

Assessment of the eating pattern and food choices of high-performance karate athletes in a post-COVID-19 pandemic championship

Avaliação do padrão e escolhas alimentares de atletas de karatê de alto rendimento em um campeonato pós-pandemia de COVID-19

Evaluación del patrón alimentario y elección de alimentos de karatecas de alto rendimiento en un campeonato pospandemia por COVID-19

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Abstract

The present study aimed to document the eating pattern and food choices of competitive high-performance karate athletes, during an in-person post-pandemic championship, for discussing adequacy and proposing alternatives to potentiate their performance and recovery in future competitions, respecting the nutritional values. The 47 athletes (57.4% male), of whom 47% had podium award, participated in the study by filling out an electronic anamnesis form and an online 24-hour recall of food intake and choices. The athletes were, on average, 37.0 (9.8) years old and, on the competition day, had a dietary pattern characterized by a normocaloric, low-carbohydrate, normoproteic, high-fiber diet including alcohol intake. Based on the analysis, changes were suggested for energy and macro- and micronutrient intake before, during and after the competition period, maintaining the nutritional values based on scientific evidence for assertive nutritional prescription focused on performance and recovery potentiation after a high-performance competition. This was the first study to perform and document the concomitant evaluation of the eating pattern and food choices during an official karate championship after 2-year suspension of in-person national contests. It was possible to reconcile guidelines to potentiate the performance and recovery in competitions, maintaining and adapting the nutritional values of karate athletes according to the nutritional science.

Keywords: Martial arts; Eating; Sports nutritional sciences; Athletic performance; COVID-19.

Resumo

O objetivo deste trabalho foi documentar o padrão de consumo e escolhas alimentares de atletas de alto rendimento competitivos de Karatê, durante campeonato presencial pós-pandemia, para discutir a adequação e propor alternativas para potencializar o rendimento, e a recuperação, em futuras competições, respeitando o padrão alimentar. Participaram 47 atletas (57,4% do sexo masculino), sendo 47% com premiação em pódio, por meio de preenchimento on line, de formulário eletrônico de anamnese e recordatório de 24 horas, do consumo e escolhas alimentares. Os atletas possuíam em média 37,0 (9,8) anos de idade e tiveram no dia da competição um padrão alimentar caracterizado por dieta normocalórica, hipoglicídica, normoprotéica, hiperlipídica, com alto teor de fibra e com ingestão de álcool. A partir desta análise, foram sugeridas alterações no consumo energético, assim como de macro e micronutrientes antes, durante e após o período competitivo, com manutenção dos valores alimentares, baseado em evidências científicas para prescrição nutricional assertiva, direcionada à potencialização do rendimento e recuperação pós competição de alto rendimento. Este estudo foi o primeiro a realizar e documentar a avaliação do padrão de consumo, concomitante às escolhas alimentares, durante um campeonato oficial de Karatê, após 2 anos de suspensão de torneios presenciais nacionais. Constatou-se a possibilidade de conciliar diretrizes para potencializar o rendimento, e recuperação, em competições, com a manutenção e adaptação dos valores alimentares dos atletas de Karatê com embasamento na ciência nutricional.

Palavras-chave: Artes marciais; Ingestão de alimentos; Ciências da nutrição e do esporte; Desempenho atlético; Artes marciais; COVID-19.

Resumen

El presente estudio tuvo como objetivo documentar el patrón alimentario y la elección de alimentos de atletas de kárate de alto rendimiento competitivo, durante un campeonato presencial pospandemia, para discutir la adecuación y proponer alternativas para potenciar su rendimiento y recuperación en futuras competencias, respetando los valores nutricionales. Los 47 atletas (57,4% hombres), de los cuales el 47% obtuvo podio, participaron en el estudio completando un formulario de anamnesis electrónica y un recordatorio en línea de 24 horas de ingesta y elecciones de alimentos. Los atletas tenían, en promedio, 37,0 (9,8) años y, el día de la competencia, tenían un patrón dietético caracterizado por una dieta normocalórica, baja en carbohidratos, normoproteica, alta en fibra, incluida la ingesta de alcohol. Con base en el análisis, se sugirieron cambios en la ingesta de energía y macro y micronutrientes antes, durante y después del período de competencia, manteniendo los valores nutricionales basados en evidencia científica para una prescripción nutricional asertiva enfocada en el rendimiento y la potenciación de la recuperación después de una competencia de alto rendimiento. Este fue el primer estudio en realizar y documentar la evaluación concomitante del patrón de alimentación y la elección de alimentos durante un campeonato oficial de kárate después de dos años de suspensión de los concursos nacionales presenciales. Se logró conciliar lineamientos para potencializar el rendimiento y la recuperación en las competencias, manteniendo y adecuando los valores nutricionales de los karatecas de acuerdo a la ciencia nutricional.

Palabras clave: Artes marciales; La ingesta de alimentos; Nutrición y ciencias del deporte; Desempeño atlético; COVID-19.

1. Introduction

There is an undeniable relationship between nutrition and athletic performance, characterized by the guidelines published for different sports (ACSM, 2016), including combat sports (Burke et al., 2021). However, even with all advances in nutritional sciences, applied to individual and team sports, there are scarce studies, information and guidelines applied to the usual dietary practices adopted by athletes of Olympic Combat Sports (OCS: karate, judo, taekwondo, boxing etc) (Burke et al, 2021; Rossi & Tirapegui, 2007), especially before, during and after official championships. Further attention should be given to the nutritional strategies for body weight loss adopted prior to championships or in recovery periods between weighing sessions (Pettersson & Berg, 2014; Brito et al., 2012), as well as to the comparison between food intake and reference standards (Úbeda et al., 2010). Few investigations have addressed the athletes' food choices and their reasons in a competitive period, especially in an in-person return during a post-pandemic period, as currently experienced. According to Panza and collaborators (2007), who discussed about the relationship among food intake, recommendations and eating habits, a scientific approach to such association may greatly contribute to issuing specific dietary guidelines that can help improve the individuals' physical performance, preserving their health.

In the nutritional context, decision-making related to eating is named "food choices", which can be described as the individual's form of considering and selecting food and drinks as to their acquisition, preparation and intake within a wide range of possible combinations, constituting a complex phenomenon that involves aspects relative to what, why, when and where (Fust et al., 1996). In the context of adding personal values to the study on food choices, the term defined by Connors and collaborators (2001) as "nutritional values" considers the individuals' decisions regarding eating, which would be produced by the synergism between personal values and food preferences (Lusk & Briggeman, 2009).

The aim of the present study is to document the eating pattern and the food choices of competitive high-performance karate athletes during the first post-pandemic championship in order to discuss the adequacy considering the nutritional recommendations for athletic performance and to propose alternatives for performance and recovery potentiation in future competitions, respecting the nutritional values.

2. Methodology

The present study evaluated 47 karate athletes, of whom 27 (57.4%) were male, participating in the X Karate Cup of the São Paulo State Karate Federation (FPK), at "Ginásio do Ibirapuera" in São Paulo, Brazil. After 2 years without in-person

competitions, this was the first official large sports event held when championships were allowed in São Paulo, Brazil.

The athletes were invited in competition to fill out, using Google Forms, in the immediate pre-competition period until 24 hours, an anamnesis with their personal and anthropometric data (body mass and height), awards in the competition, and use of dietary supplements. The self-reported data on body mass (BM: kg) and height (H: m) were used to calculate the Body Mass Index (BMI: kg/m²), which was classified according to OMS (2004).

The athletes were requested to previously authorize the access to anamnesis by reading and accepting a Free and Informed Consent Term (FICT), based on the model approved by the Ethics Committee CAAE: 52059921.6.0000.5435.

To quali-quantitatively investigate their eating pattern, athletes were asked to fill out a 24-hour recall, in which they described, as quantities and/or homemade measures, all food/preparation/drinks/goodies/supplements/snacks consumed on the championship day, including the three time of ingestion: pre-, intra-, and post-workout. The dietary intake of energy macronutrients (carbohydrates, proteins and fats) in addition to fiber, caffeine, alcohol and the amino acid leucine were evaluated.

To evaluate the food choices, and quali-quantitatively analyze the eating pattern, calories and macro- and micronutrient distribution, and discuss adequacies and nutritional perspectives focused on performance, the study considered n=37 food/preparation types in the pre-competition period, n=45 during the competition, and n=53 in the post-competition period. Such a pattern was also organized in feeding periods to include the recommendation before, during and after competition.

Calculations, as well as nutritional prescription, were performed using the professional software DietWin Clínico Plus, version 3090 (Brubins ®).

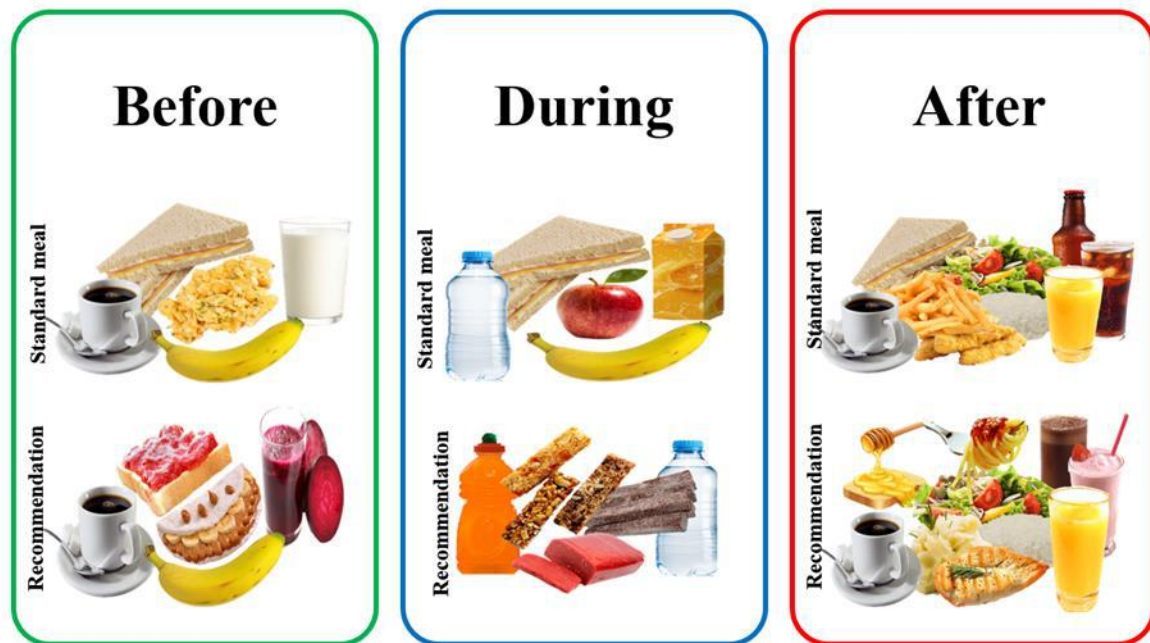
Data were plotted with the software Microsoft Excel and analyzed based on descriptive statistics; values were expressed as percentages, central tendency measures (mean) and variance (standard deviation).

3. Results

The following data were obtained for karate athletes, on average: 37.0 (9.8) years old, 73.2 (14.6) kg, 1.7 (0.01) m, and BMI of 25.41 (3.47) kg/m², which indicated overweight, according to OMS (2004). Of these, n=22 (~47%) obtained podium awards, ranking up to the third place, which attests the competitive performance degree of the sample.

Based on the food choices, quali-quantitatively the eating pattern, the most frequently consumed food/preparation types were chosen for the standard meal based on food choice before, during and after competition periods, respectively (Figure 1).


Figure 1 - Standard meal based on food choices, and recommendation proposed for the periods before, during and after championship, aligned with nutritional guidelines for the performance of combat sports athletes.



Source: Authors.

These data were used to elaborate a demonstrative “standard-meal” for the athlete, as well as a proposal of change or recommendation based on the scientific literature and focused on the area of fights, martial arts and combat sports whenever possible (Burke et al, 2021; López-Laval et al, 2021; López-González et al, 2018; ACSM, 2016; Barnes, 2014) , maintaining the reported food choices and energy intake (Table 1, Figure1).

Table 1 - Description and nutritional analysis of a standard meal based on food choices, and recommendation proposed for the periods before, during and after the championship.

| | BEFORE | | DURING | | AFTER | |
|-------------------|---|--|---|--|---|--|
| | Standard meal | Recommendation | Standard meal | Recommendation | Standard meal | Recommendation |
| Food/Preparations |  |  |  |  |  |  |
| | 1.Coffee; 2.Bread and fillings (butter, cheese, ham, mortadella, Brazilian cream cheese, white cheese, jam); 3.Banana; 4.Milk (coffee, chocolate powder, whey protein, instant coffee), and 5.Eggs (scrambled, boiled). | 1.Coffee; 2.Bread and fillings (natural jam); 3.Banana; 4.Beetroot juice, and 5.Tapioca with dulce de leche. | 1.Water; 2.Bread and fillings (cheese, ham, Brazilian cream cheese etc); 3.Mortadella, tuna pâté, butter); 4.Banana; 5.Industrial juice, and 6.Apple. | 1.Hydroelectrolytic supplement; 2.Cereal bars; 3.“Bananinha” sweet; 4.Water, and 5. Guava paste. | 1.Bread and fillings (ham, cheese etc.); 2.Rice; 3.Coffee; 4.Side (breaded chicken, meat, egg etc); 5.French fries; 6.Fruit juice; 7.Beer; 8.Soft drink; 9.Salad, and 10.Pasta. | 1.Bread with honey; 2.Rice; 3.Coffee; 4.Side (chicken, grilled beef); 5.Mashed potatoes; 6.Natural fruit juice; 7.Skimed Milk with whey protein; 8.Liquid yogurt; 9.Salad, and 10.Pasta. |
| Calories (kcal) | 775.0 | 773.5 | 550.3 | 559.0 | 1.614.9 | 1.609.3 |
| Carbohydrates (g) | 64.3 | 169.9 | 85.5 | 128.0 | 179.4 | 259.7 |
| (g/kg BM) | 0.9 | 2.3 | | | 2.4 | 3.5 |
| Proteins (g) | 29.0 | 13.5 | 23.4 | 3.0 | 73.5 | 92.9 |
| (g/kg BM) | | | | | 1.0 | 1.3 |
| Fat (g) | 45.9 | 5.9 | 13.3 | 5.8 | 55.8 | 46.3 |
| Fiber (g) | 5.9 | 5.8 | 7.3 | 3.4 | 8.3 | 9.6 |
| Caffeine (mg) | 150.0 | 150.0 | - | - | - | - |
| mg/kg BM | 2.0 | 2.0 | | | | |
| Alcohol (g) | - | - | - | - | 14.7 | - |
| g/kg BM | | | | | 0.2 | |
| Leucine (mg) | - | - | - | - | 1.4 | 2.5 |

Caption: BM: body mass. Source: Authors.

The comparative analyses among the three standard meals consumed by the athletes and recommendations are shown in Table 2. For competitions or championships, the proposed changes in the applied recommendations aimed at improving the athletes' performance and recovery with a normocaloric, high-carbohydrate, normoproteic, low-lipidic, low-fiber diet free of alcohol (ACSM, 2016; Reale et al., 2017).

Table 2 - Nutritional assessment of three standard meals based on food choices, and recommendations suggested for karate athletes.

| | Championship or Competition Day | |
|--------------------|---------------------------------|-------------------------|
| | Standard Meal | Applied Recommendations |
| Food quantity (kg) | 635.0 | 720.0 |
| Calories (kcal) | 2.939.6 | 2.941.9 |
| (kcal/kg BM) | 40.1 | 40.2 |
| Carbohydrates (g) | 333.7 | 557.6 |
| (g/kg BM) | 4.6 | 7.7 |
| %TCV | 45.0 | 74.7 |
| Proteins (g) | 125.3 | 108.4 |
| (g/kg BM) | 1.7 | 1.5 |
| %TCV | 17.0 | 14.6 |
| Fat (g) | 114.0 | 35.0 |
| (g/kg BM) | 1.6 | 0.5 |
| %TCV | 34.6 | 11.0 |
| Fiber (g) | 23.4 | 19.2 |

Caption: BM: body mass; %TCV: Total Caloric Value. Source: Authors.

4. Discussion

The major methodological challenge and contribution of the present study was to concomitantly evaluate the eating pattern and the food choices in an official karate championship after 2-year suspension of in-person tournaments. Data collection through an electronic form allowed obtaining a panorama of dietary and nutritional intake before, during and after the competition. Maintaining ad libitum feeding, changes could be made while food choices were kept and adjusted based on the nutritional recommendations for performance enhancement in future championships.

Such a pattern was also organized in feeding periods to include the moments before, during and after competition, as discussed below.

Recommendation on food and nutritional intake before the championship

The nutritional guidelines of the American College of Sports Medicine (ACSM, 2016) consider an acute strategy, for practice/competitions lasting >60min, the previous ingestion (1–4h) of 1-4g carbohydrates/kg body mass (BM) for performance optimization. The moment, the quantity and the type of food and/or beverages that are sources of carbohydrates should be chosen based on the practical needs of the event and on the preferences/previous experiences of each athlete. Since there is a higher risk of gastrointestinal stress during the event, food rich in fat, proteins or fiber should be avoided. In light of such recommendations, an adaptation was proposed to the standard meal, keeping the quantity of energy (775.0 to 773.5kcal) and the food choices, but increasing carbohydrates (0.9 to 2.3 g/kg BM), reducing fat (45.8 to 5.9g) and proteins (29.0 to 13.5g), and keeping low the dietary fiber intake (~5.9g) (Figure 1, Table 1). Reale and collaborators (Reale et al., 2017) regarded as highly adequate for ECO athletes in pre-competition the ingestion of options rich in easily digestible carbohydrates, with low fat content, low fiber content and, consequently, low gas production before and between fights. Such a dietary pattern is also focused on reducing gastrointestinal stress, since the athletes receive blows to the abdominal region and the assertive prescription of easily and rapidly digested and absorbed food and/or beverages is essential to prevent any

discomfort or accidents due to the sports nature (ACSM, 2016; Reale et al., 2017).

An advantageous proposal of pre-event meal, for performance enhancement, was the use of beetroot juice instead of milk (Figure 1, Table 1). This was based on the increasing evidence of the beetroot juice effects, due to inorganic nitrate (NO₃⁻) supply, on raising the blood levels of nitric oxide (NO) and promoting vasodilation, greater blood flow and better muscle contraction during exercise efforts of high demand on oxidative energy metabolism (Senefeld et al., 2020). Domínguez and collaborators (2018) conducted a review of the beetroot juice supplementation effects on intermittent efforts in high-intensity exercises, applicable to combat sports, and noted an improvement in the muscle fatigue indicators, although the mechanism responsible for this effect remains unknown. Miraftebi et al (2021) supplemented taekwondo athletes with 400mg NO₃⁻, using beetroot juice, and found an improvement in their cognitive tests; effects with dosages superior to 800mg NO₃⁻ were also reported but greatly varied, indicating that, although these results are promising, further studies are needed for a larger sample of athletes and other combat sports.

The consumption of caffeine, from coffee, reported by the athletes was 150mg or 2 mg/kg BM, which could be increased since caffeine (1,4,7 trimethylxanthine) has proven effects on the performance of athletes of combat sports, especially karate, and its dosage to obtain an ergogenic effect is between 3 and 6mg/kg weight, or 219.6 and 439.2 mg, 1 hour before competition (López-González et al., 2018). Rezaei et al (2019) studied the effect of caffeine supplementation on the perceived (peripheral) fatigue or subjective (central) fatigue of high-performance karate athletes. In a double-blind, randomized, placebo-controlled study, those authors investigated central fatigue relief before, during and after training for groups: control (CON); placebo (PLA); caffeine-supplemented (CAF) – 50 min before – 6mg/kg weight; sodium bicarbonate-supplemented (SB) – 3 days – 0.3 g/kg divided into 3 doses, and 120, 90 and 60 min before – 0.1 g/kg weight, and CAF+SB-supplemented. Classical fatigue measurements were assessed, including time to exhaustion, rate of perceived exertion and blood lactate level before, immediately after and 3 minutes after Karate Specific Aerobic Test (KSAT), developed to mimic the physiologic demands during a fight (kumite). For all groups, there was an increase in the peripheral fatigue indicator (blood lactate); however, CAF and SB, both alone or in combination (CAF+SB), before the exercise, were effective in relieving the perceived exertion and, therefore, central fatigue.

Recommendation on food and nutritional intake during the championship

According to the nutritional guidelines of the American College of Sports Medicine (ACSM, 2016), the strategy during practice/competitions longer than 1 to 2.5h, continuous or intermittent (stop and start: like combat sports), is to ingest 30 to 60g/hour carbohydrates, both for muscle fuel supply and endogenous reserve supplementation. The opportunities for consuming food and beverages vary according to the rules and nature of each sport, including a variety of daily dietetic choices and specialized sport products, from liquid to solids. In a nutritional planning, a refueling protocol must be designed and practiced according to the individual's goals, including hydration needs and gastrointestinal comfort (Burke et al., 2021; ACSM. 2007).

As regards the eating pattern and the proposal for the period during the championship, the following changes were recommended, maintaining the energetic consumption (550.3 and 559.0 kcal): increase in carbohydrates (85.5 to 128.0g), and reduction in dietary fiber (7.3 to 3.4g), fat (13.3 to 5.8g) and proteins (23.4 to 3.0g) (Figure 1, Table 1). The athletes are advised to divide the total food and beverages, contained in the guidelines, into two ingestions at every 1h, accounting for ~60g/h, thus allowing the performance maintenance during the classification phases until the final competition, which occur on the same day.

Recommendation on food and nutritional intake after the championship

The athletes declared to prefer a complete meal after the competition for the purpose of celebrating, opting for a “free meal” pattern with comfort food, junk food and alcohol intake, due to the high number of athletes who received medals. Given the diversity of food/preparations (total of 53), the eating frequency was higher, differently from the periods before and during competition, which had a more monotonous pattern; therefore, 10 options were selected to represent the eating pattern and food choices. To potentiate the post-competition recovery maintaining the energetic value (1614.9 and 1609.3 kcal), the following changes were implemented for macronutrients: reduction in fat (55.8 to 46.3g), removal of alcohol (9.8g), and increase in dietary fiber (8.3 to 9.6g), carbohydrates (179 to 259.7g) and proteins (1.0 to 1.3 g/kg BM) (Figure 1, Table 1). Such recommendations allow reaching the proportion between carbohydrates and proteins of 3:1 and leucine essential amino acid from 1.4 to 2.5 mg.

Scientific literature on prescriptions for combat sports after practice and/or competitions is rather scarce. The narrative review conducted by López-Laval and collaborators (2021) addressing post-practice recovery based on evidence for combat sports indicated that the athlete’s recovery is benefitted from the ingestion of 1g/kg carbohydrates, 1.4 to 2.0 g/kg proteins, co-ingestion of carbohydrates and whey protein supplement at 3-4:1 proportion, and consumption of leucine between 0.7 and 3g (Kerksick et al., 2017).

To follow the specific recommendations, inclusion of skimmed milk with whey protein instead of beer positively impacted the nutritional relationship between carbohydrates and proteins and increased total leucine (1.4 to 2.5mg) (Kerksick et al., 2017). As to alcohol intake, in case the athletes maintain the ingestion of 1 beer (9.8g or 0.1 g/kg BM) after the sport/practice, a dose of up to ~0.5g/kg BM is not likely to affect most recovery aspects and, therefore, can be consumed during this period (Barnes, 2014; El-Sayed et al., 2005); an alternative can be non-alcoholic beer.

5. Conclusion

The present study was the first to evaluate the eating pattern and food choices during an official karate championship, after 2-year suspension of in-person national tournaments. The eating pattern and the food choices of competitive high-performance karate athletes were documented and evaluated before, during and after competition, having in common the lack of balance between energy macronutrients, especially by carbohydrates. Then, nutritional recommendations for athletic performance were presented based on guidelines aimed at potentiating performance and recovery in future competitions but maintaining the nutritional values for assertive prescription based on the nutritional science.

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