

# An assessment of diet among high – rank professional judo athletes

Anna Książek<sup>(A,B,C,D,E,F)</sup>, Aleksandra Kopec<sup>(A,B,C,D,E,F)</sup>, Małgorzata Słowińska-Lisowska<sup>(A,B,C,D,E,F)</sup>

Department of the Biological Basis of Sport, University of Physical Education, Wrocław, Poland

**Key words:** Judo, Dietary habits, Food and nutritional intake

## Summary

**Background.** Rational diet is a major factor affecting the training process and sport success. The aim of the study was to assess the energy value and the intakes of nutrients, minerals, vitamins, dietary fibre and water in daily food rations including and excluding supplements among high-rank male judo athletes.

**Material and methods.** A total of 28 elite judoists (13 classified as first sport class, 12 as champions class, and 3 as international champions class) were included in the study. They engaged in sport professionally for an average  $12.9 \pm 3.7$  years. The energy value of the diet and the amounts of the dietary ingredients were assessed on the basis of food diaries using the software Dieta 5.0.

**Results.** The study has shown that the mean consumption of all the analysed dietary ingredients was significantly higher after taking into account food supplements and foodstuffs intended for special nutritional purposes. We found that supplementation with products containing proteins among professional judo athletes is not recommended. On the other hand, we found that supplementation of folic acid, vitamin D and calcium is justified. Of note is the fact that the recommended daily intakes of sodium, phosphorus, vitamin A and B – group vitamins (except for B<sub>2</sub>) were exceeded both in the diet without supplementation and in the diet with supplementation.

**Conclusions.** The study casts doubt on the justifiability of using protein supplements. However, it seems justified to administer vitamin and mineral supplements, particularly those that contain vitamin D, folic acid and calcium.

## Introduction

Judo is one of the speed and power sport disciplines in which short bouts of high-power exercise occur but which also require high aerobic capacity that determines a higher economisation of work [1].

A rational model of nutrition, based on a varied and balanced diet, makes it easier for athletes to meet the increased requirements for energy, the building blocks and regulatory components, including vitamins and minerals. A correct diet is one of the most important factors that affect exercise capabilities, optimise training outcomes and increase the likelihood of sport success [2,3].

The widespread use of food supplements and foodstuffs intended for particular nutritional uses by athletes should also be taken into account in their nutrient intake sheet. Many authors point out that food supplements are very commonly used by athletes [4,5,6].

The available literature provides very little data on the assessment of diet among high-level professional judo athletes.

The aim of the study was to assess the energy value and the intakes of nutrients, minerals, vitamins, dietary fibre and water in daily food rations including and excluding supplements among male judo athletes.

## Material and methods

A total of 28 professional judo athletes (13 classified as first sport class, 12 as champions class, and 3 as international champions class) were included in the study. They engaged in sport professionally for an average  $12.9 \pm 3.7$  years. The mean age was  $20.9 \pm 3.1$  years, the mean body mass was  $83.2 \pm 17.2$  kg and the mean height was  $181.1 \pm 9.0$  cm.

The study athletes' diets were assessed by the 5-day recall method, including one Sunday each, using the software Dieta 5.0. We analysed the energy value and the contents of nutrients, minerals, vitamins, dietary fibre and water in the diets of the elite judo athletes. The diets were also analysed after taking into account the intake of food supplements.

The values of nutrients, minerals, vitamins, dietary fibre and water were compared with the norms recommended by Benardot [7].

Normally distributed results were analysed using parametric tests (t-Student test) and those with a non-normal distribution were analysed using the non-parametric Wilcoxon signed – rank test. The statistical analyses were performed using *Statistica 10*.

## Results

The results of the study are summarised in Tables 1 and 2.

With the exception of sodium and dietary fibre, the mean daily intake of the dietary ingredients was significantly higher when food supplements and foodstuffs intended for particular nutritional uses were included in the analysis compared to the diet that excluded the supplements (Tables 1 and 2).

The mean energy value of the daily food ration in the diet excluding supplementation was significantly lower than that in the diet that included supplementation (2766.57±605.16 vs 2964.99±692.38 kcal).

The analysis of the diets has shown that carbohydrate intake among the judoists was significantly lower in the supplement-free diet than in the diet that included supplementation (4.18±1.02 vs 4.48±1.05 g/kg). Carbohydrate intake among the athletes was below the recommended norm also when the food supplements were included in the analysis (Table 1). Dietary fibre intake did not differ significantly between the diet with supplementation and the diet without supplementation, and was in line with the recommended norm for dietary fibre intake (Table 1).

The study has showed that the mean protein intake overall was significantly higher in the diet with supplements than in the diet that excluded supplements (1.81±0.49 vs 1.62±0.32 g/kg) (Table 1). With the diet with supplementation and without supplementation, the athletes exceeded the recommended norm for daily protein intake.

The mean percentage fat intake did not differ significantly between the diet without supplementation and the diet that included supplementation (32.75±5.06 vs 32.33±5.75 %). Fat intake among the elite judo athletes was above the recommended norm in the diet (both with and without the inclusion of supplementation) (Table 1).

The statistical analysis of daily water intake showed significant differences between the supplementation-free diet and the diet that included supplementation (2123.36±622.47 vs 2309.96±668.50 ml) (Table 1). The athletes drank insufficient amount of water both in the diet without supplements and in the diet with supplements.

The assessment of the diet among the athletes showed potassium deficiency both in the diet without supplements and in the diet with supplements. Calcium deficiency was also observed, although after taking into account the supplements the levels of this bioelement were found to be normal. The diet among the professional judo athletes showed an excessive intake of sodium and phosphorus (both with and without the inclusion of supplementation) (Table 2).

Significant differences between the diet without supplementation and the diet with supplementation were observed in the daily intake of all the vitamins (A, D, C, E, B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>6</sub>, B<sub>12</sub>, and folic acid). When we assessed vitamin intake we found that the judoists did not meet the requirements for vitamin D, folic acid and vitamin B<sub>2</sub>. Vitamin C deficiency was observed in the diets consumed by the athletes (both with and without supplementation). Excessive intakes of vitamin A and the B group vitamins (except for vitamin B<sub>2</sub>) were also noted (Table 2).

Tab. 1. Energy and nutrients intake by judoists

Component	Recommendations	Diet excluding supplements	Diet including supplements
<b>Energy</b>			
kJ	13408	11580.2 ± 2580.0	12417.1 ± 2949.3***
kcal	3200	2766.57 ± 605.16	2964.99 ± 692.38***
<b>Carbohydrates</b>			
g/d	500 - 600	340.6 ± 78.9	366.6 ± 90.6**
g/kg body mass	7 - 8	4.18 ± 1.02	4.48 ± 1.05**
% E	55 - 65	47.1 ± 5.7	49.7 ± 6.2***
Fiber g/d	20 - 38	23.44 ± 8.03	23.38 ± 8.11
<b>Protein</b>			
g/d	112 - 119 <sup>a</sup>	133.2 ± 32.3	150.3 ± 53.7**
g/kg body mass	1.6 - 1.7 <sup>a</sup>	1.62 ± 0.32	1.81 ± 0.49**
% E	14 - 15 <sup>a</sup>	19.8 ± 4.0	20.2 ± 4.7
<b>Fat</b>			
g/d	-	104.8 ± 32.7	106.8 ± 33.3**
g/kg body mass	1	0.94 ± 0.22	0.90 ± 0.20**
% E	20 - 30	32.75 ± 5.06	32.33 ± 5.75
<b>Water</b>			
ml/d	3200	2123.364 ± 622.47	2309.96 ± 668.50***

Mean value ± SD. \*  $p < 0.05$ . \*\*  $p < 0.01$ . \*\*\*  $p < 0.001$ . <sup>a</sup> [8], Norms according to Benardot [7]

Tab. 2. Minerals and Vitamins intake by judoists

	Recommendations	Excluding supplements	Including supplements
Sodium (mg/d)	1500	4941.89 ± 1524.86	4950.62 ± 1542.26
Potassium (mg/d)	4700	3639.02 ± 852.80	3766.34 ± 849.29 *
Calcium (mg/d)	1300 – 1500	1135.71 ± 423.09	1396.62 ± 599.28 ***
Phosphorus (mg/d)	1250 – 1500	2105.80 ± 482.51	2177.65 ± 508.07 *
Magnesium (mg/d)	400 – 450	412.12 ± 115.5	554.70 ± 250.10 ***
Iron (mg/d)	15 – 18	14.83 ± 4.72	16.43 ± 7.27 *
Iodine (µg/d)	150	171.46 ± 55.84	199.0 ± 75.48 *
Vit. A (µg/d)	700 – 900	1177.14 ± 548.81	1470.48 ± 919.68 **
Vit. D (µg/d)	15	6.31 ± 4.93	16.72 ± 35.18 **
Vit. C (mg/d)	200	93.73 ± 48.63	166.14 ± 130.83 **
Vit. E (mg/d)	15	16.37 ± 6.41	23.17 ± 12.28 ***
Vit. B <sub>1</sub> (mg/d)	1.5 – 3.0	1.74 ± 0.55	2.77 ± 3.41 **
Vit. B <sub>2</sub> (mg/d)	3.5	2.57 ± 0.84	3.63 ± 3.32 **
Vit. B <sub>3</sub> (mg/d)	14 – 20	27.13 ± 7.42	32.87 ± 13.95 **
Vit. B <sub>6</sub> (mg/d)	1.5 – 2.0	2.72 ± 0.77	4.51 ± 4.10 **
Vit. B <sub>12</sub> (µg/d)	2.4 – 2.5	5.44 ± 1.97	7.47 ± 5.86 **
Folic acid (µg/d)	400	337.48 ± 90.86	409.56 ± 176.74 *

Mean value ± SD. Vit. = Vitamin. \*  $p < 0.05$ . \*\*  $p < 0.01$ . \*\*\*  $p < 0.001$  Mean value ± SD. \*  $p < 0.05$ . \*\*  $p < 0.01$ . \*\*\*  $p < 0.001$ . <sup>a</sup> [8], Recommendations according to Benardot [7]

## Discussion

Following the principles of correct diet in highly competitive sports may be an essential factor determining victory in sports competition [9].

The study has shown statistically significant differences in energy value and in the intakes of carbohydrates, proteins, water, potassium, calcium, phosphorus, magnesium, iron, iodine, vitamins A, D, C, E, B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>6</sub>, B<sub>12</sub>, and folic acid in daily food rations among the elite judo athletes between the diets that included supplementation and the diets that excluded supplementation. Similar to the study, a study by Kozłowska and Jurkiewicz investigating members of the Polish national speed skating team showed differences in the diet that included foodstuffs intended for particular nutritional uses and supplements compared to the diet that did not include those [10]. Significantly higher degrees of meeting the dietary norms, including the supplements, was observed with respect to the intakes of energy, carbohydrates, calcium, magnesium, vitamin B<sub>1</sub> and folic acid.

The daily energy values of the diet among the judoists in the study were 2766.57 kcal in the diet without supplementation and 2964.99 kcal in the diet with supplementation (both of these values are below the recommended norm for athletes). Of note is the fact that an insufficient amount of carbohydrates was also shown in the diet. Degoutte et al. demonstrated that French judoists consumed an average of 42.8 ± 2.6 kcal/kg daily. It should be noted that while the study by Degoutte et al. was conducted during the competitive period during which the athletes performed exercise at the mean level of 92%  $\dot{V}O_{2max}$ , the study was performed during the preparatory period characterised by lower exercise loads, which may result in a lower energy expenditure [11].

Carbohydrate intake among the elite judo athletes in the diet with supplementation and in the diet without supplementation was 4.18 ± 1.02 g/kg and 4.48 ± 1.05 g/kg, respectively.

These values are below the recommended norm for carbohydrate intake. This tendency is widespread among people who practise sports, which may be confirmed by the results of studies by Artioli et al., Teshima et al. and Żebrowska and Pokora [12,13,14]. It should be emphasised that carbohydrate deficiencies in food rations of individuals practising sports may impair the work of muscles by restricting their ability for prolonged activity and brief but very intensive bouts of exertion. Also, insufficient supply of carbohydrates coupled with a low energy value of the diet may lead to using up dietary and structural proteins as an energy substrate [1, 15].

The study showed that elite judoists consume an average of 23.4 ± 8.2 g of dietary fibre daily. The daily intake norm for dietary fibre has been met here in contrast to Swedish judoists and boxers, whose daily consumption averaged 13 ± 7 g [16].

Based on the results it may be concluded that consumption of protein supplements by judoists is not recommended, as the protein intake by the elite judo athletes in the study averaged 1.62 ± 0.32 g/kg in the diet without supplementation and 1.81 ± 0.49 g/kg in the diet with supplementation. It should be stressed that a daily protein intake exceeding 2.0 g/kg may have an adverse effect on the human body, leading to acidosis and a reduction in systemic pH, which may in turn prolong post-training regeneration time [17]. Increased protein intake may also lead to dehydration and adversely affect renal and hepatic function [18].

The study showed that fat intake among elite judo athletes, both on a diet with supplements and a diet without supplements, exceeded 30% of total energy intake. Similar results have been obtained by Piliś et al., who analysed the diet of Polish weightlifters, and by Teshima et al., who analysed the diet of Japanese highly competitive collegiate karate players [13, 19]. The high fat intake among the athletes was mainly due to the high consumption of animal products (meat, cold meats, cheese and eggs). According to the recommendations by Benardot, a threshold of 30% of fat-derived energy should

not be exceeded if one wishes to preserve health [7]. It should be emphasised that excessive consumption of fat lowers exercise capacity and may therefore negatively affect the sport result [16].

The mean daily water intake among the athletes we investigated was  $2123.4 \pm 622.5$  ml in the case of the diet without supplementation and  $2310.0 \pm 668.5$  ml in the case of the diet with supplementation. The values we obtained were similar to those obtained by Pettersson et al. [16]. The average water intake among the Swedish elite judoists and boxers was  $2800 \pm 1100$  ml. The above results are also comparable to the data obtained by Smith, who conducted a study in professional boxers [20].

In the study, we observed a sodium consumption that was three times above the recommended norm ( $4941.9 \pm 1552.8$  mg in the case of the diet without supplementation and  $4950.7 \pm 1570.6$  mg in the case of the diet with supplementation). A similar tendency was shown by Teshima et al., who analysed the diets of Japanese highly competitive collegiate karate players, where sodium consumption was  $4472 \pm 1254$  mg [13]. Going over the recommended norm has also been shown by Pilis et al. [19]. Coles et al. suggest that excessive dietary sodium consumption by athletes is a common phenomenon and is a result of high consumption of processed foods [21]. According to Sacks et al., small excesses in sodium intake are not dangerous, as increased physical activity and excessive sweating during training sessions results in increased sodium loss [22]. Benardot suggests that in cases of considerable sodium loss with sweat the norm for sodium intake may even exceed 10 g/day [7].

Exceeding the recommended norm for daily phosphorus intake by 69% in the non-supplemented diet and by 74% in the supplemented diet among the athletes we investigated may have been associated (based on the analysis of diet ingredients) with the consumption of considerable amounts of processed meats, fizzy drinks and confectionery products. According to Pilis et al. and Ziemiański, supplementation of this bioelement is not recommended, as the excess of phosphorus may lead to changes in blood levels of calcium and parathyroid hormone [19,23].

The studied group of elite judoists was characterised by a low consumption of potassium both in the diet without supplementation and in the diet that included supplementation. The results are consistent with the results obtained by other authors regarding potassium intake among elite combat sports

athletes [13]. The low dietary intake of potassium among these athletes may have been caused by the low consumption of fruits and vegetables.

The study showed vitamin C deficiency in the diets of the elite judoists even after taking into account supplementation ( $166.1 \pm 133.2$  mg). Insufficient dietary intake of vitamin C has also been observed among weightlifters [19] and among highly competitive collegiate karate players [13]. Insufficient dietary vitamin C supply in the study population may also have been caused by insufficient consumption of fruits and vegetables.

The above studies, similarly to the study of Polish weightlifters [19] and a study of Iranian wrestler [24], showed vitamin D deficiency. Insufficient consumption of vitamin D by professional judo athletes may be a result of the low vitamin D content in the products that are normally consumed in Poland [10]. In the study, administration of supplements to the judoists corrected the vitamin D deficiency.

Of note is the fact that excessive supply of B-group vitamins has been shown in the study both in the diet with supplementation and the diet without supplementation. It seems that this may have been caused by consumption of large amounts of meat products by the athletes. One must remember that exceeding the norms in cases of vitamins B<sub>1</sub>, B<sub>2</sub> and B<sub>12</sub> is not associated with any health risks, and in cases of vitamins B<sub>3</sub> and B<sub>6</sub> the consumed amounts of the vitamins would have to be many times higher to lead to any changes in the functioning of the body [19,23].

## Conclusions

1. It seems necessary to develop individual nutritional programmes that would be based on the analysis of diet and control over the supplements used by elite judo athletes.
2. Monitoring of the consumed energy, proteins, minerals and vitamins may contribute to the optimisation of the training process.
3. Despite the use of supplements judoists have not fulfilled the recommended norm for daily energy and carbohydrate intakes.
4. The study casts doubt on the justifiability of using protein supplements.
5. It seems justified to administer vitamin and mineral supplements, particularly those that contain vitamin D, folic acid and calcium.

## References

1. Kujach S, Samuraj M, Grzywacz T, Łuszczuk M, Ziemann E, Laskowski R. Krzywa mleczanowa podczas zawodów judo – opis przypadku [In Polish] [Dehydrogenase Curve in a Judo Competition. A Case Study]. *Rocznik Naukowy. AWFIS Gdańsk*. 2011; 20: 24-31.
2. Biela B, Zagrodzki P. Ocena opieki żywieniowej u zawodników wyczynowo uprawiających skoki narciarskie i kombinację norweską [In Polish] [Assessment of nutritional care in professional athletes practicing ski jumping and Nordic combined]. *Probl Hig Epidemiol*. 2013; 94(2): 291-293.
3. Morawska A, Bolesławska I, Przysławski J, Chrzanowski S, Jagielski P. Wartość energetyczna oraz podstawowe składniki odżywcze w całodziennych racjach pokarmowych (CRP) mężczyzn uprawiających karate [In Polish] [Energetic value and essential nutrients in daily food rations of karate athletes]. *Probl Hig Epidemiol*. 2013; 94(3): 514-517.
4. Otten J, Hellwig JP, Meyers LD. DRI, Dietary Reference Intakes: The Essential Guide to Nutrient Requirements. Washington: National Academies Press; 2006.

5. Reddy ST, Wang CY, Sakhaee K, Brinkley L, Pak CY. Effect of low-carbohydrate high-protein diets on acid-base balance, stone-forming propensity, and calcium metabolism. *Am J Kidney Dis.* 2002; 40(2): 265-74.
6. Wróblewska M, Smoleń A. Suplementy diety stosowane przez zawodników sportów walki [In Polish] [Dietary supplements used by martial artsists]. *Żywnie Cziow Metab.* 2009; 26(1): 107-111.
7. Benardot D. *Advanced Sports Nutrition – 2nd ed.* Champaign. USA: Human Kinetics; 2012.
8. Gibala MJ. Dietary protein, amino acid supplements, and recovery from exercise. *GSSI Sports Science Exchange.* 2002; 15(4): 1-4.
9. Clarys P, Rosseneu A, Aerenhouts D, Zinzen E. Energy expenditure and intake in judo athletes during training camp. *J Sports Sci Med.* 2011; 1(2): 7-11.
10. Kozłowska L, Jurkiewicz M. Ocena sposobu żywienia członków kadry narodowej łyżwiarzy szybkich z uwzględnieniem stosowanych suplementów i środków spożywczych specjalnego przeznaczenia żywieniowego [In Polish] [Assessment of dietary habits of national team in speed skating with regard supplements and special foods]. *Żyw Cziow Metab.* 2009; 36(1): 95-99.
11. Degoutte F, Jouanel P, Filaire E. Energy demands during a judo match and recovery. *Br J Sports Med.* 2003; 37: 245-249.
12. Artioli GG, Gualano B, Franchini E, Batista RN, Polacow VO, Lancha AH Jr. Physiological, performance, and nutritional profile of the Brazilian Olympic Wushu (kung-fu) team. *J Strength Cond Res.* 2009; 23(1): 20-25.
13. Teshima K, Imamura H, Yoshimura Y, Nishimura S, Miyamoto N, Yamauchi Y. Nutrient intake of highly competitive male and female collegiate karate players. *J Physiol Anthropol Appl Hum Sci.* 2002; 21(4): 205-11.
14. Żebrowska A, Pokora I. Poziom spożycia podstawowych składników pokarmowych a wybrane wskaźniki antropometryczne stanu odżywienia u mężczyzn o wysokiej aktywności fizycznej [In Polish] [Consumption of basic nutrients and selected anthropometric indicators of nutritional status in men with high physical activity]. *Żyw Cziow Metab.* 2003; 30: 603-606.
15. Burke LM, Hawley JA, Wong SH, Jeukendrup AE. Carbohydrates for training and and competition. *J Sports Sci.* 2011; 29(S1): 17-27.
16. Pettersson S, Berg CM. Dietary Intake at Competition in Elite Olympic Combat Sports. *Int J Sport Nutr Exerc Metabol.* 2013; Epub ahead of print.
17. Campbell B, Kreider RB, Ziegenfuss T, Bouny PL, Roberts M, Burke D. International Society of Sports Nutrition position stand: protein and exercise. *J Int Soc Sports Nutr.* 2007; 4(8): 2-7.
18. Poortmans J, Dellalieux O. Do regular high protein diets have potential health risks on kidney function in athletes? *Int J Sport Nutr Exerc Metab.* 2000; 10(1): 28-38.
19. Piliś A, Piliś K, Michalski C, Jelonek J, Piliś W. Ocena sposobu żywienia i stanu odżywienia członków kadry narodowej w podnoszeniu ciężarów i studentów wychowania fizycznego [In Polish] [Estimation of nutrition of polish national weightlifting team and physical education students]. *Żyw Cziow Metab.* 2011; 38(5): 350-363.
20. Smith M. Physiological profile of Senior and junior England international amateur boxers. *J Sports Sci Med.* 2006; 5: 74-89.
21. Coles MG, Luetkemeier MJ. Sodium – facilitated hypervolemia, endurance performance, and thermoregulation. *Int. J. Sports Med.* 2005; 26(3): 182-187.
22. Sacks FM, Svetkey LP, Vollmer WM. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. *N Engl J Med.* 2001; 4:344(1): 3-10.
23. Ziemiański S. *Normy Żywienia Człowieka [In Polish] [Standards of Human Nutrition].* Warszawa: Wydawnictwo Lekarskie PZWL; 1998.
24. Daneshvar P, Hariri M, Ghiasvand R, Askari G, Darvishi L, Iraj B. Dietary behaviors and nutritional assessment of young male isfahani wrestlers. *Int J Prev Med.* 2013; 4(S1): 48-52.

**Address for correspondence:**

Anna Książek  
Department of the Biological Basis of Sport  
Wrocław University of Physical Education  
ul. I.J. Paderewskiego 35, 51-612 Wrocław, Poland  
e-mail: anna.ksiazek@awf.wroc.pl