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## The training, nutrition and physical conditioning programme: a challenge for kickboxing athletes to achieve athletic greatness

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### Abstract

**Introduction:** In the last decade in Romania, following the international trend, the interest for combat martial arts sports increased among the young generation. From all the contact sports, kickboxing was one of the most accessed athletic disciplines by both amateurs and professional athletes due to all the benefits of the complex training sessions.

**Aim:** The aim of the study was to analyze the differences between professional and non-professional males concerning the evolution of food habits and performance improvement when they follow the same training programme.

**Results:** Data analysis reveals an increase of physical performance in all performed tests. A significant improvement has been shown for both professional and non-professional athletes after 8 weeks of specific training. In the non-professional athletes group, the improvement of physical performance was even greater than in the professional group. Data analysis according to the age group revealed that in the case of the mature athletes the physical performance progress showed a lower augmentation than in the young ones, but the level of performance was at higher values than the performance of the young ones. In terms of nutrition, both groups need an improvement of their dietary habits, even if the professional ones revealed a better nutritional approach than the non-professional participants. **Conclusion:** The results of this pilot study indicate that an integrative approach of a martial art athlete training is important in order to develop sports elites. The long term training programmes combined with proper nutrition are the key factors of the strategy for achieving greatness. Further studies are necessary in order to set the best physical and metabolic parameters in order to create the framework for a long term training strategy.

**Key words:** professional athlete, physical performance, nutrition, training strategy

### Rezumat

**Introducere:** În ultimul deceniu în România, se poate observa o urmare a tendinței internaționale cu privire la creșterea interesului tinerei generații pentru sporturile de contact. Dintre toate artele marțiale de contact, Kickboxing-ul fost una dintre cele mai accesate discipline atât de către amatori, cât și de sportivi profesioniști, datorită tuturor beneficiilor determinate de sesiunile complexe de antrenament. **Scop:** Scopul studiului a fost de a analiza diferențele dintre sportivii de sex masculin profesioniști și cei neprofesioniști în ceea ce privește evoluția obiceiurilor alimentare și îmbunătățirea performanțelor atunci când aceștia urmează același program de antrenament. **Rezultate:** Analiza datelor arată, după 8 săptămâni de antrenament specific, o creștere semnificativă a performanței fizice la toate testele, atât pentru sportivii profesioniști, cât și pentru cei neprofesioniști. În grupul neprofesioniștilor s-a înregistrat o îmbunătățire a performanței fizice superioară celei obținute în grupul profesioniștilor. Analiza datelor în funcție de grupa de vârstă a arătat că, în cazul sportivilor maturi, progresul performanței fizice a suferit o augmentare mai mică decât la cei tineri, dar nivelul de performanță a fost la valori mai ridicate decât performanțele acestora. În cazul nutriției, ambele grupuri au demonstrat o

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nevoie de îmbunătățire a obiceiurilor alimentare, chiar dacă grupul profesionist a arătat o abordare nutrițională mai bună decât neprofesioniștii. *Concluzie:* Rezultatele acestui studiu pilot indică faptul că o abordare integrativă a antrenamentului unui sportiv de arte marțiale este importantă pentru a dezvolta elite în sport. Programul de formare pe termen lung, combinat cu o nutriție adecvată, reprezintă actorii-cheie ai strategiei de obținere a unor rezultate remarcabile. Sunt necesare studii suplimentare pentru a se stabili cei mai buni parametri fizici și metabolici necesari pentru a crea cadrul pentru o strategie de formare pe termen lung.

**Cuvinte cheie:** sportiv profesionist, performanță fizică, nutriție, strategie de formare

## Introduction

The international trend in the last decade regarding the interest for contact sports has also been noticed among the young generation in Romania. From all the contact sports, kickboxing was one of the most accessed athletic disciplines by both amateurs and professional athletes. This is due to all the benefits of the complex training sessions: increasing muscle tone, joint mobility, improvement of the general cardiovascular performance, stress reduction, and an increased personal level of confidence. Involving both strength and stamina as components of a highly conditioned physical performance, kickboxing became an alternative to cardio workout [1]. Moreover, achieving the best results in both physical conditioning and competition performance in this sport also involves an increased interest in a healthy diet and lifestyle [2].

The aim of the study was to analyze the differences between professional and non-professional male kickboxing athletes regarding the evolution of food habits and performance improvement when they follow the same programme strategy. All non-professional subjects are experienced athletes even if they are not in the professional circuit.

## Methodology

In the present study, we have hypothesized that an integrative approach of physical performance consisting of applying a specific training and nutrition strategy for an 8 weeks period will determine an increase of athletic performance by at least 5% versus basal results.

The study consisted of an analysis of food and training behaviour of professional versus non-professional kickboxing athletes from KnockDown Sports Club Timisoara.

The study group consisted of 24 senior male athletes (18-33 years) who were divided into four groups, by age: 18-25 years of age non-professional (PA) and professional athletes (UPA) (G1-UPA and G3-PA), 26-33 years of age non-professional and professional athletes (G2-UPA and G4-PA), respectively.

**The selection criteria of the study group** consisted of:

- frequency of attendance at the training sessions;
- compliance with the training programme. For the non-professional athletes - only the athletes that participated in all sessions together with the professional ones were selected.
- competition programme - for professional athletes;
- personal consent to participate as subjects in the study, according to the law.

**The exclusion criteria** consisted of:

- any injury in the last 24 months;
- lack of compliance in filling in the food questionnaire or training sessions.
- acute medical conditions that led to stopping the training programme.

All athletes followed the same training protocol developed within the KnockDown Sports Club Timisoara:

- Circuit training sessions;
- High-intensity interval training sessions;
- Isokinetic training sessions;
- Isometric training sessions.

The nutritional behaviour data were obtained by applying a food habit questionnaire. The results have been compared with the guidelines promoted by the Romanian Health Ministry [3].

For the physical performance evolution, a battery of physical tests has been applied at two designated moments of the study. The values were analyzed at the beginning and at the end of the 8 weeks training programme and compared with recognized reference values as follows:

1. The hand grip force has been analyzed on both hands and compared with a control value provided by the producer of the hand grip testing hydraulic device (model: sh 5001, Grip Saehan Co, South Korea).

The reference values for each age group in the handgrip test [4] are depicted in table I.

**Table I.** Reference values for the handgrip test by age group

| Age         | Tested hand | Weak result | Normal result |
|-------------|-------------|-------------|---------------|
| 18-24 years | Left        | 33 kgf      | 68 kgf        |
|             | Right       | 41 kgf      | 75 kgf        |
| 25-29 years | Left        | 34 kgf      | 63 kgf        |
|             | Right       | 35 kgf      | 71 kgf        |
| 30-34 years | Left        | 29 kgf      | 65 kgf        |
|             | Right       | 31 kgf      | 77 kgf        |

2. Time results for 1000 m running test – the time results were measured with a digital chronometer (model: MF01J002Y, Q&Q, Japan).

The reference time values [5] for the running test are depicted in tables II and III.

**Table II.** Reference time values for the running test in the 18-25 years group of age

| Performance criteria | Time reference (mm:ss) |
|----------------------|------------------------|
| Excellent            | 03:20                  |
| Very good            | 03:25                  |
| Good                 | 03:35                  |
| Medium               | 03:45                  |
| Under-medium         | 03:55                  |
| Low                  | 04:05                  |
| Very low             | 04:15                  |

**Table III.** Reference time values for the running test in the 26-33 years group of age

| Performance criteria  | Time reference (mm:ss) |
|-----------------------|------------------------|
| Excellent             | 03:35                  |
| Very good             | 03:40                  |
| Good                  | 03:50                  |
| Medium                | 04:00                  |
| Under-medium          | 04:10                  |
| Low                   | 04:20                  |
| te left hand Very low | 04:30                  |

3. Burpee test – the test consisted of quantifying the number of repetitions exceeding a 30-seconds time period, measured with a digital chronometer (MF01J002Y, Q&Q, Japan).

The normal values for the burpee test [6] are depicted in table IV.

**Table IV.** Normal values for the burpee test

| Performance criteria | Number of repetitions |
|----------------------|-----------------------|
| Excellent            | >15                   |
| Very good            | 15                    |
| Good                 | 14                    |
| Medium               | 13                    |
| Under-medium         | 12                    |
| Low                  | 11                    |
| Very low             | <11                   |

In the case of nutrition evaluation, a nutrition questionnaire score (NQS) of 100 points has been considered the maximum value of the questionnaire. This maximum value indicates that the subjects have an optimum diet regarding the sex and age group. In our study, the results have been expressed both for the group and for the individuals. The group results have been compared with the maximum results of the questionnaire score.

## Statistical analysis

The data were computed using a statistical analysis software (GraphPad Prism 5.0; Microsoft Excel). The statistical tests used for group comparisons were Student t-test and One-Way Analysis of Variance (ANOVA) followed by Bonferroni's post-hoc multiple comparison test. The values of  $p < 0.05$  were considered statistically significant.

## Results

### 1. Handgrip (HG) test

For professional athletes, there is no significant difference regarding the progress for the force developed in the left hand (p-ns) between the assigned testing moments. In contrast, the progress recorded for the force developed in the right hand reveals a stronger upper limb after 8 weeks of training in comparison with the beginning of the study period ( $p < 0.05$ ).

For the non-professional athletes the results revealed no significant difference between the force developed in the left hand compared to the reference values indicated by the producer of the hand grip device. For the right hand both tests (initial and final) indicated that the athletes are stronger than the controls ( $p < 0.01$ ).

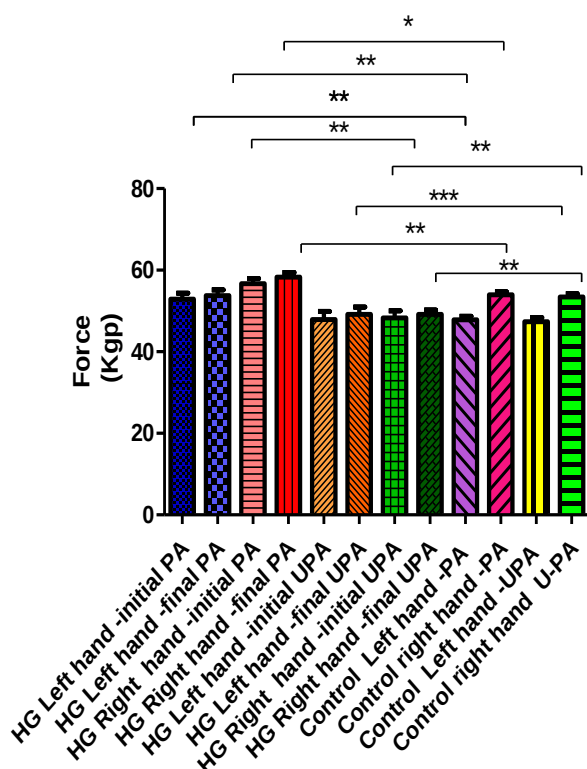
The results expressed as mean values  $\pm$  SEM (standard error of the mean) regarding the forces developed in both hands for professional athletes are depicted in tables V, VI and figure 1.

**Table V.** Hand grip test results for professional athletes

|      | HG left hand initial result | HG left hand final result | HG right hand initial result | HG right hand final result |
|------|-----------------------------|---------------------------|------------------------------|----------------------------|
| Mean | 52.92                       | 53.75                     | 57.08                        | 58.75                      |
| SEM  | 1.438                       | 1.393                     | 1.300                        | 1.088                      |

**Table VI.** Hand grip test results for non-professional athletes

|      | HG left hand initial result | HG left hand final result | HG right hand initial result | HG right hand final result |
|------|-----------------------------|---------------------------|------------------------------|----------------------------|
| Mean | 43.33                       | 45.00                     | 46.67                        | 48.33                      |
| SEM  | 1.66                        | 1.29                      | 1.05                         | 1.05                       |



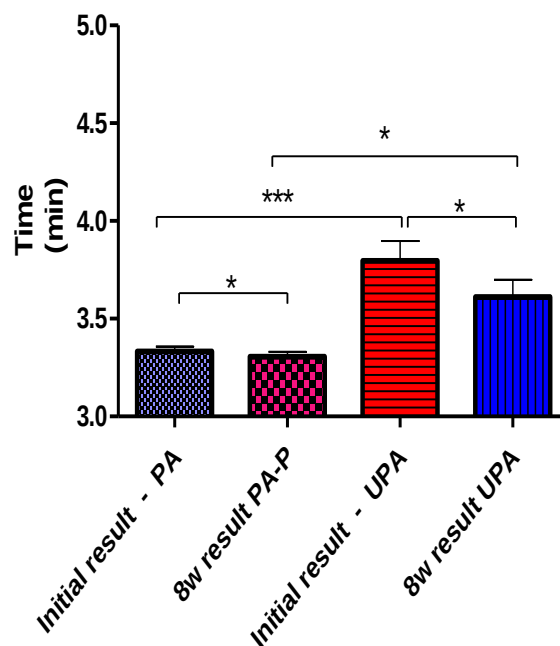
**Figure 1.** Hand grip test results – comparison between professional and non-professional athletes

The results for the run test are presented in table VII, as a comparison between professional and non-professional athletes at both testing moments.

**Table VII.** Run test results

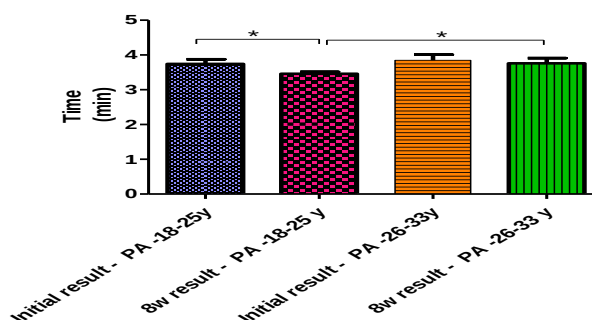
| UPA    | Initial result | Final result | PA   | Initial result | Final result |
|--------|----------------|--------------|------|----------------|--------------|
| UPA1   | 04:01          | 03:58        | PA1  | 03:32          | 03:30        |
| UPA 2  | 03:58          | 03:55        | P A2 | 03:35          | 03:30        |
| UPA 3  | 04:05          | 03:59        | PA3  | 03:40          | 03:35        |
| UPA 4  | 03:45          | 03:40        | PA4  | 03:38          | 03:40        |
| UPA5   | 04:03          | 03:40        | PA5  | 03:40          | 03:3         |
| UPA6   | 03:35          | 03:24        | PA6  | 03:39          | 03:35        |
| UPA7   | 04:05          | 03:49        | PA7  | 03:28          | 03:20        |
| UPA8   | 04:30          | 04:17        | PA8  | 03:15          | 03:12        |
| UPA9   | 03:58          | 04:00        | PA9  | 03:25          | 03:28        |
| UPA 10 | 03:50          | 03:42        | PA10 | 03:30          | 03:27        |
| UPA11  | 03:40          | 03:38        | PA11 | 03:33          | 03:30        |
| UPA12  | 04:25          | 04:11        | PA12 | 03:45          | 03:47        |

For professional athletes, there was a statistically significant reduction in the running time over a 1000m distance (Figure 2).



**Figure 2.** Run test results – comparison between professional and non-professional athletes

Compared to the goal of 3.45 minutes, all professional athletes initially achieved at least equal times to the reference value (Table VII). Concerning the final results, the same trend was observed for 75% of the athletes. Only 25% of the PA achieved a poor result, i.e. about 2.0-3.0 sec. more, compared to the initial value. On average, performance improved by 3 seconds within the professional athletes' group. Regarding age distribution, the results of the statistical analysis showed a significant improvement ( $p < 0.05$ ) only for young athletes 18-25 years (figure3).



**Figure 3.** Run test results young (18-25 years) vs. mature professional athletes (26-33years)

## 2. Burpee test

The results for the burpee test are presented in table VIII, as a comparison between professional and non-professional athletes at both testing moments.

**Table VIII.** Burpee test results

| UPA    | Initial result | Final result | PA   | Initial result | Final result |
|--------|----------------|--------------|------|----------------|--------------|
| UPA1   | 14             | 15           | PA1  | 17             | 19           |
| UPA 2  | 14             | 14           | PA 2 | 18             | 20           |
| UPA 3  | 15             | 14           | PA3  | 17             | 20           |
| UPA 4  | 14             | 16           | PA4  | 16             | 17           |
| UPA5   | 15             | 19           | PA5  | 16             | 19           |
| UPA6   | 17             | 19           | PA6  | 17             | 18           |
| UPA7   | 15             | 18           | PA7  | 20             | 23           |
| UPA8   | 12             | 16           | PA8  | 21             | 25           |
| UPA9   | 15             | 20           | PA9  | 20             | 22           |
| UPA 10 | 16             | 20           | PA10 | 18             | 21           |
| UPA11  | 15             | 18           | PA11 | 17             | 18           |
| UPA12  | 13             | 16           | PA12 | 17             | 19           |

Burpee test: the results for the 8 weeks training period showed that: i) all athletes achieved the goal regarding the 5% improvement of the performance; ii) 33% of athletes achieved a moderate performance increase of 5-10%; iii) 25% of athletes achieved an important performance increase of 11-15%; iv) 41% of athletes achieved a very high-performance increase by 16-20%.

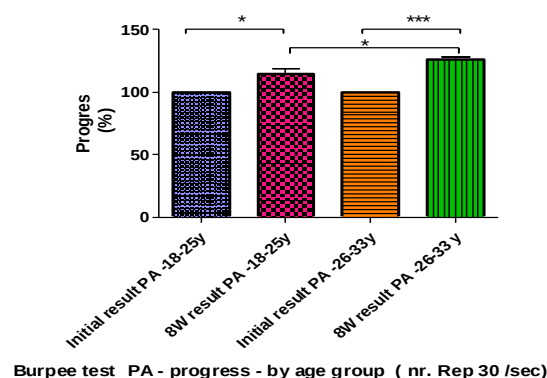
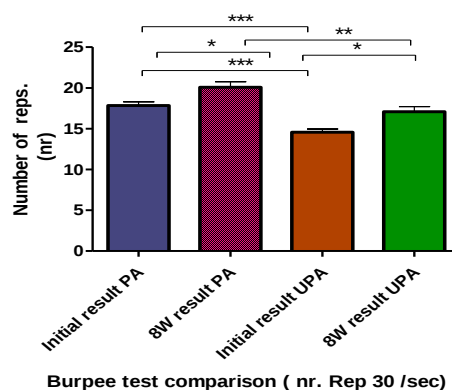
The statistical analysis regarding sport performance showed that in the case of professional athletes the training programme had a significant effect on their performance. They achieved an extremely significant improvement after 8 weeks of specific training ( $p < 0.001$ ) compared to the initial result (Figure 4). Thus, initially, the mean value of the group was  $17 \pm 0.47$  (values expressed as mean  $\pm$  SEM). At the end of the programme a 12.6% performance improvement for this test was observed ( $12.08 \pm 0.66$ ).

The analysis by age group showed that both young and amateur athletes (Figure 3B) had a significantly higher performance than the original outcome ( $p < 0.05$ ). From the group of young athletes, one of the athletes did not progress and one regressed without significant differences for the average of the lot.

In the case of mature athletes (26-33 years), there is an extremely significant increase in progress ( $p < 0.001$ ) for all athletes, some of them have improved their performance by 33% compared to the original outcome. Also, the progress analysis showed a significant difference ( $p < 0.05$ ) within the age group among non-professional athletes, with

progress being more significant for the 26-33 years age group.

**Figure 4 A.** Burpee test comparison between PA and UPA groups A.



**Figure 4 B.** Burpee test progress analyzed by age group in professional athletes

## 3. Analysis of nutritional habits

Tables IX and X present the results regarding the analysis of the nutritional questionnaire. The results are presented as mean values  $\pm$  SEM. The presentation of the scores was correlated to the age group, respectively.

**Table IX.** Global values of the Nutritional questionnaire score (NQS)

|            | NQS-PA | NQS-UPA | NQS max |
|------------|--------|---------|---------|
| Mean       | 71.83  | 56.50   | 100     |
| Std. Error | 0.82   | 1.20    | 0       |

**Table X.** Age related NQS

|            | NQS -PA 18-25y | NQS -PA 26-33y | NQS -UPA 18-25y | NQS -UPA 26-33y | NQS max |
|------------|----------------|----------------|-----------------|-----------------|---------|
| Mean       | 71.83          | 72.33          | 56.83           | 56.17           | 100     |
| Std. Error | 1.400          | 1.05           | 2.19            | 1.22            | 0       |

Data analysis showed that the NQS for the PA group revealed that the great majority of the subjects have a healthy diet. Still, some nutritional deficiencies have been revealed by the data analysis. The most deficient eating habit is the consumption of vegetables. 62.5% of the professional athletes need to improve their consumption of these foods to reach the recommended minimum dose of 2.5 servings of vegetables/day. At the time of applying the questionnaire, all athletes consumed at most 2/3 of the recommended dose of 3 servings of vegetables per day. The non-professional athletes revealed better vegetable consumption. Only 45.45% of the consumption of vegetables being the most important food custom to be corrected compared to the PA group ( $p < 0.05$ ).

The second habit to be improved is healthy lipid consumption. More than 50% of the athletes have to focus on good lipid sources like fish, oil, avocado, seeds. Concerning the consumption of comfort foods, the data show that in professional athletes only 30% of the athletes do not follow the recommendation. For the amateur athletes even if this habit is not rated as the most deficient one, all athletes are advised to change their diet by significantly reducing the consumption of this food category.

In terms of fruit consumption, 66% of the amateur athletes do not consume enough fruits unlike professional athletes, where only 33% of the group members have to improve their habit. In terms of high protein consumption, the vast majority of athletes consume a sufficient amount.

## Discussion

The martial arts are known to be beneficial for developing the fitness level and physical performance. There are only a few studies that investigated this effect on young people and teenagers [7-10]. Their results revealed a significant improvement in the physical and motor capacities of the fighter. Also, these benefits have been confirmed by longitudinal studies by analyzing the health-related physical fitness variables [11, 12].

Bompa (2014) is one of the authors who believe that physical activity is an integrated one consisting of elements of force, agility, range of motion. Also, to increase stamina and resistance in performing strenuous effort the athlete has to perform strength exercises [13]. For kickboxer's flexibility, speed and coordination are some of the most important qualities that have to be developed in order to achieve the performance goals.

Our study revealed a great improvement of the individual fitness level for all groups. The results

are consistent with the data from the literature. Oergui and col. (2014) confirmed that a period of 5 weeks of specific training induced a great improvement on physical performance on anaerobic performance capacity for both the upper and lower-body [14]. Moreover, in our study the athletes had to perform a complex training programme based on the execution of powerful exercises at high intensity and also the testing protocol consisted of both simple and combinations of repeated techniques.

Nutrition is a key factor in achieving greatness in sports. That's why promoting proper nutrition has to become a goal for each athlete, professional or not. Good nutrition will help avoiding injuries or diseases induced by nutritional deficiencies.

As Satya S. Jonnalagadda reveals, physical performance has two determinants: the training schedule of the athlete and diet, as a dramatic influencing factor. The food intake has a great influence on general training and performance. Also, it influences the individual particularities of the athlete such as strength and endurance capacity. Moreover, the composition of dietary intake determines a great impact on the metabolic and, further, on the physical and competitive performance [15]. The Dietetic Associations from the United States of America and Canada are two of the most reliable sources regarding the sports nutritional recommendations for achieving the nutritional goals for optimal performance. They also provided recommendations for daily basis nutrition and promote strategies to enhance performance [16]. The Romanian official guideline promoted by the Romanian Health Ministry, a great tool in our study in order to evaluate the nutritional habits of our group, promoted a strategy for daily dietary intake in the general population that is similar to the one recommended by the American and Canadian Associations.

Moreover, the comparison of our results with a recent nutritional survey developed by CSIRO revealed that both our groups of athletes have similar habits as subjects in the Commonwealth and also, in both cases, the most deficient food group is represented by vegetable consumption [17].

## Conclusion

The results of this pilot study indicate that an integrative training approach of a martial arts athlete is important in order to develop sports elites. The long term training programme, combined with proper nutrition, are the key actors for achieving greatness. Ensuring the fuel for body workout with the optimum composition in macro

and micronutrients will support the intense effort that a kickboxer has to perform in order to increase his personal fitness level, flexibility, aerobic and anaerobic capacities. Starting from this pilot study, further studies are necessary in order to set the best physical parameters for creating the framework for a long term training strategy.

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