

Food rebalancing in a complex with relaxation exercises improves performance, body structure, metabolism during a lost of weight body in elite judokamen

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Abstract

Objective Background Periodic weight loss is often necessary for judo athletes. The health of bones during weight loss in judokas has not been previously investigated. We assessed a new method of rebalancing diet, which is based on the circadian rhythm of various hormones. In addition, the psychophysiological functions of 12 male athletes (28 years old) were examined. The athletes engaged in judo training at a professional level and regularly (3_4 times a year) practiced fast weight reduction. **Materials and Methods** We assessed 12 elite judoist men. They followed the LE PANSE method for 10 months. This method is based on hormonal peaks as well as individualized personalized training and medical attention to the subject. Lean mass (LM), fat mass (FM), lumbar spine (LS), total hip (TH), and whole body (WB) were measured using DEXA. Electroencephalography and the Spielberg methods of self-evaluation of anxiety were used. **Results** The LE PANSE method significantly increases bone density at all sites studied (-2.7 % whole body; 8.7% total hip, and 3.7% lumbar spine ($p < 0.05$), decreases fat mass (-37.7%) ($p < 0.05$) and preserves muscle mass. Studies conducted after psychophysical correction showed a decrease in functional tension in athletes. **Conclusions** Our data suggest that the LE PANSE method decreases fat mass, preserves muscle mass, and increases BMD at all sites measured without alteration in performance during national and international championships. The correction of the psychophysical state of athletes practicing weight loss, using the method of balanced nutrition Le Pans, will help to maintain the optimal functional state of the body and improve athletic performance.

Key words: Bone mineral density, Nutritional rebalancing, Overweight, Psychophysical regulation, Relaxation

Introduction

Judo is an Olympic combat sport with a competitive weight class system. To gain a competitive edge over their opponents, many judoists seek to make the weight that is below their usual one, thus undergoing cycles of losing and regaining weight [1].

The need for weight reduction exists both for people in general and for sports, especially for acyclic sports and martial arts [3,5]. It is known (to the authors) that rapid weight loss has a negative effect on the basic physiological systems of the body, including the cardiovascular and central nervous systems [1]. The psychoemotional state of athletes also worsens; they suffer irritability, as well as reduced tolerance to stress and working capacity [12]. Forced weight loss is a stress [20], so in some cases, inadequate behavioral reactions are inevitable. In practice, the main reason for leaving high-level sports is premature exhaustion of the psychological resource [4,8, 10].

For example, a higher level of activity of delta waves in a state of rest was observed on electroencephalograms (EEG) of the frontal region of the brain in acyclic sports athletes than in cyclic sports athletes not practicing rapid weight loss [9,12]. Furthermore, in acyclic sports athletes practicing functional tests, irradiation of delta waves across the cerebral cortex and activation of alpha waves are observed in the frontocentral region of the brain when the eyes are open. This can be interpreted as signs of functional stress in the central nervous system [18].

Correction of the psychophysical state of the body is necessary to improve the working capacity and functional condition of the individuals who need rapid weight loss in sports as well as in clinical practice [2,6,16,17,19].

The aim of this study was to examine, in the weight loss if this LE PANSE method, a method of rebalancing diet altered body composition, bone mineral density, the psycho-emotional state and the effect of its correction by "exercices Popova method autoregulation" of the athletes judokas

Materials and methods

Subjects

Twelve elite judoists volunteered to participate in this study. All participants received verbal and written informations about the protocol of LePanse Method. Each participant gave his informed written consent. None of the subjects reported any medications, diuretics, protein supplements, or creatine monohydrate. Exclusion criteria were failure to follow the LePanse Method for more than 3 months. The athletes began has to follow the method Le Panse from the beginning by the sports season and till the end the international championships: the follow-up was realized over 10 months.

The psychophysiological functions of 12 male athletes 28.5 ± 3.2 (years), height of 181.1 ± 4.6 (cm) and mean weight of 75.6 ± 12.22 (Kg), were also examined. Nous expliquons simplement dans quels sujets nous avons mesuré les fonctions psycho-physiologiques. Les résultats de ces mesures sont présentés plus loin dans l'article. Athletes engaged in judo training at a professional level and regularly (3-4 times a year) practicing fast weight reduction. The control group included 13 untrained men of the same age with similar anthropometric data. All the subjects were practically healthy and on the day of the examination they did not present any complaints.

In the control group, the subjects were only engaged in general fitness training. The studies were conducted in accordance with the ethical principles of the Declaration of Helsinki. IRB approval was not required for this study. Prior to the tests, we had obtained informed written consent from all of the subjects.

Assessment of Bone Mass and Body Composition

A dual-energy X-ray absorptiometry (DXA) scanner (Hologic Discovery A, Hologic Inc., Bedford, MA, USA) was used to measure Bone Mineral Density (BMD) (g/cm^2) at the whole body (WB), lumbar spine (LS) including L1-L4 and the dominant proximal femur (total hip, TH). The coefficient of variation for our device during measurement on a standard phantom was less than 1% for TH, WB and LS BMD. We further assessed total body fat mass (FM, kg) and total lean mass (LM, kg) according to manufacturer-recommended procedures. Analysis of scans was performed using software (Hologic Discover, version 13.4.2) and the regions of interest for all sites were placed manually by trained study staff according to a standard analysis protocol. All analyses were checked by one researcher for consistency (BLP). The quality control program included both a daily spine phantom scan and at least once per week body composition phantom scan as recommended by the manufacturer protocol. The coefficient of variation (CV) for our DXA was 0,86% for BMD and 0,56% for soft-tissue.

Physical activity and lifestyle

The judoists were questioned regarding their training and weight history. Confirmation of these variables was obtained from medical records and training logs.

A food questionnaire on 7 days is asked the subjects at the beginning of the study. All questionnaires were administered by the same researcher.

These questionnaires are analyzed and allow making an average on the quantities of proteins, carbohydrates and lipids absorbed by the subject

A calorimetry (CHU Orléans 4500, France, Oxycon Pro, JAEGER) is then realized on every subject to distribute individually the good quantities of proteins, carbohydrates and lipids according to the daily activities of each of each.

Methods of psychophysiological research

Applied the methods of self-evaluation of anxiety for Spielberg [23] and the registration of the electroencephalogram (EEG) at rest and with functional tests. Using the Neuron-Spectrum device (Neurosoft, Russia), multichannel EEG recording was performed from 8 cup electrodes connected to the ear electrodes and localized in accordance with the 10-20 system. The parameters of the spectral power of the EEG rhythms and the correlation analysis were analyzed.

The group of athletes for 3 months engaged in psychophysical regulation of the program we created. L'EEG a été effectuée avant et après trois mois d'exercices d'autorégulation. The program contained methods for training muscle relaxation [15] psychophysical exercises (PFE) for creating a "body weight sensation", breathing exercises, PFEs for self-regulation of the functional state in conditions of changing diet and changing body weight. After the end of the course, the examinations were repeated.

Method LE PANSE

The method involves to follow the circadian rhythm of the various hormones [19]. It takes into account the individuality of the subject and the substrats (proteins, carbon hydrate, lipids) are distributed according to the activities of the subject and of various training

The loss of weight with this method implies to eat regularly without limitation and without frustration. A psychological questionnaire is given to every athlete before beginning the method concerning their food habits. A second document is asked: the athletes have to fill during 7 days all the absorbed food.

A calorie average is realized then as well as the quantity of protein, carbohydrates and lipids were absorbed by athletes. At the same time, a calorimetric measure is realized to determine individually the basic metabolism and the necessary quantity of substrata has athletes (proteins, carbohydrates, lipids) needs.

The coefficient of activity Le Panseallowsto add on the metabolism the necessary quantities of proteins, carbohydrates and lipids according to the activities of the athlete.

These indications will allow to choose the coefficient of activity the most adapted in typical day:

1: No activity of the day: sleep, lengthened (stretched out) rest.

1,2: Very light activity = seated sedentary work, office work + irregular sports walking / activity.

1,3: Light activity: seated work + 1 at 2 am of regular / week activity.

1,4: Pretty poor activity = sedentary work, travels(movements) + 2 at 3 am of regular / week sports activity.

1,5: Activity averages = sedentary work, travels (movements) + 3 at 4 am of regular / week sports activity.

1,6: Very moderate activity = work in position standing, travels (movements), do-it-yourself + regular sports activity (at least 2-3h / week).

1,7: Moderate activity = work in position standing, travels (movements), do-it-yourself + regular sports activity (at least 3-4h).

1,8: Important activity = physical work with many travels (movements), handling, outdoor work + regular sports activity (at least 2-3h).

1,9: Very important activity = physical work with many travels (movements), handling, outdoor work + regular sports activity (at least 3-4h).

2 intense Activity = works of strength, building, excavation + regular sports activity (at least 2-3h) / or high-level sportsman.

The rates of proteins and lipids absorbed will have to be the same as the theory; the rates of carbohydrates absorbed by the athlete will have to be kept by taking into account hormonal fluctuations in the first time and increase during the weeks to have enough energy and to be at the theory found by calorimetry. However, if the athlete absorbs more carbohydrates than body needs then it is necessary to apply the theory about the rate of carbohydrates.

Statistical analyses

Means and standard deviations (SD) were calculated for the anthropometric and densitometric measurements.

The Gaussian distribution of the parameters was tested by the Shapiro-Wilk. Statistical differences between groups were determined using a parametric paired t-test. Differences were considered significant at p value < 0.05. Statistical analyses were performed using the R software Core Team (2015, R Foundation for Statistical Computing, Vienna, Austria, Version 0.99.896, RStudio, INC).

Results

Baseline characteristics

Table 1 describes the baseline characteristic of male judoists. Twelve men with a mean age of 28.5±3.2(years), height of 181.1±4.6 (cm) and mean weight of 75.6±12.22 (Kg) wereincluded in the analysis. The characteristics of the subjects are given in Table 1. Amongtheseparticipantsall participants are professional judokas.

Table 1 Characteristics of the subjects

	Men's judoka (n=12) Mean±SD
Age (years)	28.5±3.2
Height (cm)	181.1±4.6
Weight (Kg)	75.6±12.2
Whole body BMD (g/cm ²)	1.42±0.1
Lumbar spine BMD (g/cm ²)	1.29±0.1
Total hip BMD (g/cm ²)	1.26±0.1
Lean mass (Kg)	64±9.9
Fat mass (Kg)	8.55±2.7

The differences between the first anthropometric and densitometric measurements before and after dietary monitoring by Lepanse method are listed in Table 2.

Table 2. Difference between anthropometric and densitometric parameters in participants after the Lepanse method

	First measure (1)		Second measure (2)		p	0%
	M±SD		M±SD			
Weight (kg)	75.0±12.2	72.4±11.2*	-0.05	-4.4%		
Whole body BMD (g/cm ³)	1.42±0.1	1.48±0.1*	+0.05	3.7		
Lumbar spine BMD (g/cm ³)	1.29±0.1	1.34±0.1*	+0.05	3.7		
Total hip BMD (g/cm ³)	1.26±0.1	1.30±0.1*	+0.05	4.7		
Lean mass (kg)	64.9±9	64.1±10.0	NS	0.1		
Fat mass (kg)	8.0±2.7	8.31±3.1*	+0.05	+37.7%		

* Differences were considered significant at p value < 0.05 between the measures 1 and 2

0% = (Second measure - First measure)/First measure x 100

All differences are significant (p < 0.05) between the first and second anthropometric and densitometric measurements expected for muscle mass.

Body fat is the parameter with the largest significant difference in variation (-37.7%). The LePanse method therefore significantly increases bone density at all sites studied (whole body, total hip and lumbar spine), as other authors confirm [21].

The results of psychophysiological research showed that in athletes after 3 days of diet by the LePanse method [19], in contrast to the control group, the level of personal anxiety significantly increased (Table 3). When questioned, athletes noted increased irritability and fatigue. The heart rate (HR) rate in them increased from 76.4 ± 2.5 to 82.3 ± 3.1 beats / min (P < 0.05). In the control group, in these 3 days, anxiety and heart rate did not change significantly.

Table 3. — Change in anxiety after a three-day strict weight loss diet

Groups	Personal anxiety before	Personal anxiety after
athletes	41,1±3,3	48,1±3,1*
untrained	38,4±2,2	37,5±3,2

* religious differences with baseline (p<0,05)

Almost all athletes had alpha-waves on electroencephalograms in a state of rest with open eyes, and in the subjects of the control group they were detected only in 2/3 of the cases. In athletes, the amplitude and the alpha-rhythm index were on average 25-30% more than those not taking part in sports.

The amplitude of high-frequency (20-35 Hz) beta rhythm in athletes in the initial state was 10-15% more than in untrained. The domination of low-frequency beta-rhythm in them was in the fronto-central leads, in contrast to the central-occipital in the subjects of the control group. Beta activity in athletes often prevailed in the right hemisphere. These data indicate a certain degree of functional tension in athletes of acyclic sports. Studies conducted after the course of psychophysical correction, showed a decrease in functional tension in the body of athletes. Thus, the procedure for weight reduction, carried out after this course of correction, did not practically change the rates of anxiety (Table 4).

Subjects talked about improving the psychoemotional state, the appearance of a sense of self-confidence and the possibilities of the body. In the control group, anxiety rates were higher than in athletes. After the end of the course of PFEs, systolic blood pressure was lowered from 117.5 ± 3.2 to 107 ± 2.8 (P < 0.05), and a trend towards a decrease in heart rate (up to 74.4 ± 3.5) and diastolic blood pressure.

Table 4. — Change in anxiety after a three-day strict weight loss diet after of the course of psycho-physical exercises (PPE)

Groups	Personal anxiety before	Personal anxiety after
athletes	35,0±2,8*	37,0±3,1
untrained	40,3±3,1	38,2±2,8

*- Reliable differences with the baseline in Table 3

When performing PFC there was a significant increase in the power of alpha rhythm in the occipital region (Fig. 1).

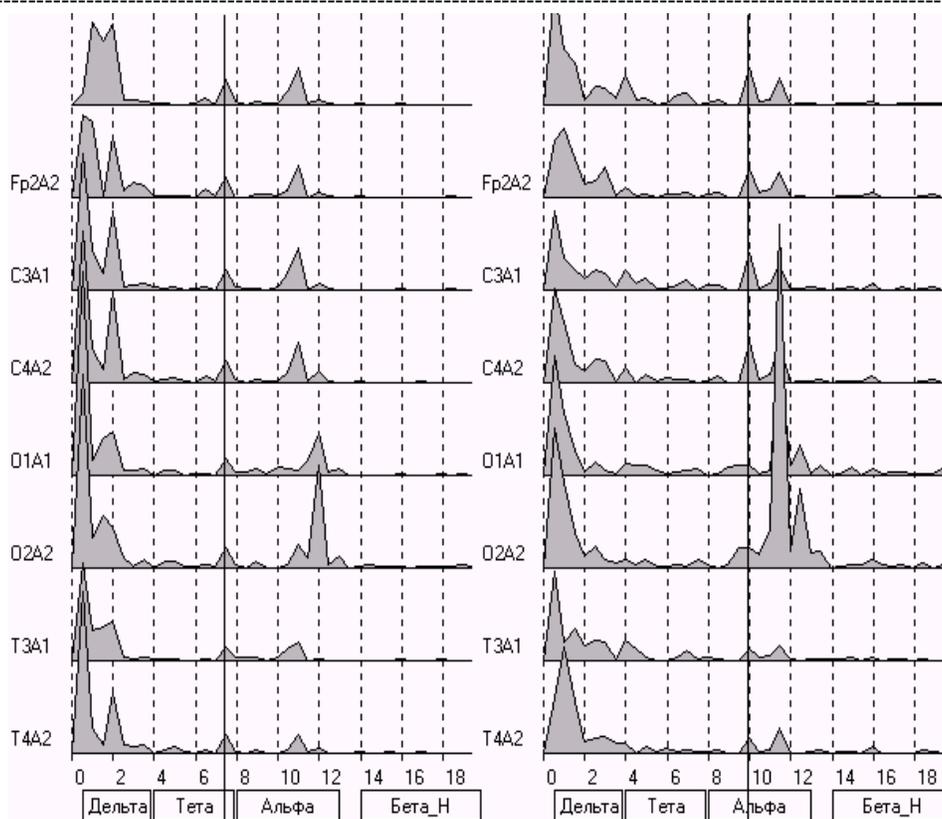


Figure 1.— Spectral analysis of electroencephalograms after the course of psycho-physical exercises

Previously revealed [18] episodes of regular synchronization of alpha rhythm on EEG in athletes who also differed from untrained subjects. Athletes. Regularly practicing relaxation exercises, the magnitude of the period of these patterns was 15 ± 5 s, and in untrained 25 ± 6 s.

The data obtained by us testify to the favorable influence of the means of psychophysical correction on the physical state of the organism of athletes.

Discussion

Thus, our results indicate that the balanced Le Panse diet and regular relaxation exercises according to the Popova's self-regulation have a positive effect on the metabolism of the body and, on the other hand, on psychophysiological functions. We tried to give a physiological explanation of these factors in Food rebalancing [15].

Any person, regardless of his/her experience or level, may suffer from factors of sustained stress, both mental and physical. Diet rebalancing both for athletes and non-athletes must be combined with psychophysical regulation [19,22]. The approach to weight loss has to be gradual and controlled.

According to the psychological testing data obtained earlier, significantly lower neuroticism rates were observed in the experimental group in comparison with the control group; apparently, this indicates strong emotional stability of persons engaged in psychophysiological experiments (PPE), as they contribute to the preservation of organized behavior, situational targeting in normal and stressful situations, as well as high adaptability. The neuropsychic stress indicators were also significantly lower in those who were regularly engaged in PPE [19].

Relaxation psychophysical regulation based on the holistic approach to a man contributes to the restoration of physical and mental health, extends the range of acceptability of various forms of adaptive behavior [7, 24].

Various specialists—physicians [13], sociologists, psychologists, teachers, biologists—look for ways to improve the psychophysical state of a person [6,8,11].

The weight reduction effect depends not only on the physiological processes, but also largely on the impact of psychological factors, as they affect not only the functional state of the body and the metabolic processes, but also the sports performance [2,20]. Excessive (especially forced) weight loss negatively affects the psyche: there is a state of anxiety, unrest, and reluctance to endure high volume and intensity of loads reducing

the motivation to win. To adjust the psychophysical state, the coach/teacher needs to know how the weight reduction process affects the psyche of athletes [16,22].

In [9,18], the alpha rhythm synchronization was slow (according to the EEG) in the group of persons with high anxiety (NNT), with a period of 30 ± 7 s, in comparison with athletes. The most common synchronization pattern—between the frontocentrottemporal leads of the cerebral cortex—is most often found in athletes and individuals practicing relaxation classes. This individual synchronization profile was combined with good abilities for self-regulation and psychophysical self-management.

The author explained this by the concerted activity of the thalamocortical and brain stem modulatory systems. A certain “filter” for the thalamocortical system is also recognized by many scientists [24,25]. The author [4,24] showed that upon addition of a mental training, athletes increase muscle strength and optimal hormonal reactions, as well as tolerance to physiological stress, improve the cardiorespiratory system and results of sports tests.

Conclusions

Our results suggest that relaxation techniques are recommended to form and enhance a weight reduction apparatus. They provide for the adoption of certain poses (lying, sitting, or reclining) and distraction from any external and internal stimuli, creating a state of rest, sensations of heaviness, warmth, and muscle relaxation. These procedures may involve psychotherapy, psychomotor training, sleep management activities. Correction of the psychophysical state of the athletes practicing weight loss will help to maintain the optimal functional state of the body and improve athletic performance.

Our results also suggest that the Le Panse method may be recommended to help sportsmen retain the best possible condition without frustration and constraints while losing weight, as it allows stabilizing glycemia and thus decreasing fatigability and optimizing performance. The significant results showing muscle mass retention, reduced fat mass, and increased bone mineral density go against the strict dieting practiced by most sportsmen.

Notes

Conflicts of interest.

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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Author Contribution

B.P.¹ organized and prepared the manuscript, prepared tables; T. S.² conducted research and statistical processing of the results; TVP³ conducted a study, prepared part of the manuscript; K.V.⁴ and OGK⁵ took part in the physiological analysis of the results, and the selection of literature.

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