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**BUSHI'S BODY:
GESTUAL SYMBOLISATION AND MARTIAL EFFICIENCY**

Florence Braunstein
Ecole Supérieure de Mécanique, Paris
France

Purpose - If sciences of nature allowed us to understand the bio-mechanical limits of human body and their further aim in martial arts, they unfortunately also contributed to transform the body in a place of evaluation of mathematical statistics and of measurements.

Isolating the human body in such a manner, they implicate it as a simple piece of the space and not as a possibility of being condition of this science. Human condition became a secondary hypothesis, because too often built of symbols and not enough flesh.

My interrogation is based upon the link between culture and symbolisation of technical gesture and their contributions in the martial arts.

Method - It is necessary to point out some of martial techniques, Chinese, or Japanese, and to catch their spiritual similarities of an outside and interior world, to show as intelligible this modifications, this transformations by transposition.

Are we allowed in consequence to suppose that any style of fighting is in connection with a metaphysical, a philosophical way of thinking?

I will study a few examples as the important amount of circular movements in Chinese fighting arts like *Tai chi chuan*, or in *Bagua zhang*, which are not only used as symbol of eternal and philosophical stability, because they need a centrifuge force which round gestures make it hard to grasp or stop.

The questions, I will answer, will be what could have been the importance of culture in the Asian fighting practices. What was the importance of the symbol of left or right in Asian martial arts? Why the beginning of some Shotokan kata, by example Kushanku, is a clear allusion to a symbolic universe, difficult to understand today?

Florence.braunstein@wanadoo.fr

**CHOICES AND PREFERENCES IN JUDO, WHAT LOGIC OF PROGRESSION
TO LEARN / TO TEACH THIS ACTIVITY?**

Michel Calmet

**Centre Universitaire de Recherche en Sciences de l'Éducation de Picardie
Faculté des Sciences du Sport, Amiens
France**

Purpose - Historically judo owns two finalities (mutual help and prosperity, optimum use of energy) and experts describe specific objectives in judo:

Goals of results (fights competition)

Goals of dexterity (fights training, technique, katas and self-defense).

Why is a physical education method such as judo so unused in physical education courses in France ?

Methodology - We have analyzed different groups: judo teachers, judokas in special competition training school, judokas from French team, pupils at school, young judokas in clubs, young judokas before competition, physical education teachers, students (practicing judo or not)

We have analyzed their preferences in judo, by questioning them with seven items classed between: finalities, goals of dexterity, goals of results and self-defense.

Replies were analyzed with the Antoine de Condorcet's mathematical election theory.

Results - Our work is build on 925 questionnaires. We cannot present all the results, but in next slides we can see comparison between 106 experts and five groups.

139 pupils at school

67 young judokas in clubs

86 45 judokas in school training in Amiens, 31 competitors from judo French team

128 students (92 in physical education, 36 in an other instruction)

72 physical education teachers

Conclusions - Judo cannot be reduced to the combat dimension alone. Judo is often presented on this only way in physical education in France. The teaching of judo (and by extension physical fighting activities) has to be multi-dimensional (finalities and at least two specific objectives), during practice and evaluation. For example: Finalities / to learn throws, to improve and to learn self-protection, or Finalities / to learn throws, to improve and to win fights.

In that way, judo would be more used in physical education courses.

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Calmet M., (1999) , Enseigner le judo ou le savoir combattre, communication affichée, Colloque international de l'AIÉSEPS, Besançon.

**TEACHING JUDO, AND TO A WIDER EXTENT, ANY COMBAT PHYSICAL
ACTIVITIES: HOW TO FIGHT AGAINST COMMONPLACES.**

Michel Calmet

**Centre Universitaire de Recherche en Sciences de l'Éducation de Picardie
Faculté des Sciences du Sport, Amiens
France**

Combat Physical Activities (CPA) such as wrestling or judo are little practiced during Physical Education periods at school. What could the reasons be for such a desertion?

There is certainly not a single answer to that question.

During the training sessions we are in charge of, (Initial at University and Continuous throughout the FPC training courses) the different topics dealt with are as follows:

the activity technicality; the internal logic of the activity; beginning by an on the ground practice; the level group; how to differentiate the roles; length of the combats and strategies; how to get to the activity by the means of games.

Many of these topics are part of the P.E teachers' discourses we may hear (or read as well), and they tend to be accepted as commonplaces, thus representing an impediment to our teaching these CPAs.

Regarding these considerations, four topics have attracted our attention, and in order to study them, we are asking the following questions: "The predominant logical characteristic is opposition: am I supposed to reduce the CPAs to that only and one dimension?". "Do the pupils have to begin the practice of the CPAs with an on the ground or a standing up position?". "Are the weight, skill and tonicity categories the only methods to organize the confrontation?". "The pupils have problems with turning their backs for an attack; can they still progress?"

To answer these four questions, we will bolster up our considerations with the following elements:

1) The mechanisms of the didactic transposition. 2) Surveys carried out by using Antoine de Condorcet's method of pair comparisons. 3) Our own personal and professional experiences.

Our conclusions will lead us to differentiate the internal logic of the activity from the logic of progression in the activity.

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TRADITIONAL KARATE AT SCHOOL: A DIDACTIC PROJECT

Bernardo Contarelli^{1,2}, Michela Turci²

¹ **Presidente Commissione Tecnica FIKTA**

² **Commissione Scientifica FIKTA**

(Federazione Italiana Karate Tradizionale e Discipline Affini)

Italy

Introduction - Karate is an ancient discipline that largely spread in Japan, during the first years of '900. At the present time, it represents a Japanese Martial Art practiced worldwide. Karate is not only a useful mean of self-defense and a competitive sport, but also consists in a valuable physical activity that involves the global nature of a person. Karate can be studied either by children or by old people, without any discrimination on the sex of its performer (1). Furthermore, the different motory and cognitive capabilities of each learner are correctly stimulated by the practice of this discipline.

Methods - Traditional Karate is deeply based on important principles, either motory or cognitive, while promoting the development of a young subject on his physical and spiritual aspects. The study of Karate allows the learner to improve his physical capabilities (i.e. endurance, muscular strength), to understand the inner mean of any movement, to gain a better self-esteem. Furthermore, the respect of neighbor is the first rule to be taught in Karate. In the Italian Public Schools, these educational purposes are indeed recommended in the programs for the teachings of Physical Education. The correct teaching of the three different components of Karate, *kihon* (basics), *kata* (forms), and *kumite* (sparring), could help young people to obtain a progressive and optimal development either of their body or of their mind. The practice of Traditional Karate at school should represent a pedagogical mean, considering the motory and cognitive capabilities of learning at the different ages of the subjects. In contrast, Karate has not to be considered a target, but only a valuable help to support and develop the biological and psychological peculiarities of each student.

Conclusions - For its particular characteristics, Traditional Karate may be studied by young people, starting from Primary School. Nevertheless, a specific didactic project on Karate at school has to take in charge the effective and correct growth of boys and girls. In the school context, the mere achievement of antagonistic results would oppose the current concepts of Education.

Reference - 1. Funakoshi G, Karate-do: my way of life. Tokyo: Kodansha, 1973.

**THE MORPHOLOGICAL 3D ANALYSIS OF MOVEMENT:
APPLICATIONS TO TRADITIONAL KARATE****Virgilio F. Ferrario****FARC (Functional Anatomy Research Center)****LAFAL (Laboratorio di Anatomia Funzionale dell'Apparato Locomotore)****Facoltà di Medicina e Chirurgia – Università degli Studi di Milano****Italy**

In Traditional Karate, great importance is given to correct form, one of the key aspects for the evaluation of the performer. Indeed, several sports depend on a correct body form for the effectiveness of their techniques, and the level of repeatability of any standardized movement is currently considered one of the indicators of the performer ability. Literature reports many studies demonstrating that elite athletes are able to repeat the basic techniques of a sport better and more efficiently than less experienced athletes. Examples can be found in golf and tennis, athletics and gymnastics, soccer and basketball, and also in Traditional Karate, where top levels of performance belong to high *dan* grades.

Up to now, the evaluation of the experience, ability and level of performance of *karateka* has been left to the sensibility of the masters during daily training, or to the competence and promptitude of the referee and judges during a competition. Nevertheless, the naked eye observation, even though correct, is not completely able to assign a quantitative value to a set of movements, but only a qualitative opinion.

In our laboratory, a method to quantify the repeatability of selected sport movements has been developed. The method individualizes single landmarks on the body of the athlete; the landmarks are selected among those with an anatomical/bio-mechanical significance for that movement, which is repeated by the single athlete in standardized conditions. Landmark positions in space and time are recorded by computerized infrared stereo-photogrammetry, and a three-dimensional reconstruction of the movement is performed. Original mathematical algorithms quantify the repeatability of the movements in single athletes, and the parts of the body which repeat the movement with more or less consistency are singled out. The analysis also allows to quantify the symmetry of paired movements. The method has been applied to several sports, and in particular to selected movements in Traditional Karate (choku-tsuki, oi-tsuki, mae-geri-keage), as well as to athletes and *karateka* of different level.

**KARATE AS ADAPTED ACTIVITY FOR OLD PEOPLE:
A PRELIMINARY SPECIFIC PROJECT****Paolo Garzotti^{1,2}, Gaetano Zavateri¹****¹I Divisione Geriatrica -Ospedale Civile Maggiore - Borgo Trento - Verona****²Medical Committee of FIKTA****(Federazione Italiana Karate Tradizionale e Discipline Affini)****Italy**

Introduction – Karate is not only a technical–antagonistic event, but could also represent a specific physical activity for old people, who will shortly constitute the majority of population, in technologically advanced societies. The professional figure of geriatric physician should provide as assistant for the Karate master. They both will organize specific courses of Traditional Karate for old people.

Methods – A proper physical activity is a valuable mean to maintain people healthy, also during advanced age. Indeed, literature reports the beneficial effects either in cardiovascular, respiratory, and locomotor apparatus or in the metabolic functionality. Traditional Karate, properly adapted to the real physical characteristics of an old subject, could constitute a valuable support to obtain these results. In the organizing projecting phase of a Karate course for old people, the places, the persons in charge, and the possible beneficiaries have to be found. A preliminary and accurate check up allows the individuation of the particular characteristics of each subject, and his consequent introduction to a proper group of activity. The geriatric physician represents the best professional figure to detect the real conditions of health in old people. A personal health record, and a file of evaluation of the residual functionality, containing anamnestic data (i.e. age, weight, height and consequent body mass index, cardiovascular, respiratory, surgical, traumatological, reumatological, and metabolic anamnesis, probable current therapies), whose score is added to the functional tests (i.e. step test, trunk range of motion), are the instruments for a first screening, that are necessary to organize a real adapted activity for each subject. The Karate master, properly informed by the physician about the effective physical capabilities of each participant, compiles an adapted technical – practical program. Furthermore, a record of final evaluation allows the computing of the functional variations obtained in the course, and permits to operate possible changes in the structure of the course.



**DO KARATEKA BETTER MAINTAIN THEIR EQUILIBRIUM
ON A TILTING PLATFORM THAN OTHER SPORTSPERSONS?**

**GianPiero Grassi¹, Chiarella Sforza^{1,2}, Nicola Fragnito¹,
Vanina Vanini¹, Virgilio F. Ferrario^{1,2}**

¹Laboratorio di Anatomia Funzionale dell'Apparato Locomotore (LAFAL),

²Functional Anatomy Research Center (FARC),

Istituto di Anatomia Umana Normale, Università degli Studi di Milano
Italy

Introduction – Sport performance depends also on the maintenance of equilibrium. The present study analyzed the effect of the practice of different sports on the maintenance of equilibrium while standing on a tilting platform.

Materials and methods – Forty-seven young healthy athletes aged 14-35 years practicing several sports (karate: 7 men, 8 women; gymnastics: 9 men, 9 women; volleyball: 8 men, 8 women) were asked to stand in bare feet on a wooden platform that tilted on a steel half sphere, and instructed to keep the platform as horizontal as possible over a 30 s test. The task was repeated three times. The 3D movements of the platform versus the ground were recorded by a motion analyzer system, and analyzed by original software in the last 20 s of each test (1). From the center of gravity of the platform, the directrix of the plane was computed, and its antero-posterior and left-right inclinations were quantified calculating the area of the confidence ellipse at length 1 (proportional to the variability of the oscillation). Mean values were computed for each sex and sport, and compared using ANOVA.

Results - On average, within each sport male and female sportspersons had similar performances. Karateka and gymnasts showed the smallest area of oscillation (i.e., the platform movement was less variable), volleyball players showed the highest area. A large variability was observed, with standard deviations as large as 95% of the relevant mean, and ANOVA found significant differences ($p > 0.05$) neither between sexes nor between sports.

Discussion and Conclusions – Karateka and gymnasts obtained the best results with the present test. It seems that both sports imply a careful control of body stance that allows the athletes to well perform even on an ever-changing surface. The present results are obviously preliminary, and only a larger number of subjects will allow a deeper understanding of the peculiar characteristics of each sport.

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**A HEALTHY BODY IN A HEALTHY MIND: THE ENACTION OF A SPIELRAUM
AS A MENTAL PROLONGATION OF THE BODY**

Domenico Masciotra
Université du Québec à Montréal
Hôpital Rivière des Prairies
Canada

A being is in the world because the body becomes a mind that envelops and prolongs the body within space-time. Therefore, the maxim a healthy mind in a healthy body must be inverted. From this point of view, the mind is not only located in the brain, it has ramifications, via the nervous system and the blood circulation, in the whole body and branches out space-time to constitute in it a “spielraum”, i.e. a room to maneuver (Damasio, 1995; Masciotra, Ackermann, Roth, in press). The term “spielraum”, which has been borrowed from Heidegger (1977), represents the field of action generated by an individual involved in a situation (ex: karate fight).

Varela, Thompson, and Rosch (1993) “propose as a name the term *enactive* to emphasize the growing conviction that cognition is not a representation of a pregiven world by a pregiven mind but that is rather the enactment of a world and a mind on the basis of a history of the variety of actions that a being in the world performs” (p. 9). Thus, the adversary in karate and the spielraum in which he acts are not pregiven to a mind empowered to transform them in “representational knowledge”, as presumed by cognitivism. The combatant does not debate with the accuracy of his representations, he combats against the opponent facing him here and now.

Hence the question: What are the conditions under which the individual standing right here, in front of me, constitute for me an adversary whom I am facing? In the theoretical perspective held here, the combatant must “enact” the adversary by means of his guard. The guard is defined as a system of virtual actions whose intentional threads (Merleau-Ponty, 1945) enable the combatant to existentially link himself with the adversary. Metaphorically, the system of actions spreads out his intentional threads within space-time very much alike the spider that builds its web so as to generate a favorable spielraum.

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FIKTA 2000



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THE PRAISE OF CULTURAL TRAINING

Ivana Padoan

**Facoltà di Filosofia – Università di Venezia “Cà Foscari”
Facoltà di Psicologia – Università di Padova
Italy**

EPISTEMOLOGY OF KARATE

Luciano Puricelli

ITKF Vice-President

(International Traditional Karate Federation)

Karate is a practical activity and a men-made art.

The history of Karate is the history of the activities and the ideals of men who became masters. The form and the art can not be divided from the ethical and philosophical values on which they both are based. The sense and the deep essence of Karate should be analyzed, starting from Sokon Matsumura's *makimono*, that represents the oldest written document about Karate we have ever known. In this document, the importance of *bub bub ryo do* (harmonizing themselves either the physical training or the study of philosophy) is well highlighted.

Furthermore, observing the experiences of the Masters Itosu and Funakoshi, is possible to affirm that the coupled principles of *bub bub ryo do* and *shi gi tai* (mind – body – spirit) have contributed to synthesize Traditional Karate in the ancient and current concept of *karate ni sente nashi* (Karate has to be practised during all the life).



EMOZIONI E PRESTAZIONE IN ATLETI PRATICANTI KARATE

**Claudio Robazza¹, Franco Campanati³,
Valter Durigon², Elena Brunello³**

¹ **Facoltà di Medicina e Chirurgia, Scienze Motorie, Padova**

² **Ministero Pubblica Istruzione - CONI**

³ **FIKTA (Federazione Italiana Karate Tradizionale e Discipline Affini)
Italy**

Le emozioni che l'atleta sperimenta prima della gara possono influire sulla sua prestazione. Secondo il modello delle zone individuali di funzionamento ottimale (modello IZOF: Individual Zones of Optimal Functioning), emozioni strettamente personali, sia piacevoli che spiacevoli, agiscono facilitando o danneggiando la prestazione sportiva attraverso meccanismi di produzione e di utilizzo dell'energia psicofisica. E' prevista buona prestazione qualora, prima della competizione, l'intensità delle emozioni facilitanti sia all'interno di una gamma (zona) di intensità ottimale e, contemporaneamente, l'intensità delle emozioni inibenti sia al di fuori della zona disfunzionale. Per verificare questa ipotesi è in corso una ricerca con atleti evoluti e di alto livello praticanti karate. Un ulteriore obiettivo della ricerca è di completare lo studio delle emozioni considerando anche variabili fisico-motorie costituite da capacità condizionali, coordinative e tecniche. In generale, si desidera verificare se la valutazione delle condizioni psicofisiche che precedono la gara sia collegata alla prestazione. Dai risultati si potranno: ottenere informazioni sul modo in cui gli atleti vivono l'esperienza agonistica, con particolare riferimento al vissuto emozionale della competizione; ricavare indicazioni utili agli operatori sportivi per favorire negli atleti un'esperienza sportiva gratificante e di successo.

**A 3D BASED ANALYSIS OF THE REPEATABILITY OF CHOKU-TSUKI
AND OI-TSUKI IN TRADITIONAL KARATE****Chiarella Sforza^{1,2}, Michela Turci², GianPiero Grassi²,
Yuri Shirai², Virgilio F. Ferrario^{1,2}**¹ FARC (Functional Anatomy Research Center)² LAFAL (Laboratorio di Anatomia Funzionale dell'Apparato Locomotore)
Istituto di Anatomia Umana Normale, Università degli Studi di Milano
Italy

Introduction - A correct body form is one of the principles on which Karate is based: the higher the level of the *karateka* the better his morphological performance. Moreover, the capability to repeat a selected specific movement is currently considered as an indicator of the experience of the performer (1). A preliminary study quantified the repeatability of two standardized attack techniques (*choku-tsuki* and *oi-tsuki*) of Traditional Karate (1). In the present investigation, the same movements have been analyzed, in a larger sample of high-level *karateka*.

Materials and Methods - Thirteen *karateka* (eight men, five women) from 1st to 5th Dan, were filmed with a system that allows the 3D reconstruction of fast and complex movements. Thirteen landmarks were analyzed while each *karateka* performed 10 repetitions each of *choku-tsuki* and *oi-tsuki*. For each *karateka* and punch, the average time of execution was calculated, and the standard deviations of each of the three spatial coordinates were computed for each landmark. A total standard deviation (*SD*) of the single *karateka* was also calculated.

Results and Discussion – All the subject performed *oi-tsuki* in a longer time than *choku-tsuki*. The best repeatability in time (lower *SD*) was generally obtained by more experienced *karateka*. On average, in both techniques the execution times were shorter in men than in women. The best individual repeatability in *choku-tsuki* was observed in three men; in contrast, women demonstrated a better homogeneity in their global performance. Both men and women generally performed a similar mean repeatability. In both techniques, the largest variability was found on *x* coordinate (direction of movement). In *choku-tsuki*, hips and shoulders showed the best repeatability in all participants. In *oi-tsuki*, the best individual repeatability was observed in two women. On average, female athletes performed a better repeatability than men. In the same technique and in almost all participants, the worst repeatability was observed in the ankle corresponding to the displaced limb.

Conclusions – As already demonstrated (1), the most experienced *karateka* generally obtained the best repeatability. Furthermore, the level of performance was independent on the sex of the performer. In conclusion, the method could be used to detect athletes particularly gifted for karate; it could help the athletes indicating which parts of their body do not repeat a movement with sufficient accuracy, thus assisting in the achievement of a correct body form.

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TRANSACTIONAL ANALYSIS APPLIED FOR KARATE

Guranda Tevdoradze, Oleg Chikovani
Georgian Shotokan Karate-Do Association, Tbilisi
Georgia

Authors intend to investigate the phenomenon of karate as a part of Eastern Culture implanted into the Western one, from the point of view of psychology, namely – using transactional analysis.

As we know, the oriental methods of fighting are based on the great systems of philosophy and religion (it's even difficult to put a border between them). Taken separately, they lose their essential meaning and are doomed to be transformed. Such a transformation happens with karate when it is studied and used by Europeans. As a rule the western mentality isn't able to swim in deep waters of eastern philosophy even in case if there exists a will to do it, and moreover the person who wishes simply to possess the secrets of karate doesn't want to deal with any philosophy at all because he regards the mentioned system only as a kind of sport, and nothing more. So, arises the question: how great is the difference between the Karate-Itself and the Karate-for-the-European? In other words, if we'll take two sportsmen from the corresponding parts of the world and if we'll compare: what does karate mean for the European having learned it and what does karate mean for the Asian that has absorbed it, - how strong will be the contrast?

The question that is connected with the mentality and consciousness must be answered by the means of psychological methods, the best way to realize the thought of the person and to come to know with its modelling algorithm is to take for operations the simplest theory of transactional analysis. For this reason the authors have done the considerations about the transactions: European Karatist – His Trainer, European Karatist – His Oppositionist, European Karatist – His TeamMate; Asian Karatist – His Trainer, Asian Karatist – His Oppositionist, Asian Karatist – His TeamMate.

The conclusions are such that karate itself is understood and regarded by European on the level of the Childish part of his Ego, and Asian understanding is concentrated entirely on the Parent's part. This is the short contents of the report.

THE EFFECT OF MENTAL TRAINING ON THE REPEATABILITY OF A SELECTED SEQUENCE FROM HEIAN YODAN KARATE KATA: A 3D ANALYSIS.

**Michela Turci¹, Chiarella Sforza^{1,2}, Giovanni Michielon¹,
Virgilio F. Ferrario^{1,2}, Giuliano Pizzini¹**

¹LAFAL (Laboratorio di Anatomia Funzionale dell'Apparato Locomotore)

²FARC (Functional Anatomy Research Center)

Istituto di Anatomia Umana Normale, Università degli Studi di Milano
Italy

Introduction - Traditional Karate is a martial art that involves both physical and mental aspects. Moreover, in karate the effectiveness of any technique largely depends on a correct body form. The repeatability while executing standardized movements of a discipline is an indicator of the athlete's level (1). In the present study, the effect of a mental training program, already used in archery (2) and successively adapted to the improvement of karate techniques, was quantified.

Materials and methods - A group of 4 *karateka*, 3 men and one woman ranging from brown-belt to 2nd *dan*, volunteered in the study. Starting from *ko-kutsu-dachi* (back stance) and right *morote-uke* (augmented forearm block), all the techniques till right *yoko-geri-kekomi* (side thrust kick), *uraken-uchi* (back fist striking) and left *empi-uchi* (elbow striking) were executed. The sequence was recorded by an optoelectronic image analyzer, and the 3D reconstruction of the displacements of 17 standardized body landmarks was performed. Each *karateka* executed 10 repetitions of the sequence. The trial was repeated before and after a 4-weeks technical and mental training performed twice a week. A control group of 3 female *karateka* (green and brown belt, and a 2nd *dan*), also volunteered in the study, participating only to the technical training. For each *karateka* and sequence, the standard deviation (*SD*) of the 3 spatial coordinates (*x*, *y*, *z*) were computed for each landmark, as well as a total *SD*. Data were compared within group before and after training.

Results and discussion - In all the mental trained *karateka* an improvement of the repeatability (smaller *SD*) was observed. In contrast, the two colored belts of the control group showed a decrement in their performance, while the 2nd *dan* had a small improvement. Considering selected paired landmarks in the mental trained group, the largest significance ($p \leq 0.001$) was observed in the repeatability of right and left wrists and elbows. A significant improvement was also found in the repeatability of knees, heels and hips ($p \leq 0.05$).

Conclusions - Mental training could improve Karate performance. 3D analysis can detect athletes gifted for the discipline, and quantify the improvements after a specific training, indicating the best repeatable landmarks.

Reference -1. Sforza C, Turci M, Grassi GP, Fragnito N, Pizzini G, Ferrario VF. The repeatability of choku-tsuki and oi-tsuki in traditional shotokan karate: a morphological three-dimensional analysis. *Perceptual Motor Skills*, 2000, 90, 947-960.

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**INFLUENCE OF DEHYDRATION AND REHYDRATION ON THE SPEED
ENDURANCE PARAMETERS IN TRADITIONAL KARATE****Vladimir K. Yorga¹, Ilia K. Yorga¹, Vesna M. Ljusic², Labud Jankovic³****¹University of Belgrade-Chair for Sports Medicine****²International Clinics in Sports Medicine-Belgrade****³University of Novi Sad-Faculty of Physical Education and Sport Sciences
Jugoslavija**

The significance of euhydration in karate closely related to the mechanisms of the body thermoregulation and recovery after the prolonged training and competition. The level of hydration is also a foundation for adequate and very specific sports nutrition. During different phases of training in environment of high temperatures and humidity, dehydration has a profound effect on the body, e.g. on the speed of movements (e.g. punches and kicking). In our study we have selected 30 top karate athletes, with anthropological measurements. They have completed specific training, based on our medical protocol (I-non hydration, II-hydration). We have conducted the supervised training consisting of 10 minutes warming-up procedure, specific testing of the number of punches and kicks for the duration of 10 second and 60 seconds. After the completion of the test, they have performed the standard training of duration 90 minutes. The second-final test was performed at the end of the training, and after the 10 minutes of cooling down. The sportsmen were measured once again. The same protocol was done after one week, with the only difference that the sportsmen had the regular water intake in the 15 minutes intervals, 200 ml of water. The percentage of the loss of body weight was 2.2-3.4%.

In protocol II (hydrated individuals), the loss of body weight was significantly lower. Athletes completed the training with a 1.8-2.2% loss. The number of punches and kicks in 10 and 60 seconds was significantly lower in protocol II. Results are pointing out a necessity of introduction of the regular prehydration, transitory hydration, and rehydratuion. Intake of water should be higher than 150% of body weight loss to satisfy the hydration needs of athletes for proper recovering.

**THE ROLE OF CREATINE AS SPORTS FOOD SUPPLEMENT
IN KARATE TRAINING**

Vladimir K. Yorga
Chair for Sports Medicine, University of Belgrade
Jugoslavija

During the last decade in the sports medicine scientific literature, the positive effects of creative ingestion mechanisms have been positively verified. Testing on karate athletes of both genders has shown to us that creatine supplementation has positive influence on karate performance (numbers of punches, punch power, and speed endurance). The exact mechanism of intake of creatine and how it influences the sport performance was not yet cleared. In the study we have chosen as a statistical sample the karate sportsmen and sportswomen groups, which have the regular, prescribed medically allowable levels of creatine, by performing the double blind placebo test studies.

During the experimental period we have examined the daily intake of four times a day with a regular dosage of 5 gr, during the period of five days. We have established that this quantity is significant to amount of work, which can be performed by the healthy karate athletes during the repeated sets of the maximum load exercise. The testing was performed on the CYBEX power machine and specifics in karate tests. These findings are in compliance with results which have been obtained earlier (Balsom et al. 1993, Birtch et al. 1994, Yorga et al. 1995). It is clear from the series of consistent research conducted on top karate athletes that ingestion of creatine during the five days period at the rate of 4 times a day, dosage of 5 grams, is adequate for the desired level of performance. In the follow-up period of two months, the daily intake of creatine was 2 gr. We have noticed the significant improvement and increase of the body mass, which was in the area 1 to 3%, while the protocol of nutrition remained unchanged.

INDEX OF AUTHORS

Braunstein Florence, 1.	Tevdoradze Guranda, 13.
Brunello Elena, 11.	Turci Michela, 4, 12,14.
Calmet Michel, 2, 3.	Vanini Vanina, 7.
Campanati Franco, 11.	Yorga Ilia K., 15.
Chikovani Oleg, 13.	Yorga Vladimir K., 15, 16.
Contarelli Bernardo, 4.	Zavateri Gaetano, 6.
Durigon Valter, 11.	
Ferrario Virgilio F., 5, 7, 12, 14.	
Fragno Nicola, 7.	
Garzotti Paolo, 6.	
Grassi GianPiero, 7, 12.	
Masciotra Domenico, 8.	
Jankovic Labud, 15.	
Ljutic Vesna M., 15.	
Michielon Giovanni, 14.	
Padoan Ivana, 9.	
Pizzini Giuliano, 14.	
Puricelli Luciano, 10.	
Robazza Claudio, 11.	
Sforza Chiarella, 7, 12, 14.	
Shirai Yuri, 12.	