Dual concentration in karate and its use in diagnosis of sport

Authors' Contribution:

A – Study Design
B – Data Collection
C – Statistical Analysis
D – Manuscript Preparation
E – Funds Collection

Ján Pivovarník

University of Matej Bel in Banská Bystrica, Faculty of Phylosophy, Slovakia

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Abstract

Introduction: *The goal of our study was to identify and compareimpact of specific dual focus of concentration known in Goju-ryu schoolas a system of KZR (closed hands kata) - heishu, concentration inside the body versus KOR (open hands kata) - kaishu, concentration outside of the body.* **Method:.** *Studysample consisted of Karate Dojo Pivovarník karateka from Hanušovce nad Topľou, Slovak republic (n=7, 6 men and 1 woman), all of them were holders of at least. 1ˢᵗ. Dan master grade, theywere able to practice in dual focus. We have compared the trainings performed by both systems KZR vs. KOR while respecting relatively identical conditions. At the same time we observed physiological, biochemicaland somatic indicators. Participants completed a questionnaire,consent form and filled outpersonality questionnaire. The data were evaluated with statistical programs MS Excel, SPSS Statistics, biochemical results were obtained in laboratory Synlab Slovakia s.r.o, Prešov and the data were calculated by Dorste, Planta [14]. To determine the significance of differences at entrances and exits KZR vs. KOR we used the Mann-Whitne U – test and Wilcoxon test. Statistical significance was set at (p < 0.01,p <0.05).* **Result:** *We assumed that the dual concentration will not cause any significant differences from training KZR compare to KOR. However, that was not confirmed. We have detected several statistically significant physiological biochemical and somatic differences.* **Summary:** *Our results point to the possibility of efficiency gains and predicting training (performance, intensity etc.). Nevertheless, this pilot study does not allow the results to be generalized for relatively small sample size, and the number of such studies, in spite of thisour studypoints out the high potential and possible future objectification.*

Keywords: concentration, oxygen, bicarbonate, karate, training unit, psyche

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Address for correspondence:

Ján Pivovarník, University of Matej Bel in Banská Bystrica, email: karatedojojp@gmail.com

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INTRODUCTION

Sport is a phenomenon, in his professional or recreational form. Different approach in perception of sport from the psyche concertation with effect on physical perception viewpoint can be simply divided as a form of tension and relaxation. This is how sport is perceived in the eastern philosophical circles. Martial arts, karate included, uses this difference in perception for sports growth. Authors [1,2,3] point out the perception of the athlete in training process from the perspective of his inside and inside changes as a heishu exercise, in our case KZR (kata of closed hands) – concentration to the inside, or from the perspective of his external focus, that is monitoring and adaptation mostly on outside stimuli percieved as kaishu kata, KOR (kata of open hands) – concentration to the outside. This way we can get to another level of adaptation in the dual system, we can fully concentrate on work and control of inside adaptation stimuli, or vice versa, outside stimuli. In practical karate we proceed to such combination of this duality, which is useful for improvement of performance. Karate is exercised on only on a proffesional level, many practitioners go through the training process to strengthen health and raise comfort of life. The relatively easy system of such dual concentration requires high focus of psyche and personal commitment. Certain duality of sensing movement through psychological regulation is confirmed also by percieving of precesses in brain with transmission of nerve impulses [4]. Even though this method of duality by training by relaxation (KZR) and tension (KOR) os known on Goju-ryu style karate for a long time, todays sport karate obviously does not use this method. This is the result of many factors, like few masters with the understanding of this old system, the need of fast preparation of sport karateka (with the negatives in soon retirement, usually at junior age) and sparcity of experts in training process. To show the possibilities of such specific duality system training and its effect on sports performance, we had to acquire probands that are able to work isolated in these two systems and then get relevant values to compare. In karate these two systems are not isolated, in praxis these are used in combination. We acquired probands by targeted selection, where the conditions were to have mastered these two systems of body work, to have obtained the masters degree Dan and to be in good physical condition. The assumption was that in such system age, sport results, possible disease or gender will not be an important factor. In our experience, even amateur karateka are able to give great athletic performance in the training process, without age or other mentioned factors playing a role. Psychic regulation is regulated by combining methods of breathing, autogenous training and progressive muscle relaxation.

Differences described in the literature [5] are telling us about „fullness and emptiness of blood", while not giving any credit to muscles. KOR and KZR method has some specific manifestations in organism [2,3]. KZR is manifested by higher salivation, eructation, not feeling acute exhaustion, thirst, overheating of core, organism being energized even after training without the need for instant regeneration. Breathing occurs ot „hara" – abdominally, muscles are not tense and we concentrate on tendon tension. Short term memory is dominant, so is postrual muscles work, emotions are suppressed adn thoughts are just observed with the concentration being on own body. It is necessary to keep movement of upper and lower limbs separate. These principles are trained in specific exercises sanchin and tensho. KOR is manifested by the feeling of dryness in the mouth, by thirst, hunger and loss of energy. After the performance regeneration an mental activation is necessary. Movement acts are conducted predominantly in the state of tension, by emohasis on phasic muscles, used are also long term memory, impact breathing as needed, intensive sweating and feeling of hypertermia. Movements of upper and lower limbs run in paralel. The main idea of such training is some „tenseness" of organism and concentration to outside adaptation stimuli.

In meta-analytical study the activity of brain was described [6] during swallowing of own saliva and water, by which left-side sensory-motor cortex, right-side motor cortex and

gyrus cinguli on both sides were activated. Activity of brain during such activity is overlapping and differs. Swallowing of saliva activates premotor areas in connection with initiating control of movement. Long term memory [7] relates to skeletal muscles and authors [8] connect short term memory (working memory) wothphenological loop, visually-spatial sketching and neocortical senzoric and motor interface. A confirmation exists [9], that activity of working memory has a key importance in modulation of selective visual attention. During studies of fake (illusionary) memory and in comparison with proper recognition a double-sided rise in concentration of oxidized hemoglobin (OxyHb) was demonstrated in prefrontal cortex [10]. As described [11], from the viewpoint of neurology, high skill and response of hand movement in primary motor cortex (M1) and primary sensory-motor cortex (S1) is somatotopic, while activated cortical areas partially overlap (movement of thumb, fifth finger and other three fingers with wrist). Their mutual activation in S1 differs from activation in M1 in this movement so that movements activated a higher count of loci in S1, that were of smaller areas when compared to M1, similar mutual overlap of activated areas was lower in M1 than in S1. Motoric skills are developed in two ways, which we can obtain concurrently [12]. Many studies predict differences between activity of brain during different emotions and emotionally neutral state. Emotional valence (dimension of like/not like) and extent of energizing is property of two different neural systems [13].

METHODS

Participants

The selected research set of probands was composed of 7 karateka of Karate Dojo Pivovarník in HanušovcenadTopľou,Slovak republic (6 men, 1 female), all able to work in the regime of borderline concentrationto the inside (KZR) and to the outside of the body (KOR), age = 29.14±8.48 years, height = 177.14±9.48 cm, body weight $_{input\ KZR}$ = 77.63±10.49 kg, body weight$_{input\ KOR}$ = 78.71±10.45 kg). All subjects were informed about the research and signed consent form.

Measures and procedures

Values were acquired from one KZR training modul and eight weeks later that from an KOR training, in the meantime trainings continued in usual manner. Trainings were identical during approximately same conditions – ambient temperature, composition of training unit and its difficulty. During KZR the stimulation of concentration was based on concentrating on ownbody, commands were issued without vocalization, besides the probands and a short doctors visitation there were no other people present during the 90 minutes training session. During KOR the stimulation during the identical training was concentrated on outside adaptation, concurrently the training session of other members of the club took place, spectators were present, commands were loudly vocalized. Before and after the session basic somatometric data were measured, relative air humidity was monitored, ambient temperature, basic physiological data were measured, venous blood was collected from the forearm of probands to determine necessary data.

Medical staff was present during the collection and measurement – a doctor, certificated nurse and a medical laboratory technician. Collected blood was sent to Synlab Slovakia, sro. laboratory in Prešov, where necessary laboratory measurements were made. During the experiment no food or fluid intake.

After both training units subjective feelings of probands were recorded by a set of test questions and by an personality test. Necessary data were calculated [14].

All data were registered to protocols. Values of chosen trace elements in blood were monitored, acid-base balance and derived data (examination of parameters pH, HCO_3^-, pCO_2,

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pO_2, BE, Hb and chosen indicators influencing acid-base balance as ion concentrations – natrium, kalium, calcium, magnesium, chlorine, phosphorus) were also examined.

Statistical analysis

Collected empirical data are and were evaluated by mathematical – statistical methods, by form of analysis and deduction. To determine the significance on input and output KZR data we used Mann-Whitney nonparametric U-test, by which it is not possible to predict normal spread of probability of monitored signs, where we monitored significance on the level $p < 0.01$ and $p < 0.05$. To determine significance of effectivity of stimuli in KZR and KOR we used Wilcoxons nonparametrical test to find statistical significance of difference of input and output at 1 and 5% ($p < 0.01$, $p < 0.05$). Measurements and standards Synlab Slovakia,s.r.o., calculations of deficit, SO, AM and others according to the manual [14].

RESULTS

The results point to non-confirmation of the hypothesis that monitored values in KZR and KOR would not differ significantly. It was found, that some values are highly significant and based on these values the two training units can be clearly distinguished.

After KZR, MAL (metabolic alkalosis) and RAC (respiratory acidosis) is caused, alternatively normal (only in PP and LK, who recently got through respiratory tract infection). After KOR everyone is getting to normal state after the training session, eventually RAC, RAL (respiratory alkalosis) and MAC (metabollic acidosis) (JK and PP, declared a very high fatigue state), interpretation based on acid-base balance disorders based on pCO_2 a HCO_3^-[14].

Compared output KOR a KZR (Mann-Whitney U test): HCO_3^- and MetHb significant based on level of significance $p < 0.05$; pO_2, $SatO_2$, OxyHb and DeoxHb on the level of $p < 0,01$.

Compared changes of input and output values in KOR and KZR (Vilcoxon test) : concurrent changes on the level of significance $p < 0.05$ in pO_2, OxyHb andDeoxHb.

Significant changes of input and output in KZR and KOR by Vilcoxon test without concurrent significance influence: pCO_2 (KOR $p < 0.05$), haemoglobin (KZR $p < 0.05$), COHb (KZR $p < 0.05$), HCO_3^- (KOR $p < 0.05$), water deficit $DefH_2O$ (KZR and KOR $p < 0.05$), sodium deficit DefNa (KOR $p < 0.05$). Interesting : body weightin KZR and KOR $p < 0.05$, magnesium in KZR and KOR $p < 0.05$.

Data in Table 1 point to highly significant differences, which show that training by first or second way of concentration (KZR and KOR) has got a highly significant influence in measured values. We assumed by null hypothesis, that values would not significantly differ, but statistically it is confirmed, that these variables do probably have predictive value. Differences in output values and their comparison (Table 1) highlight the highly significant change on the level of $p < 0.01$ in kalium, pO_2, $satO_2$, OxyHb, DeoxHb, AG (anion gap). On the level of $p < 0.05$ we have a significant change in bicarbonate, base excess (BE) and MetHb.

In Table 2 we see changes on the level of significance $p < 0.05$ with captured change of arithmetic mean. By specifically oriented training unit KZR and KOR we caused changes in the organism, sometimes with a paradoxical value (e.g. body weight) or interesting result of a decrease in $DefH_2O$, where in KZR the decrease is in excess. Interesting are the values of pO_2, that are below normal with the exception of one case (Table 4), at the same time e.g. pCO_2, HCO_3^- (Table 3, Table 5) predominantly above the norm with interesting changes after the effect of a single stimulus. Surprisingly, also the effect of kalium and deficit of H_2O in the organism were statistically confirmed for single stimuli.

Table1. Comparison of output in KOR and KZR, Mann-Whitney U – test

Monitoredvalue	p-value	2*1sided exact p	Significant an p<0,01; p<0,05
Kalium	0.0021	0.0006	p<0.01
HCO_3^-	0.0295	0.0262	p<0.05
BE	0.0152	0.0111	p<0.05
pO_2	0.0049	0.0023	p<0.01
$SatO_2$	0.0033	0.0012	p<0.01
OxyHb	0.0033	0.0012	p<0.01
MetHb	0.0211	0.0175	p<0.05
DeoxHb	0.0040	0.0012	p<0.01
AG	0.0106	0.0070	p<0.01

Table 2. Comparison of changes of values in input and output in KOR and KZR, Vilcoxon test

Monitored value	Valid N	increase/decrease change mean	Level of significance p
Body weight (kg)	KOR 7	↓1.3143	p<0.05
	KZR 5	↑0.7285	p<0.05
Calcium ($mmol.l^{-1}$)	KOR 6	↑0.0986	p<0.05
	KZR 7	↑0.1157	p<0.05
Natrium ($mmol.l^{-1}$)	KOR 7	↑3.0286	p<0.05
	KZR 7	↑2.0428	p<0.05
Magnesium ($mmol.l^{-1}$)	KOR 6	↓0.0471	p<0.05
	KZR 7	↓0.0314	p<0.05
pO_2 (kPa)	KOR 7	↑2.3571	p<0.05
	KZR 7	↓0.9600	p<0.05
OxyHb (%)	KOR 7	↑23.3429	p<0.05
	KZR 7	↓18.7286	p<0.05
DeoxHb (%)	KOR 7	↓23.2714	p<0.05
	KZR 7	↑19.3571	p<0.05
SO (mosmol/kg)	KOR 7	↑4.1914	p<0.05
	KZR 7	↑5.4957	p<0.05
Def. H_2O (l)	KOR 7	↓0.2700(-)	p<0.05
	KZR 7	↓0.2294(+)	p<0.05

DISCUSSION

The objective of this partial study was to show that i tis possible to clearly identify a different approach in perception of training by tension and relaxation based on dual concentration. Despite reasonably consistent conditions the hypothesis about nonsignificance of collected data was not confirmed. Data confirmed that there is a difference in training units led this way, and that there exists a possibility to clearly identify such dual state, by some biochemical values collected from the blood of probands after exercise. It is necessary to point out that venous blood was collected after the end of the training unit, within 15-20 seconds.

When we contemplate changes of HCO_3^- (bicarbonate), it predominantly serves as means to transport CO_2, maintaining pH and probably acts on decomposition of lactate. Changes of HCO_3^- (Table 3) point out to possible prediction in difference between KZR training (relaxation) and KOR (tension) as possible analyzator of fatigue. Its increase in KZR and deep

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Table 3. changes HCO_3^- (mmol.l^{-1})

Proband	input KZR	output KZR	input KOR	output KOR
JP	27.9	30.3 ↑	29.1	24.4 ↓
PB	27.0	30.4 ↑	32.1	29.1 ↓
JV	30.1	30.1 =	31.8	26.6 ↓
LK	28.3	28.4 ↑	30.9	26.6 ↓
JK	27.0	29.0 ↑	28.2	18.2 ↓
DK	28.0	28.9 ↑	28.2	23.5 ↓
PP	26.8	24.2 ↓	25.2	18.2 ↓

Legend: value over the norm – red, below the norm – blue, norm 22 – 26 mmol·l^{-1}

Table 4. Changes pO_2 (kPa)

Proband	input KZR	output KZR	input KOR	output KOR
JP	3.84	2.31 ↓	4.6	4.76 ↑
PB	4.05	2.73 ↓	3.59	5.25 ↑
JV	3.91	2.45 ↓	2.94	4.9 ↑
LK	3.6	2.75 ↓	3.57	3.46 ↓
JK	4.77	3.21 ↓	5.4	11.0 ↑
DK	4.08	3.69 ↓	3.74	7.63 ↑
PP	3.12	3.51 ↑	3.34	6.68 ↑

Legend: value over the norm – red, below the norm – blue, norm 8,00 - 14,00 kPa

decrease in KOR indicates a possibility of another buffer mechanism during each focuses of the training unit. Its increase could signalize protection against the action of lactate directly in tissues.

In pO_2 (Table 4) we can observe that the values of probands are very low, they even do not reach prescribed normal values. During KZR training the values even decreased, which shows better utilization of oxygen in tissues. In KOR the values increase, showing a high decrease in utilization of oxygen by the tissues. We can consider the eventuality that free hydrogen in the organism can during specific conditions that arise during KZR system training couple with radical oxygen with specific influence on formation of highly viscous water. By that we could explain the anomaly of increase in body weight (Table 2). High pO_2 during KOR training (11 kPa), that was basically normal, but with other stimuli in the proband JK it could have caused the declared high fatigue and inability to continue in subsequent training session.

Pressure pCO_2 depends on minute ventilation (breathing frequency x breathing volume). During increased ventilation ↓pCO_2decreases and ↑pHincreaces – alkalinization occurs, during decreased ventilation increase of ↑pCO_2 and ↓pH occurs. During increase of ↑pCO_2 respiratory center activates, its sensibility decreases during values above 8 kPa, subsequently leaving

Table 5. Changes pCO_2 (kPa)

Proband	input KZR	output KZR	input KOR	output KOR
JP	6.7	7.45 ↑	6.56	5.87 ↓
PB	6.35	7.11 ↑	8.43	6.51 ↓
JV	6.79	6.9 ↑	7.59	5.86 ↓
LK	6.05	6.04 ↓	7.35	6.12 ↓
JK	5.73	6.06 ↑	6.78	4.34 ↓
DK	6.34	6.27 ↓	6.55	4.91 ↓
PP	6.2	5.33 ↓	6.13	3.79 ↓

Legend: value over the norm – red, below the norm – blue, norm 4,65 - 6,00 kPa

Table 6. AG changes (anion gap)

Proband	input KZR	output KZR	input KOR	output KOR
JP	9.7	9.7 =	8.8	14.3 ↑
PB	10.4	7.5 ↓	5.6	9.4 ↑
JV	8.4	9.1 ↑	7.3	11.7 ↑
LK	8.6	10 ↑	7.7	12.6 ↑
JK	11	10.8 ↓	9.4	20.5 ↑
DK	8.8	8.7 ↓	8.7	12.8 ↑
PP	8.6	11.6 ↑	9.6	14.9 ↑

Legend: value over the norm – red, below the norm – blue, norm 8 - 12 mmol.l^{-1}

Table 7. Saturation O_2

	mean	median	SD	obliquity	sharpness
Input KZR	0.56	0.58	0.11	-0.26	3.18
Output KZR	0.37 ↓	0.36	0.13	0.42	1.95
Input KOR	0.53	0.46	0.13	0.9	2.29
Output KOR	0.77 ↑	0.75	0.15	-0.32	1.96

Legend: SD- St.deviation, standard -venous blood 55 – 70 % [14]

the only stimulus to the center to be ↓pO_2. Values in KZR stay largely above the normal with increase, in KOR values decrease and possibly normalize (Table 5).

Calculation of AG helps in differential diagnostics of metabolic acidosis. Overproduction of acid in metabolism leads to a high AG, during higher excretion of HCO_3^- the AG stays normal. Table 6 highlights values of Anion gap, that points out the specification of metabolic acidosis. Overproduction of acid in metabolism leads to high values and during higher HCO_3^- excretion AG stays normal. In our case, anion gap increeaces only mildly in KZR. In KOR, anion gap vaules rise above the normal values, decrease of HCO_3^- is significant, while it gets near or to the normal (Table 3).

During the comparison of these two training sessions from the viewpoint of utilization of oxygen in the tissues the advantage of KZR training is approximately 40 % (saturation of O_2) more when compared to KOR training (Table 7). Among other things it is visible (Table 5), that probands work during entering the training sessions with very high values of CO_2 pressure in the blood, above the normal.

Dual concentraion training oriented on relaxation, respectively tension of the organism, evokes in probands in some cases divergent measurable vaules on a significant level. Probands were not homogenous in the sense of one age, specifically performance and gender structure, since it was not intended to describe only certain specified group. It was a demonstration of the fact that there is a possibility to conduct the training process by non-tension factor, thus relaxation, a full range of athletes, which could have a positive impact on further possible developments in sport training with possible diagnostics. Probands in the whole spectrum highlighted the joint fact, that there exist such real possibility. Improvement of saturation by oxygen after exercise by about 40% and value of oxygen generally with influence on haemoglobin, bicarbonate values, or other significant data point to the fact that training by dual method is some guide on how to easily influence training in its quantitative and qualitative indicators with possible predictive and diagnostic aspect.

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