Rossi, Luciana; Elen Goya, Rosecler; Veridiano Matayoshi, Magna Aparecida; Cardoso Pereira, Carla Cristine; Bernardo da Silva, Juliana

NUTRITIONAL EVALUATION OF TAEKWONDO ATHLETES
Brazilian Journal of Biomotricity, vol. 3, núm. 2, junio, 2009, pp. 159-166
Universidade Iguaçu
Itaperuna, Brasil

Available in: http://www.redalyc.org/articulo.oa?id=93012708009
ORIGINAL PAPER (ARTIGO ORIGINAL)

NUTRITIONAL EVALUATION OF TAEKWONDO ATHLETES

Luciana Rossi, Rosecler Elen Goya, Magna Aparecida Veridiano Matayoshi, Carla Cristine Cardoso Pereira, and Juliana Bernardo da Silva

Centro Universitário São Camilo.

Corresponding author:
Luciana Rossi, PhD
Centro Universitário São Camilo.
Rua Raul Pompéia, 144. Pompéia –
CEP 05025-010 – São Paulo, SP.
E-mail: lrossi@scamilo.edu.br.

Submitted for publication: March 2009
Accepted for publication: May 2009

ABSTRACT
ROSSI, L.; GOYA, R. E.; MATAYOSHI, M. A. V.; PEREIRA, C. C. C.; SILVA, J. B. Nutritional evaluation of taekwondo athletes. Brazilian Journal Biomotricity, v. 3, n. 2, p. 159-166, 2009. This work aimed to evaluate food intake by Brazilian high-rank taekwondo athletes in order to assess nutritional adequacy and draw comparisons with other sport modalities of fight. The study included five male athletes of mean age 23.4 ± 2.5 years; weight 61.8 ± 5.7 kg; stature 171.9 ± 6.2 cm; BMI 20.8 ± 0.7 kg/m²; and fat percentage 8.2 ± 3.2%. Based on a 3-day diet record, nutritional inadequacies were detected concerning protein and fiber intake. Although the intake of most of the analyzed macro and micronutrients was adequate, an investigation during different training/competition periods may reveal further details on the risk of a sport with weight categories and consequent weight cycles to obtain competitive benefits, a strategy commonly reported for other sports.

Keywords: nutrition; nutrients; nutritional recommendations; martial arts.

INTRODUCTION
Although the Orient is the cradle of martial arts, taekwondo originated in Korea over one thousand years ago and was widely spread in the Occident (MELHIM, 2001; BOUHLEL et al., 2006), becoming an accepted sports in Sydney 2000 Olympics (LIN et al., 2006). The World Taekwondo Federation (WTF) establishes the rules and regulations for Olympic competitions, besides the eight distinct weight classes (KAZEMI et al., 2005). In all modalities presenting weight categories (boxing, judo, rowing, wrestling etc), the so-called weight cycling, i.e. the rapid weight loss due to auto-induction by methods such as limited food intake and/or dehydration, is extremely common. However, in taekwondo the impact of such strategies on the athletes’ nutritional status and efficiency has been less investigated than in other similar sports (FOGELHOLM et al., 1993; HALL & LANE, 2001; ALDERMAN et al., 2004).

Nutritional evaluation is an important factor in diet elaboration and adhesion; a detailed analysis of food history allows the establishment of strategies to introduce the necessary
diet modifications, and prescriptions should be flexible and capable of transforming the food habit (GILBERT, 2009). In addition, the following must be considered: practiced sport modality, training phase, aim of the technical staff concerning performance, data on basal metabolism and training energetic requirements, necessary modifications in the body composition, and significant clinical factors (GILBERT, 2009; BOUHLEL et al., 2006). In fight and combat sports, low-carbohydrate diets may compromise the physical performance, causing negative effects; thus, the ingestion of carbohydrate-rich foods is advisable to favor the reposition of hepatic and muscular glycogen storage, mainly after training/competitions (KERKSICK et al., 2008). Besides, carbohydrate consumption may reduce the negative alterations caused in the immune system by the excessive exercise stress (NIEMAN et al., 2001), favoring therefore not only the performance but also the mood of the athlete (ACHTEN et al., 2004).

The present work aimed to evaluate nutrient intake by Brazilian high-rank taekwondo athletes in order to establish similarities with other martial arts and direct future nutritional instructions to improve the sport efficiency.

MATERIALS AND METHOD
- **Subjects**

After free and informed consent, according to the protocol approved by the Ethics Committee of São Camilo University Center, 5 Brazilian high-rank taekwondo male athletes were included in the study based on the following criteria: older than 18 years, minimum rank of black belt, training compatible with the competition purposes of the modality (minimum of 3x/week for 2h), and sport curriculum including participation and awards in several national and international competitions. The mean ± standard deviation for the variables age, body weight, stature, BMI, and fat percentage was 23.4 ± 2.5 years, 61.8 ± 5.7 kg, 171.9 ± 6.2 cm, 20.8 ± 0.7 kg/m², and 8.2 ± 3.2%, respectively. Body density was calculated using the equation proposed by Jackson & Pollock (1978) and fat percentage, according to Siri (1961).

- **Hydration status**

The athletes were subjected to bioelectrical impedance analysis (BIA) using Biodynamics 310e devices to determine total body water (L), lean mass hydration percentage, and water percentage relative to body weight.

- **Dietary information**

Food consumption was recorded in 3 non-consecutive days (including one day of the weekend) and instructions were given not to alter the habits during this period (TESHIMA et al., 2002). The record was voluntary and done by the athletes after receiving standardized instructions from a nutritionist. To analyze energy, macro and micronutrient intake, DietWin Profissional 2.0 Nutritional Support Software was employed.

RESULTS

Hydration status values obtained in the BIA indicated that the athletes had on average 23.8 ± 4.2 L total body water, representing 38.3 ± 3.3% body weight, 69.8 ± 0.4% in lean mass.

In Table 1, the mean values of macro and micronutrient intake are indicated. The adopted cutoff point for inadequate nutrient intake was below 66% of the value recommended by
RDA or DRI, considering that a diet can be regarded as inadequate for a certain nutrient when it provides less than 2/3 of the established values (LEVERTON, 1975).

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>Recommendation 20 – 30 years</th>
<th>%ADQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>2939.7 (576.6)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Energy (kcal*kg⁻¹)</td>
<td>48.4 (13.4)</td>
<td>37 – 41#</td>
<td>-</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>763 (244.1)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Carbohydrate (g*kg⁻¹)</td>
<td>7.0 (1.8)</td>
<td>6 – 10#</td>
<td>-</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>165.2 (74.3)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Protein (g*kg⁻¹)</td>
<td>2.2 (0.8)</td>
<td>1.6 – 1.7#</td>
<td>-</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>112.5 (73.7)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fat (g*kg⁻¹)</td>
<td>1.3 (0.5)</td>
<td>1.0#</td>
<td>-</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>1383.5 (615.3)</td>
<td>1000.0**</td>
<td>-</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>24.5 (10.1)</td>
<td>8.0*</td>
<td>306.2</td>
</tr>
<tr>
<td>Vitamin A (mcg)</td>
<td>609.5 (312.7)</td>
<td>900.0*</td>
<td>67.7</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>240.1 (147.3)</td>
<td>90.0*</td>
<td>266.7</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>15.0 (10.6)</td>
<td>15.0*</td>
<td>100.0</td>
</tr>
<tr>
<td>Fiber (g)</td>
<td>18.6 (4.5)</td>
<td>38.0**</td>
<td>-</td>
</tr>
<tr>
<td>Water (mL)</td>
<td>1645.9 (810.4)</td>
<td>3700.0***</td>
<td>-</td>
</tr>
<tr>
<td>%E:carbohydrates</td>
<td>58.9 (8.2)</td>
<td>60 – 70#</td>
<td>-</td>
</tr>
<tr>
<td>%E: proteins</td>
<td>17.5 (4.6)</td>
<td>15 – 20#</td>
<td>-</td>
</tr>
<tr>
<td>%E: fats</td>
<td>23.7 (4.2)</td>
<td>20 – 25#</td>
<td>-</td>
</tr>
</tbody>
</table>

%ADQ= Percentage of adequacy; E= percentage of energy intake. #ADA (1993); *Lukaski (2004); **IOM (2004); ***IOM (1998).

DISCUSSION

Data collection included only male competitive athletes. Some sport categories, such as martial arts, have a training pattern typical for men and scarce women are inserted in this context. This fact was also observed by Costa and collaborators (2003), who described the predominance of the former gender in martial modalities with a probable masculinity reaffirmation pattern.

The sampling in the present study had anthropometric profile values similar to those of high-rank Shotokan-karate athletes (n=12), who presented 24 ± 5.8 years mean age, 68.0 ± 11.1 kg weight, 172.2 ± 6.1 cm stature, 22.9 ± 2.9 kg/m² BMI, and 10.5 ± 3.0 fat percentage (%F) (ROSSI & TIRAPEGUI, 2007). Lin et al. (2006) recorded 19.8 ± 3.4 years, 64.5 ± 6.9 kg, 1.72 ± 0.05 m, and 19.4 ± 4.3 %F for Thai Olympic taekwondo athletes (n=11); Kazemi et al. (2006) observed that the medalists (n=16) in Sydney Olympics had 24.4 ± 3.3 years, 73.4 ± 12.1 kg, 1.83 ± 0.08 m, and 21.9 ± 2.4 kg/m²;
Bouhlel et al. (2006) noticed that the Tunis taekwondo team (n=8) had $20.0 \pm 1.0$ years, $70.8 \pm 6.0$ kg, $179.9 \pm 4.0$ cm, and $11.8 \pm 3.0$ %F; Noorul et al. (2008) studied teenage practitioners and recorded $18.63 \pm 1.92$ years, $68.29 \pm 20.69$ kg, $1.68 \pm 7.36$ m, and $21.40 \pm 6.30$ %F for boys. Such differences among values are related to factors like body composition, age range, training degree, protocol for obtaining fat percentage etc.

As regards food intake by taekwondo athletes, some studies indicate that energy and nutrient demands are still inadequately fulfilled in several athletic groups, suggesting the need of wide nutritional education since several factors intrinsic to the sport modality such as training schedules and requirements concerning body image can influence the dietary habits of athletes (GILBERT, 2009). Kazemi et al. (2006) investigated the pre-competition habits of taekwondo athletes of both sexes and observed that 53% used to undergo fasting in the days preceding competition – 33.3% of these without and 50% with liquid ingestion – and 17% consumed only food with no liquid ingestion. Several studies describe that when the athlete aims to rapidly lose weight before the competition (< 1 week to hours), the most frequently employed primary strategy is dehydration (FOGELHOLM, 1994; SHIRREFFEFS, 2009). Brazilian taekwondo athletes were within the normal hydration status (euhydrated), which is reached, according to BIA, when the lean mass hydration percentage is between 69.5 and 7.5% (ROSSI et al., 2004). BIA is a reliable non-invasive methodology to evaluate the hydration status once pre-evaluation hydration conditions are observed (SHIRREFFEFS, 2003; ROSSI & TIRAPEGUI, 2001).

In wrestlers, symptoms like headaches (44%) or dizziness and nausea (42%) were reported by those used to undergo fasting, besides hot flashes, nosebleeds, feverish sensations, disorientation, and increased heart rate (ALDERMAN et al., 2004). As to the relationship between micronutrient intake and restrictive food habits in wrestlers and judokas, there was a significant reduction concerning B-complex vitamins, as well as K, Ca, Mg, Fe and Zn (FOLEGELHOM et al., 1993).

Mean energy intake by Brazilian athletes was $48.4 \pm 13.4$ kcal•kg$^{-1}$•day, indicating adequate caloric intake; FOLGELHOLM (1994) stated that a moderate energy restriction for fight athletes is between 25 and 33 kcal•kg$^{-1}$•day$^{-1}$. According to ADA's recommendations (2001) for individuals practicing intense physical activity, energetic requirements can range from 2000 to 6000 kcal•day$^{-1}$, confirming the adequacy of the data obtained in the present study, $2939.7 \pm 576.6$ kcal•day$^{-1}$. Other works indicate that, although there is depletion of some nutrients, if an energy intake compatible with the modality expenditure is kept, the efficiency is not affected (FOLGHELHOM et al., 1993, KAZEMI et al., 2005; SMITH et al., 2001, ROSSI et al., 2004). The opposite was observed for judo athletes, who had reduced efficiency and mood alterations when subjected to energy restriction (DEGOUTTE et al., 2006).

As regards macronutrient intake, satisfactory values were obtained for carbohydrates and fats, whereas proteins were excessive according to ADA (2001). Carbohydrates were consumed following the recommendations, a very important fact concerning martial arts since the physical efforts required by this modality are of high intensity and short duration, presenting the lactic anaerobic route as the main energy supply route (DEGOUTTE et al., 2003) and glucose, especially from muscular glycogen, as the main energetic substrate (MELHIM, 2001). Although the ideal consumption for taekwondo has not been established, a low intake may prevent the resynthesis of glycogen, and less than 500 g/day is an insufficient quantity to replace post-training losses (DEGOUTTE et al., 2003).

Protein intake by athletes was already reported to be between 4.0 and 6.0 g•kg$^{-1}$•day$^{-1}$ (LEMON, 2000), which clearly represents an excess. For the general population, protein...
intake of >1.6 g•kg\(^{-1}\)•day\(^{-1}\) could be considered high and 2.4 g•kg\(^{-1}\)•day\(^{-1}\), extremely high (ROSSI et al., 2004). According to LEMON (2000), for strength athletes, protein intake should be between 1.4 and 1.8, possibly reaching 2.0, and above 2.4 g•kg\(^{-1}\)•day\(^{-1}\) the oxidation of amino acids increase, without additional lean mass gain (ROSSI & TIRAPEGUI, 2000). In another work with Japanese karate athletes, protein intake was 89.8 ± 24.5 g•day\(^{-1}\) or 1.38 ± 0.46 g•kg\(^{-1}\)•day\(^{-1}\) due to their low ingestion of red meat, milk and byproducts (TESHIMA et al., 2002).

The higher the competitive degree of taekwondo athletes, the greater the demand for aerobic and anaerobic metabolisms, which will determine the participation of lipids as energetic substrate (BOUHLEL et al., 2006). In general, the dietary intake of lipids by athletes and practitioners of physical activity should not exceed 30% of the diet energetic value or 1 g•kg\(^{-1}\)•day\(^{-1}\); the proportions among essential fatty acids maintain 10% of saturated, polyunsaturated and monounsaturated (ADA, 1993). In the present study, the mean of 1.3 ± 0.5 g•kg\(^{-1}\)•day\(^{-1}\) intake, corresponding to 23.7 ± 4.2% TCV (total caloric value) is adequate; however, in the studies of Degoutte et al. (2003) and Teshima et al. (2002) with martial art athletes, the ingestion of this nutrient tended to be excessive.

In scientific literature, there are scarce studies related to fiber intake; the work of Teshima et al. (2002) reported that Japanese karatekas had inadequacy of food source intake, which was probably higher than that of taekwondo athletes, 9.0 ± 2.9 vs 18.6 ± 4.5 g•day\(^{-1}\), respectively.

As regards micronutrients, ADA (2001) emphasizes that they play an important role in energy production, hemoglobin synthesis, bone health maintenance, immune function adequacy, and body tissue protection against oxidative damages, besides helping the construction and repair of muscular tissue following the exercise. Recommendations are that the current values of Dietary Reference Intake (IOM, 200; IOM, 2001) are appropriate to the needs of athletes (MANORE, 2000; LUKASKI, 2004); however, additional care should be given to martial art athletes such as those of the present study who, due to the maintenance or reaching of the minimum weight for the category, are at risk of inadequacy associated with certain prejudicial behaviors: energetic restriction to lose weight, exclusion of food groups due to beliefs or wrong nutritional knowledge, high intake of high glycemic index carbohydrates, diets of low energetic density etc (BONCI et al., 2008). Literature suggests that the main inadequacies concerning micronutrients, due to such practices by taekwondo athletes, are related to the intake of calcium, magnesium, zinc, iron, and B-complex vitamins (KAZEMI et al., 2005). Hydrosoluble vitamins catalyze several biochemical reactions and, although not direct energy sources, are indispensable to obtain energy for the metabolism (WOOLF & MANORE, 2006; LUKASKI, 2004). Brazilian athletes present adequacy and low risk of marginal micronutrient intake, evidenced by the variety and diversity of the food composition.

CONCLUSION

The evaluation of food intake demonstrated that taekwondo athletes are not at risk of nutritional inadequacy, except for the high intake of dietary proteins and the inadequate quantity of fibers. These results need further investigation as to meal time and nutrient combinations, since there is evidence of benefits in the prescription of this combination to potentiate the efficiency in trainings or sportive events. Associated with the training and the international projection of Brazilian athletes, an adequate and varied diet can improve the efficiency of practitioners and athletes of this Olympic modality that has been increasingly developed in Brazil and in the world.
REFERENCES


