



Nutrient Intake and Body Composition of World Karate Champions: 4 Case Reports

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Abstract

Background: The purpose of this study was to examine the nutrient intake and body composition of elite Japanese karate practitioners.

Methods: Four world champion karate practitioners volunteered as follows: a male kata (forms: pre-established sequences of defensive and offensive techniques and movements) (case 1), a male sparring (case 2), a female kata (case 3), and a female sparring (case 4). Percentage of body fat, fat mass and lean body mass were evaluated using a bioelectric impedance analyzer. Nutrient intake was assessed by a food frequency questionnaire.

Results: In both male and female athletes, a lower percentage of body fat and higher body height, heavier weight, and lean body mass were found in the sparring practitioners than the kata athletes. None of the athletes took supplements. Each athlete's diet was modified to increase or maintain Lean body mass. Because all athletes did not reach the recommended dietary allowances for certain vitamins and minerals, we recommended increasing intake levels of vegetables, fruit, milk and dairy products in order to increase micronutrient intakes.

Conclusion: The world karate champions representing Japan have a very low percentage of body fat, especially sparring athletes. The athletes became aware of the importance of a well-balanced diet.

Keywords: Dietary Assessment; Body composition; Karate; World champions

Introduction

Karate is one of the most popular martial arts, practiced both in and outside Japan and will make its first appearance as an Olympic sport at the 2020 Summer Games in Tokyo, Japan [1]. A traditional Japanese karate tournament consists of kata and sparring competitions. Kata is a

set form consisting of pre-established sequences of defensive and offensive techniques and movements, performed alone against imaginary opponents. Sparring is the execution of defensive and offensive techniques while freely moving against an opponent. There are 5 weight categories in senior sparring competitions for both male (<60 kg, <67 kg, <75 kg, <84 kg, and >84 kg) and female (<50 kg, <55 kg, <61 kg, <68 kg, and >68 kg) karate competitors [2].

Because athletic performance and recovery from exercise are enhanced by optimal nutrition [3], understanding the nutrient intake and body composition of top-level karate practitioners is needed to achieve optimal performance. One study [4] reported that some elite karate sparring practitioners engage in practices to achieve dangerously rapid weight loss in preparation for competition. This report describes the nutrient intake and body composition of 4 karate world champions.

		Case 1	Case 2	Case 3	Case 4
		Male kata	Male spar	Female kata	Female-spar
Height	cm	170	184	160	166
Weight	kg	72.3	82.6	57.6	67
BMI	kg/m ²	25	24.4	22.5	24.3
Fat	%	11.4	9.5	19.6	18.4
	kg	8.2	7.8	11.3	12.4
LBM	kg	64.1	74.8	46.3	54.6
Abbreviations: BMI: Body Mass Index; LBM: Lean Body Mass; M: Male; F: Female					

Table1: Characteristics of the subjects.

Participants

Four subjects volunteered to participate in this study. The subjects were members of the national team for the Federation of All Japan Karate Organizations and had won the first prize at each of the World, Asian, and All Japan championships. These players competed in sparring or kata competition from April to December. Regional tournaments are held from April to July, and national, international, and/or world tournaments are held from September to December. The members of the national team participated in a 3-day training camp once every month from May to August, so that all measurements and dietary information were obtained at the site of a training camp in June, which was considered representative of their physiologic status during training for their next competition. The study protocol was approved by the Ethics Committee of the University. Informed consent was obtained from each subject.

Training load

Weekly training load was measured by means of a questionnaire, in which the following questions were asked: (i) the number of days per week and (ii) number of hours per day spent for karate training,

running and/or weight training. Weekly training load was calculated using the equation: number of days × hours per day for karate, running, and weight training (hours/week). Karate experience (in years) was also asked in the questionnaire.

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Measurements and Dietary Information

Weight and height were measured to the nearest 0.1 kg and 0.1 cm, respectively. The Body Mass Index (BMI) was calculated as weight/height² (kg/m²). Percentage of body fat (%Fat), fat mass and Lean Body Mass (LBM) were evaluated using a bioelectric impedance analyzer (Inbody 430, Biospace, Seoul, Korea). Pearson's correlation coefficients of %Fat obtained using this method and dual energy x-ray absorptiometry were reported as 0.94 [5].

All subjects were interviewed by experienced dietitians using a food frequency questionnaire (FFQ), based on 29 food groups and 10 types of cooking, to estimate the energy and nutrient intakes of each subject over the previous 1 to 2 months [6]. The food items and the portion sizes listed in the FFQ were chosen as foods commonly consumed in Tokushima Prefecture in Japan [7]. The FFQ was validated by comparison with weighed dietary records for 7 continuous days [7]. From the FFQ, the mean daily intake of total energy and nutrients was calculated according to the Japanese Foodstuff Composition Tables [8]. Each athlete was also questioned as to whether they were using a nutrient supplement or on a diet. The estimated energy requirement (EER) for athletes was calculated according to the following formula

[9]: LBM (kg) × 28.5(kcal/kg) × PAL, where PAL is the physical activity level (PAL for karate is 2.0 in this formula). The joint position of the ADA, DC, and ACSM [3] was used to evaluate macronutrient intakes. The micronutrient intakes were compared using the Recommended Dietary Allowance (RDA) in Japan [10].

The characteristics of the subjects are shown in Table 1. In both male and female athletes, the sparring practitioners had lower %Fat, and higher body height, heavier weight and LBM than the kata athletes.

The energy and nutrient intakes are shown in Table 2. None of the athletes took supplements. Although some of the micronutrients were above RDAs in each subject, they did not exceed the Tolerable Upper Intake Levels.

Case Reports

Case 1

A 25-year-old male kata practitioner with 20 years' karate experience. Weekly training load was 42 hours/week for karate, 2.5 hours/week for running, and 6 hours/week for weight training. Although energy intake was approximately 600 kcal above EER, we recommended increasing energy intake slightly because the subject has been maintaining his body weight and wanted to slightly increase his LBM without gaining fat mass. Macronutrient intakes were within the recommended range, and micronutrients were above the RDA except for vitamin B₂.

		Case 1	Case 2	Case 3	Case 4
		Male - kata	Male - spar	Female - kata	Female- spar
Energy (kcal)	Intake	4251	3323	2475	2554
	EER	3650	4250	2650	3100
	recommended by RD	4400	3300	2500	3100
Protein (g/kg)	Intake	1.8	1.3	1.5	1.3
	recommended	1.5-2.0	1.2-2.0	1.5-2.0	1.2-2.0
	%Energy	12	13.1	14.2	13.9
Fat (g)	Intake	85.3	72.8	60.6	69.4
	recommended	85-120	73-92	55-70	69-86
	%Energy	18.1	19.7	22	24.5
Carbohydrate (g/kg)	Intake	10	6.5	6.6	5.8
	recommended	12-Jun	10-Jun	10-Jun	10-Jun
	%Energy	69.9	67.2	63.8	61.7
calcium	Intake (mg)	863	683	458	694
	%RDA	108	85	71	107
Fe	Intake (mg)	16.3	9.5	8.8	10.9
	%RDA	232	136	84	104
Vitamin.B ₁	Intake (mg)	2.4	1.5	1.3	1.4

	%RDA	122	102	114	101
Vitamin.B ₂	Intake (mg)	2.1	1.6	1.2	1.5
	%RDA	97	94	100	92
Vitamin.C	Intake (mg)	194.4	148.9	77.7	127.1
	%RDA	194	149	78	127
Vitamin.A	Intake (µgRAE)	1167.9	831.3	436.2	462.3
	%RDA	137	98	67	71
Abbreviations: EER : Estimated Energy Requirement; %RDA : Percentage of Recommended Dietary Allowance; RD: Registered Dietitian					

Table 2: Energy and selected nutrient intakes of the subjects.

Case 2

A 25-year-old male sparring practitioner, in the <84 kg weight category, with 22 years' karate experience. Weekly training load was 21 hours/week for karate, 2.5 hours/week for running, and 3 hours/week for weight training. Although energy intake was approximately 900 kcal below EER, we recommended maintaining energy intake because the subject had to maintain his body weight to be able to compete in his weight category. Macronutrient intakes were within the recommended range. Micronutrient intakes were above the RDA, except for calcium and vitamin B₂.

Case 3

A 22-year-old female kata practitioner with 14 years' karate experience. Weekly training load was 35 hours/week for karate, 0.5 min/week for running, and 3 hours/week for weight training. Because energy intake met EER, macronutrient intakes were within the recommended range, and the subject wanted to maintain her body weight, we recommended maintaining energy intake. Micronutrient intakes were above the RDA for vitamins B₁, B₂, and D, while calcium, iron, vitamins C and A was below the RDA.

Case 4

A 23-year-old female sparring player, in the >68 kg weight category, with 14 years' karate experience. Weekly training load was 12 hours/week for karate, 1.5 hours/week for running, and 7.5 hours/week for weight training. Energy intake was approximately 550 kcal below EER. Because the subject wanted to gain LBM, protein and fat intakes were marginal to the recommended range, while carbohydrate intake was slightly below the lower end of the recommended range, we advised the athlete to consume approximately 550 kcal more energy by increasing carbohydrates and protein intakes for the demands of training, competition, and to increase LBM. Micronutrient intakes were above the RDA for calcium, iron vitamin B₁, C and D, but vitamins B₂ and A was below the RDA.

Discussion

In both male and female athletes, lower %Fat and higher body height, heavier weight, and higher LBM were found in the sparring practitioners than the kata athletes. The sparring athletes compete in well-defined weight categories, a weight increase due to fat accumulation may lead to poor athletic performance or to competition

in a heavier weight category, which dramatically reduces the performance capacity of the athlete [2,11]. In the present study, although case 2 was in the second heaviest male weight category, his %Fat was lower than the mean value for highly competitive male collegiate karate practitioners (9.5% vs. 12.4 ± 3.0%) [12]. Similarly, although case 4 was in the heaviest female category, her %Fat was lower than the mean value for highly competitive female collegiate karate practitioners (18.4% vs. 24.1 ± 5.5%) [12], and competitive collegiate karate athletes (23.9% ± 4.1%) [13].

Karate athletes are characterized by quick execution of various techniques with the whole body quickly moving through space, either vertically, as in jumping kicks, or horizontally, as in stepping in punches [14]. Thus, if speed can be maintained, a large LBM with low %Fat is of considerable advantage, especially in the heavier weight categories.

Miyahara et al. [4] investigated nutrient intake and blood iron status of male and female elite Japanese karate practitioners in the national team. The results showed that 16% of male and 45% of female sparring practitioners were on a diet and practiced rapid weight loss in preparation for a competition by abstaining from food, especially carbohydrates and liquid, and dehydrating in a sauna. In comparison with that study [4], in the present study, none of the athletes were on diet. Furthermore, they did not take supplements and wanted to satisfy nutrient needs by eating balanced diet. Thus, the athletes were eager to obtain information on proper diet and were aware of the importance of a well-balanced diet.

Although results were somewhat variable, all athletes did not reach the RDA for certain vitamins and minerals. Thus, we recommended increasing intake levels of vegetables, fruit, milk and dairy products in order to increase micronutrient intakes.

Regarding fluid intake, cold water and sports drinks were prepared for athletes at the training camp. We instructed the athletes to drink fluid during training and to measure body weight before and after the each training. The athletes did not lose their body weight more than 2% after training, so that we consider they are drinking adequate amount of fluid during karate training.

Conclusion

From these findings, we conclude that the world karate champions representing Japan have a very low %Fat, especially sparring athletes. We modified each athlete's diet to increase or maintain LBM. We also

advised the athlete to increase intake levels of grains, vegetables, fruit, milk and dairy products in order to increase micronutrient intakes. Dietitians need to work closely with the athletes to provide sound nutritional information.

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