tractus solitarius (NTS) and nucleus dorsalis motoris of the vagus. This suggests that the hippocampus and autonomic relay nuclei of the brainstem may be interrelated by a topographic chemical linkage [27]. Afferent sensory fibers of the vagus nerve synapse bilaterally on neurons within NTS, which then projects to the noradrenergic locus coeruleus and the cholinergic basal forebrain. Electrical vagus nerve stimulation (VNS) drives neuronal activity within these regions and consequently induces release of neuromodulators throughout the cortex [review: 19].

F Biggio et al [14] showed that both acute (3 h) and chronic (1 month) VNS induces neuronal plasticity in the rat hippocampus. Enhancement of hippocampal long-term potentiation caused by VNS demonstrated Y Zuo et al [39] also in freely-moving rats. H Ura et al [38] in experiment on urethane-anesthetized rats showed that VNS induced long-lasting **enhancement of synaptic transmission** and **decreased** granule cell **discharge** in the **hippocampal** dentate gyrus. However LE Larson et al [26] on freely-moving rats showed that VNS decreased hippocampal synaptic efficacy, reflected by decreased field excitatory postsynaptic potentials slope and EEG power, but it simultaneously facilitated dentate granule cell discharge indicated depolarization of dentate granule gyrus cells.

In observation of the healthy humans revealed by fMRI that sham-controlled transcutaneous electrical VNS (in the left outer auditory canal) **decreases** of the BOLD signals in limbic brain areas, including the amygdala, **hippocampus**, parahippocampal gyrus [21] as well as in **NTS and locus coeruleus** while increased activation was seen in the insula, precentral gyrus and the thalamus [22]. On similar results reported newly E

Frangos and BR Komisaruk [16]: compared to baseline and control, transcutaneous electrical VNS (from right antero-lateral surface of the neck in healthy humans) significantly activated insula, parabrachial area, basal ganglia, frontal and sensory cortex, while **deactivation** were found in the **hippocampus**, visual cortex and spinal trigeminal nucleus.

So, caused by Kates session **decrease** of electrical **activity** in left **hippocampus** (reflected in SPD C3- θ) as well as in **sympathetic** (reflected in VLF) and **parasympathetic** (reflected in vagal markers) brainstem nuclei (locus coeruleus and NTS respectively) two healthy humans, probably, associated with **enhance** of hippocampal **plasticity**, as it was found in rat.

The decrease amplitude of β -rhythm as a manifestation of desynchronization (that is induced by VNS [19]) positively correlated with changes in SPD C3- θ (Fig. 4).

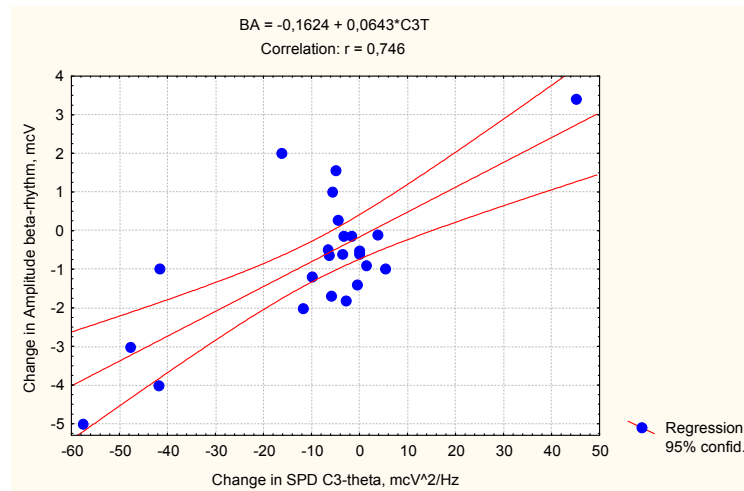


Fig. 4. Relationship between changes in SPD of θ -rhythm in locus C3 (axis X) and amplitude β -rhythm (axis Y)

In addition, changes in SPD C3- θ and amplitude of β -rhythm positively correlated with changes in HRV markers of vagal tone (Fig. 5, Table 3).

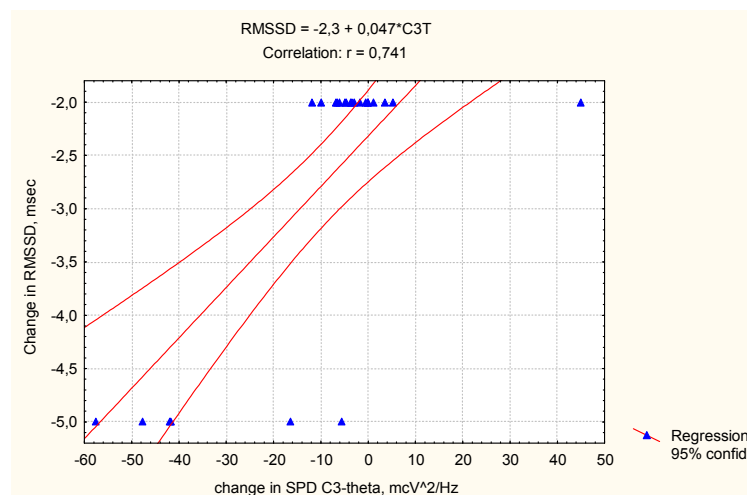


Fig. 5. Relationship between changes in SPD θ -rhythm in locus C3 (axis X) and RMSSD HRV (axis Y)

Table 3. Correlations between changes in parameters of EEG (right set) and HRV (left set)

Parame-ters	Amplitude β -rhythm	SPD C3- θ
RMSSD	0,30	0,74
HRV TI	0,36	0,40

As a result canonical correlation between changes in parameters of EEG and HRV is very strong (Table 4, Fig. 6).

Table 4. Factor Structure for changes in parameters of EEG and HRV

Right set	R
SPD C3-θ	-0,86
Amplitude β-rhythm	-0,30
Left set	R
RMSSD	-0,98
HRV TI	-0,35

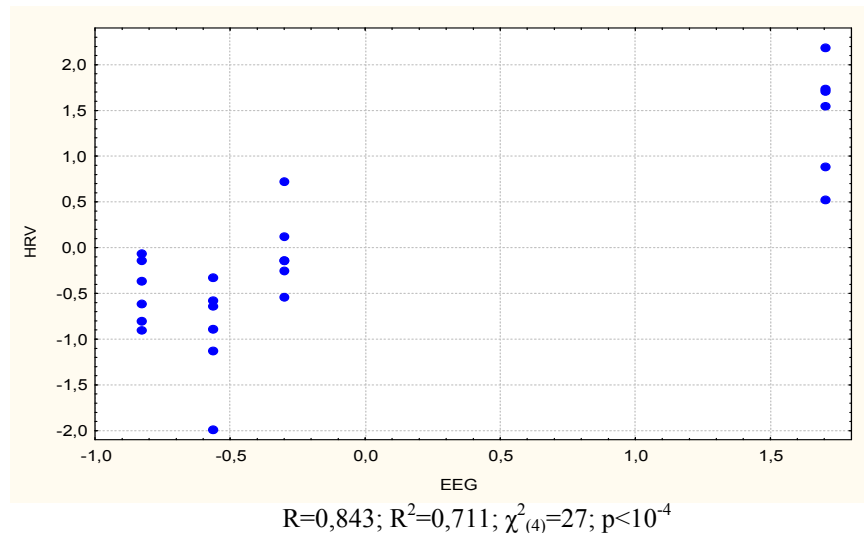


Fig. 6. Canonical correlation between changes in parameters of EEG (axis X) and HRV (axis Y)

This is consistent with the provisions that induced by VNS desynchronization is dependent on cholinergic transmission [19].

Yi-Yuan Tang et al [36] in the study of healthy young males to explore the relationship between brain activity and parasympathetic tone analysed the correlation between the changes in frontal midline θ power (related to generators in the anterior cingulate cortex) and HFnu HRV. After 5 days of integrative body-mind training correlations between HFnu and Fz-θ ($r=0,566$), FCz-θ ($r=0,551$) and Cz-θ ($r=0,575$) were significantly positive. IL Popovych et al [32] shown correlations between relative PSD HF and SPD C3-θ ($r=0,35$) as well as C4-θ ($r=0,42$), also between relative PSD VLF and amplitude of β-rhythm ($r=0,37$). GE Prinsloo et al [34] in the study for healthy males found that less pronounced changes in HRV, due to work-related stress, accompanied by higher relative PSD Fz-θ, Pz-θ and Cz-θ, lower fronto-central relative β power and higher θ/β ratio.

D Tolkunov et al [37] showed strong anticorrelation ($r=-0,61$) between the amygdala's spectral power density scaling parameter β and wake HRV, suggesting that sluggish limbic regulation translated down-stream into sluggish autonomic regulation, at both shorter-acting (parasympathetic) and slower-acting (sympathetic) time-domains, as well as suggesting a robust relationship between dysregulated limbic outputs and their autonomic consequences.

During the years 2010-2016, we studied the relationships between the parameters of GDV, with one hand, and autonomous, endocrine and immune systems, on the other. Despite the skeptics, we managed to prove quite highly informational content method GDV as one that reflects the functional status of these systems [1-11,28-31].

In this study, we found that the Area of gas discharge image (GDI) in Right projection registered without filter (baseline= 25526 ± 500 pixels; $Cv=0,073$) after Kates session increases by $5,0 \pm 1,6\%$ or $0,69 \pm 0,22 \sigma$ while after Reiki session decreases by $8,8 \pm 2,8\%$ or $1,20 \pm 0,38 \sigma$. Take place anticorrelation between changes in this parameter and SPD C3-θ ($r=-0,63$), VLF ($r=-0,64$) as well as HRV markers of vagal tone RMSSD ($r=-0,68$) and MxDMn ($r=-0,76$).

Greater interest is the virtual Chakras. According to existent ideas, Chakras are power centers, related to the endocrine glands and neural plexus as well as to some organs [35]. In particular, the first Chakra is related to the testicles and sacral plexus, second Chakra to the ovaries, adrenals and kidneys, third Chakra to spleen, liver and solar plexus, fourth Chakra to thymus, heart and cardial plexus, fifth Chakra to thyroid and parathyroid glands, sixth Chakra to pituitary gland and brain, seventh Chakra to pineal gland.

Fig. 7 visualized increasing energy third (baseline= $-0,18 \pm 0,06$ units), sixth (baseline= $-0,24 \pm 0,06$ units), first (baseline= $+0,08 \pm 0,06$ units) and fifth (baseline= $-0,09 \pm 0,06$ units) Chakras after Kates session while after Reiki session changes range around baseline. In addition, Kates but not Reiki causes right-asymmetry in seventh

Chakra (baseline= $0,00 \pm 0,04$). We detected anticorrelation between changes in SPD C3- θ and energy mentioned Chakras (r is $-0,66$; $-0,60$; $-0,58$; $-0,67$ respectively) as well as asymmetry seventh Chakra ($r=-0,57$).

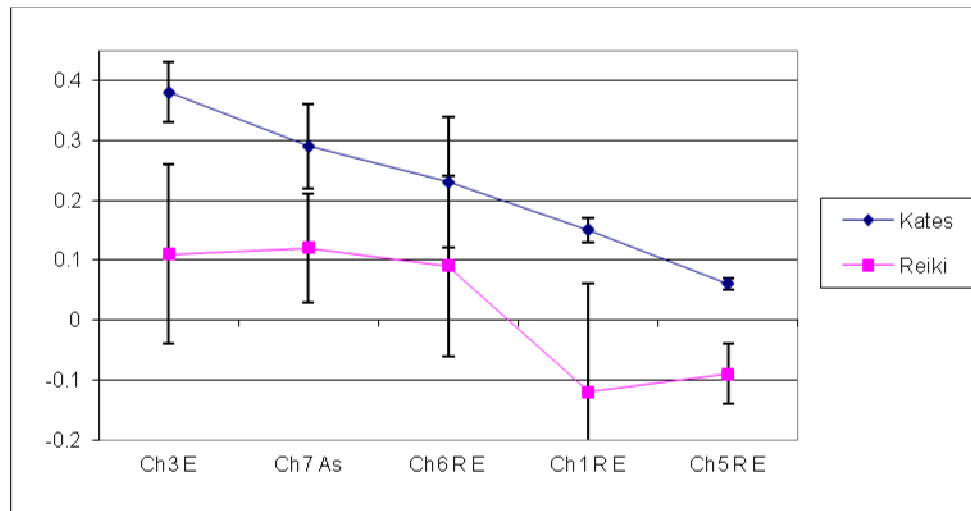


Fig. 7. Changes in the form of direct differences in parameters of GDV after Kates and Reiki sessions

In the final regression model with stepwise exclusion included only three parameters changes in which, taken together, determine changes in SPD C3- θ to 53% (Table 5).

Table 5. Regression Summary for change in Dependent Variable: C3- θ SPD

$R=0,771$; $R^2=0,595$; Adjusted $R^2=0,534$; $F_{(3,2)}=9,8$; $p<0,001$;

Std. Error of estimate: $14 \mu V^2/Hz$

		Beta	St. Err. of Beta	B	St. Err. of B	$t_{(20)}$	p-level
Independent variables	r		Intercept	-32,1	8,7	-3,68	,001
Area Right	-0,63	2,286	,969	,025	,011	2,36	,029
Ch3 Energy	-0,66	-1,051	,394	-90,8	34,0	-2,67	,015
Ch5R Energy	-0,67	-2,026	,737	-414,6	150,8	-2,75	,012

Relationships between changes in parameters HRV and GDV shown in Fig. 8 and 9 as well as in the table 6 and 7.

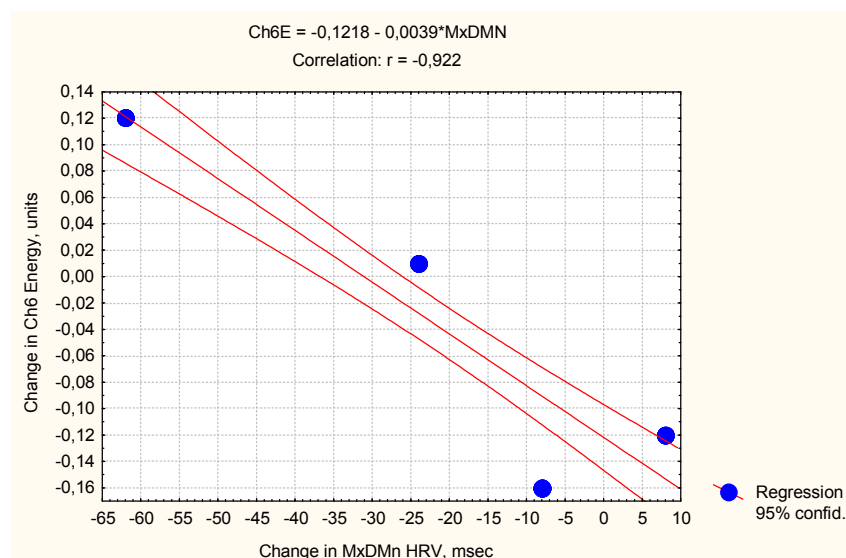


Fig. 8. Relationship between changes in MxDMn HRV (X) and Chakra 6 Energy (Y)

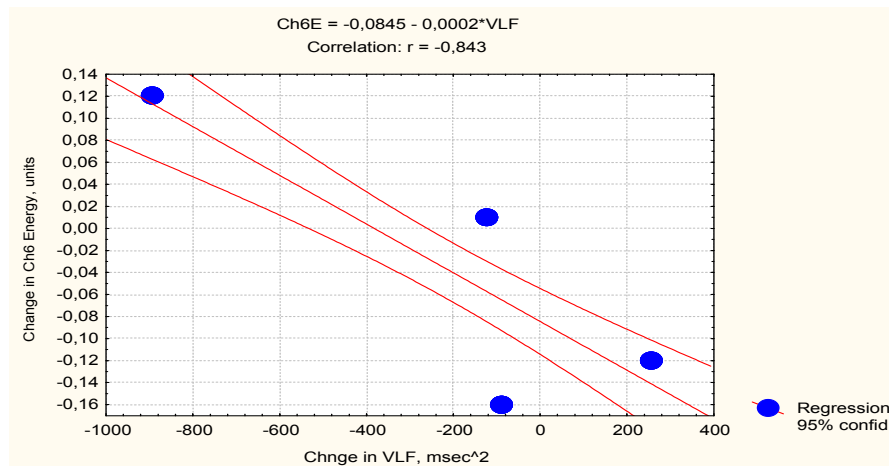


Fig. 9. Relationship between changes in VLF HRV (axis X) and Chakra 6 Energy (axis Y)

Table 6. Correlations between changes in parameters of HRV (right set) and GDV (left set)

Parameters	MxDMn	RMSSD	VLF
Ch6 Energy	-0,92	-0,25	-0,84
Ch7 Asymmetry	-0,79	-0,64	-0,66
Ch5 Right Energy	-0,66	-0,78	-0,51

Table 7. Factor Structure for changes in parameters of HRV and GDV

Right set	R
MxDMn	-0,83
VLF	-0,71
RMSSD	-0,51
Left set	
Ch7 Asymmetry	0,98
Ch6 Energy	0,96
Ch5 Right Energy	0,92

Canonical correlation between changes in parameters HRV and GDV although only four experiments pronounced as very strong (Fig. 10).

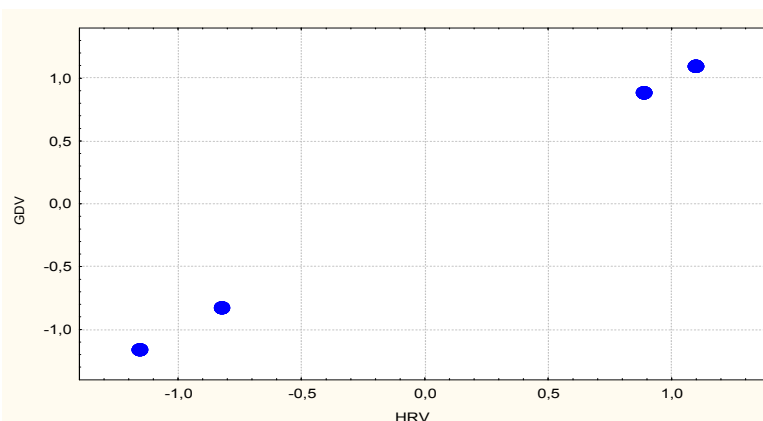


Fig. 10. Canonical correlation between changes in parameters of HRV (axis X) and GDV (axis Y)

In another study we have shown that changes in parameters of GDV, namely elimination of asymmetries of virtual chakras (first, second and third) as well as reducing the excess energy of the first chakra are accompanied by increased normal conductivity acupuncture point Pg (ND) at right side, which represent the nervous system, and electrokinetic index of epithelial cells of cheek, that indicating the "rejuvenation" of the organism but decreased initially increased vagus tone as well as plasma levels of testosterone and triiodothyronine [18].

In a separate experiment Kyokushin Karate master held four Kates with quarter hour intervals. Receptors had pharmacy distilled water (in glass vials). In parallel, in the master recorded kirlianogram before and after training. We revealed increase gas discharge distilled water by an average of $71 \pm 31\%$ ($n=5$; min.: -3% , max.: $+143\%$). These changes correlated with changes in the energy of the sixth chakra ($r=0,77$) (Fig. 11), which is connected to the brain and the pituitary gland.

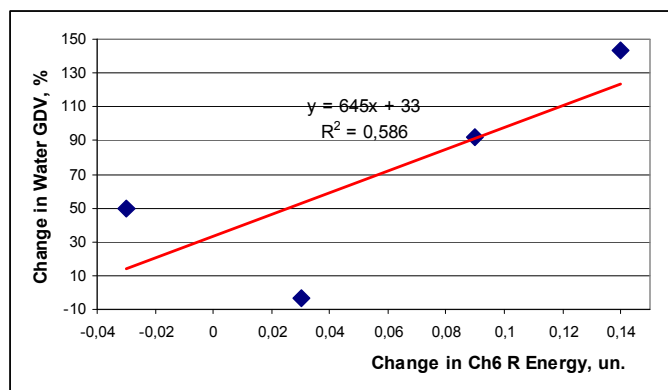


Fig. 11. Relationship between changes in Chakra 6 Right Energy of Kyokushin Karate master (axis X) and GDV of Water in ampula (axis Y) after Kates

Since brain tissue is at 4/5 of the water, the water is to be considered a target for the action of X-factor, which is still Kyokushin Karate Kates.

At present, we know that deep brain stimulation, transcranial magnetic stimulation, optogenetic stimulation, intensive repeated training could potentially trigger sufficient neuromodulatory release during experience to induce therapeutic plasticity [review: 19]. Kyokushin Karate Kates probably can take its place in this list.

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