

An evaluation of diets in the Polish national judo team during the pre-competition weight loss period

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- A Study Design
- B Data Collection
- C Statistical Analysis
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Abstract

Background & Study Aim:

Diets of professional athletes, especially during the pre-competition weight reduction period, may have a significant impact on the sport results and the athletes' health. The aim of the study was the energy value and the intakes of nutrients, minerals, vitamins, dietary fibre and water in daily food rations in the representatives of the Polish national judo team during the pre-competition weight loss period.

Material & Methods:

A total of 30 elite judoists (15 women and 15 men) were included in the study. They engaged in sport professionally for an average 11.9 ±3.5 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 mean daily intakes of the dietary components (energy, carbohydrates, dietary fibre, proteins, fats, water, minerals, and vitamins) was significantly different than the norms recommended for athletes. We found that judoists consumed less energy, carbohydrate, fat, water, potassium, calcium, iron, iodine, vitamin: D, C, E, B₂ compare to recommended norm. On the other hand, we found that dietary intake of sodium, phosphorus, vitamin: B₃, B₆, B₁₂ was significantly higher than recommended norm.

Conclusions:

The energy and macronutrient intakes in the pre-competition period should be monitored closely to avoid excessive imbalances and the consequent reduction in performance and/or development of health problems.

Key words:

combat sport athlete • dietary intake • nutritional status • rapid weight loss

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Combat sport – *noun* a sport in which one person fights another, e.g. wrestling, boxing and the martial arts [22].

Combat sports – are a competitive contact sports with one-on-one combat. Determining the winner depends on the particular contest's rules. In many combat sports, a contestant wins by scoring more points than the opponent or by disabling opponent [23].

Diet – *noun* **1.** the amount and type of food eaten **2.** the act of eating only particular types of food, in order to become thinner, to cure an illness or to improve a condition [22].

Dietary – *adjective* relating to food eaten [22].

Dietary fibre – *noun* food materials that cannot be hydrolysed by digestive enzymes and are therefore important for digestive health, found in fruit and grains. Also called **roughage, non-dietary polysaccharides** [22].

Dietary intake *noun* the amount of a nutrient that a person receives through their diet [22].

Diuretic – *noun* a substance that increases the production of urine [22].

Pre-competition – *adjective* used for describing a regime or a set of activities that are done immediately before competing, e.g. carb loading [22].

Weight loss – *noun* the fact of losing weight or of becoming thinner [22].

INTRODUCTION

Combat sports such as judo are categorised into weight classes intended to promote fair competition by matching opponents of equal (or similar) body mass. Many athletes aim to compete at the lightest weight possible in the belief that it will offer a competitive edge over opponents. Pre-competition weight reduction is a widespread phenomenon among athletes, especially in those disciplines in which weight categories are distinguished [1-3]. Previous studies have documented that weight reduction, often in the range of 5-10% of total body mass, frequently occurs in the last days before official weigh-in [2].

In order to achieve target weight, the athletes often lose weight rapidly before competitions by a gradual dieting or fasting, fluid restrictions, sweating through intensive exercise in plastic suits to promote water loss and even the use of diuretics [1]. The available literature provides information on the adverse impact of rapid weight reduction on health and exercise capacity among professional competitors. Weight reduction achieved by dehydration of the body may affect plasma and blood volumes, endocrine function, induce a physiological and a psychological stress and have immediate effects on sports performance on aerobic endurance capacity [4].

Although experts recommend gradual weight reduction in combat sports, athletes continue to follow the practice of rapid weight reduction [5]. It is important that the diet consumed by combat sports athletes in the pre-competition period ensures that muscle glycogen stores are adequately replenished and that rehydration is satisfactory, which favourably affects the athletes' well-being and the final sport outcome [3]. The available literature does not provide any information on the quantitative analysis on the diets consumed by professional judokas during the pre-competition period.

The aim of the study was the energy value and the levels of intake of nutrients, minerals, vitamins,

dietary fibre and water in daily food rations in the representatives of the Polish national judo team during the pre-competition period.

MATERIAL AND METHODS

Subjects

A total of 30 professional judo athletes from three weight categories (15 women: 57-, 63-, 70 kg and 15 men: 66-, 73-, 81 kg) were included in the study. All the participants were members of the national team and the mean career duration was 11.9 ± 3.5 years. The anthropometric characteristics of the subjects is given in Table 1.

Food diary

The study athletes' diets were assessed by the 7-day recall method using the software Dieta 5.0. The participants were instructed to record all the consumed foods and fluids including supplements. A total of 67% of the subjects used food supplements: sports bars, sports drinks, energy gels, whey protein, multivitamin/mineral supplements. The quantities of all the food items were reported in household measures or, if available, according to packaging details. Each subject completed a food diary for 7 days until the official weigh-in.

We analysed the energy value and the contents of nutrients, minerals, vitamins, dietary fibre and water in the diets of the professional judokas. The diets were 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 [6].

Body weight measurements were performed twice: 7 days before the official weigh-in and at the time of the official weigh-in. At both weigh-ins the participants were weighed in their underwear. The mean weight reduction was 2.8 ± 1.2 kg.

Table 1. Anthropometric characteristics of the study subjects (n = 30).

| Variable | Mean (\pm) | Median | Min | Max |
|--|-----------------|--------|-------|-------|
| Age (years) | 22.2 \pm 3.35 | 22.0 | 18.0 | 31.0 |
| Body weight 7 days before the official weigh-in (kg) | 70.2 \pm 8.7 | 69.0 | 58.0 | 86.0 |
| Body weight at the official weigh-in (kg) | 67.4 \pm 7.9 | 66.0 | 57.0 | 81.0 |
| Body height (cm) | 171.4 \pm 6.7 | 171.0 | 163.0 | 190.0 |

Statistical analysis

Normally distributed results were analysed using a parametric test (t-Student test) and those with a non-normal distribution were analysed using the non-parametric sign test. Statistical significance was declared when $p < 0.05$. The statistical analyses were performed using STATISTICA 10.

RESULTS

The mean energy value of the daily food ration in the diets of the study subjects was 24.0 ± 8.9 kcal/kg and was significantly lower compared to the lower limits of the recommended norms. The intake norm was realised in 49% (Table 2).

The mean intakes of carbohydrates and dietary fibre, and the percentage of this dietary component in the daily food ration were significantly below the recommended norms. The mean

intakes of carbohydrates and dietary fibre were 3.2 ± 1.2 g/kg and 17.4 ± 7.5 g/day, respectively, and the percentage of carbohydrates in the daily food ratio was 50.9%. The percentages of realisation of the lower limit of norm were 64%, 70% and 85%, respectively (Table 2).

The percentage of energy originating from proteins in the daily food ratio was 23.5% and was significantly higher than the recommended norm. The upper limit of norm was exceeded by 56%. The analysis of the subjects' diets showed that the mean intake of fats was 0.8 ± 0.4 g/kg and that it was significantly lower than the recommended intake norm. The norm was realised in 80%. The mean daily water intake was 1665.8 ± 752.7 ml and was significantly different from the norm. The lower limit of intake norm was realised in 55.5% (Table 2).

The statistically significant deficiencies are the following minerals: potassium, calcium, iron and

Table 2. Energy and nutrient intakes by judoists (n = 30).

| Component | Recommended intake | Mean intake (\pm) |
|----------------------|----------------------|--|
| Energy | | |
| Kcal | | 1676.4 ± 657.9 |
| kcal/kg body weight | 47÷53 | $24.0 \pm 8.9^{***}$ |
| Carbohydrates | | |
| g/d | – | 219.9 ± 91.9 |
| g/kg body weight | 5÷7 ^a | $3.2 \pm 1.2^{***}$ |
| % E | 60÷70 | $50.9 \pm 8.7^{***}$ |
| Fibre g/d | 25÷40 | $17.4 \pm 7.5^*$ |
| Proteins | | |
| g/d | – | 95.8 ± 48.4 |
| g/kg body weight | 1.6÷1.8 ^b | 1.4 ± 0.6 |
| % E | 14÷15 | $23.5 \pm 6.4^{***}$ |
| Fats | | |
| g/d | – | 51.5 ± 23.2 |
| g/kg body weight | 1 ^b | $0.8 \pm 0.4^{**}$ |
| % E | 25÷30 | 26.6 ± 5.8 |
| Water | | |
| ml/day | 3300÷3720 | $1665.7 \pm 657.9^{***}$ |

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$; Recommendations according to Benardot [6] and a [7], b [8]

Table 3. Mineral and vitamins intakes by judoists.

| Variable (indicator) | Recommended intake | Mean intake (\pm) |
|-----------------------------------|--------------------|-------------------------------|
| Sodium (mg/d) | 1500 | 2600.6 \pm 1264.8*** |
| Potassium (mg/d) | 4700 | 3302.3 \pm 1472.3*** |
| Calcium (mg/d) | 1300÷1500 | 674.3 \pm 294.8*** |
| Phosphorus (mg/d) | 1250÷1500 | 1543.9 \pm 614.2** |
| Magnesium (mg/d) | 400÷450 | 375.6 \pm 155.2 |
| Iron (mg/d) | 15÷18 | 11.8 \pm 4.6** |
| Iodine (μ g/d) | 150 | 106.4 \pm 41*** |
| Vit. A (μ g/d) | 700 ÷900 | 1135.7 \pm 703.6 |
| Vit. D (μ g/d) | 15 | 6.3 \pm 4.9*** |
| Vit. C (mg/d) | 200 | 111.7 \pm 73.2*** |
| Vit. E (mg/d) | 15 | 9.4 \pm 7.9** |
| Vit. B ₁ (mg/d) | 1.5÷3.0 | 1.4 \pm 1.1 |
| Vit. B ₂ (mg/d) | 3.5 | 2.7 \pm 0.6** |
| Vit. B ₃ (mg/d) | 14÷20 | 22.9 \pm 6.5*** |
| Vit. B ₆ (mg/d) | 1.5÷2.0 | 2.5 \pm 1.3** |
| Vit. B ₁₂ (μ g/d) | 2.4÷2.5 | 4.9 \pm 2.2*** |

Vit. Vitamin; **p<0.01; ***p<0.001; Recommendations according to Benardot [6]

iodine. The lower limits of intake norms for these minerals were realised in 70% for potassium, 52% for calcium, 79% for iron, and 71% for iodine. The diets of the judo athletes revealed significantly excessive intakes of sodium and phosphorus compared to the recommended norms. The upper limits of intake were exceeded by 73% for sodium and 24% for phosphorus (Table 3).

The intakes of vitamins B₃, B₆ and B₁₂ in the daily food rations were excessive and those of vitamins D, E, C and B₂ insufficient. The recommended upper limit of intake norms were exceeded by 64% for vitamin B₃, 66% for vitamin B₆ and 104% for vitamin B₁₂ and the vitamin deficiencies were established at 58% for vitamin D, 35% for vitamin E, 44% for vitamin C and 23% for vitamin B₂ (Table 3).

DISCUSSION

Inappropriate strategies used to achieve rapid weight loss in athletes during the pre-competition period may reduce their performance during competition. In addition, large energy deficits and imbalances in the intakes of macronutrients, vitamins and minerals can lead to health disorders in athletes [9, 10].

The present study showed statistically significant differences in energy values and the intakes of carbohydrates, dietary fibre, proteins, fats, sodium, potassium, calcium, phosphorus, iron, iodine and vitamins D, C, E, B₂, B₃, B₆, and B₁₂ in the daily food rations of the judokas of the Polish national team during the pre-competition weight reduction period compared to the norms recommended for athletes.

The mean daily energy value of the diets consumed by professional judo athletes was merely 1676.4 \pm 657.9 kcal, which accounts for 49% of the norm. Similar results were obtained by Drummond et al. [11], who evaluated the total energy intake of taekwondo athletes during the competition period. Energy deficits were also showed in adolescent female judo athletes in the last days before competition [12, 13]. It should be noted that such deficits can undermine performance in both the short and long terms. Energy deficits are also particularly dangerous to females, as they may contribute to the female athlete triad [14].

The mean intake of carbohydrates by the study athletes was 3.2 \pm 1.2 g/kg and did not meet the recommended norm for this dietary component. Deficits of carbohydrates in the diets of combat sport athletes are common both in the

competition [13, 15] and preparatory [16] periods. It needs to be highlighted that low dietary supply of carbohydrates limits the performance of prolonged sub-maximal or intermittent high-intensity exercise and plays a permissive role in the performance of brief or sustained high-intensity work [17].

The present study also showed an insufficient intake of dietary fibre in the daily food rations consumed by the study athletes. Similar findings were reported in an assessment of dietary intake in Swedish elite athletes in boxing, judo, taekwondo and wrestling. It should be stressed that during the competition period it is recommended that the consumption of foods rich in dietary fibre should be restricted in order to avoid gastrointestinal problems. Consumption of fibre-rich foods in close proximity to competition might be associated with gastric distress [3].

The percentage of protein in the diets of the study subjects exceeded the recommended intake norm. Excessive intakes of proteins by more than 15% in the daily food rations were observed in a study by Fleming et al. [18], who investigated the nutritional intake of taekwondo athletes during the last five days before competition, and in a study by Drummond et al. [11], who also evaluated protein intake taekwondo athletes during the competition period. It is noteworthy that in the study reported in the present paper the subjects consumed 1.4 ± 0.6 g of protein per kilogram of bodyweight. The daily protein intake of 2 g/kg is considered safe and during the weight reduction period it is in fact recommended. The protein intake of 2.0 g/kg/day may take on greater importance to combat sport athletes during pre-competition weight loss. Recent research has demonstrated that during prolonged situations of inadequate energy intake, greater protein consumption appears to protect lean body mass and prevent or minimise the catabolic consequences of low-calorie diets [19].

The intake of fats among the judoists was 0.8 ± 0.4 g/kg and did not meet the recommended norm. Deficits of fats in the diets of combat sport athletes during the pre-competition weight reduction period were also demonstrated in other studies [15, 20]. Although the majority of dietary fuel for combat sport athletes is in the form of carbohydrates, fats also play many important roles and are a vital fuel source during endurance

training. Skeletal muscle can store nearly the energy equivalent of glycogen in the form of intramuscular triacylglycerol's, which are a viable fuel source during prolonged moderate-intensity exercise up to about 85% of VO_{2max} [19].

It should be noted that the judokas consumed a mere 1665.7 ± 657.9 ml/day of fluids during the pre-competition weight reduction period. One of the methods of rapid weight reduction during the week preceding the official weigh-in is the restriction of food and drink. In addition, sweating by performing intensive exercise in a rubber or plastic suit is frequently used to stimulate water-associated weight loss. As shown in a study by Brito et al. [2], more than 23% of judo athletes reduced their weight by fluid restriction. However, such body weight reduction may affect plasma and blood volumes, muscle glycogen stores, endocrine function, may induce a physiological and psychological stress, and may have immediate effects on the aerobic endurance capacity and sports performance [21].

The present study showed that the intake norm for sodium was exceeded by 73% and that for phosphorus by 24% in the diets of the study subjects. Based on the analysis of dietary components, this might have been due to the high consumption of fresh and processed meat products, which were the principal components of the subjects' diets during the pre-competition weight reduction period. It should also be noted that sodium contained in a rehydration beverage or food will better conserve the fluid volume and increase the drive to drink. For the athlete who must rehydrate between training of competitive sessions without meal consumption, choosing a rehydration beverage with electrolytes is an important consideration [19]. Benardot [6] indicated that the intake norm for sodium may even exceed 10 g/day if the sodium loss with perspiration is high.

The professional judo athletes in the present study consumed insufficient amounts of potassium (70% of the recommended intake) and vitamin C (59% of the recommended intake). A similar trend was observed by Reljic et al. [13], who analysed vitamin status in elite male boxers, who reduced body weight rapidly before competition. The low intakes of potassium and vitamin C by the subjects might have been due to the low consumption of fruits and vegetables associated with

the restriction of intake of products that served as a carbohydrate source for the athletes during the pre-competition weight reduction period.

The present study showed calcium and iron deficiencies in the diets of the study athletes. Similar trends were shown in studies by other authors who analysed the intakes of minerals in combat sport athletes [12, 18]. Fleming et al. [18] suggested that energy-restricted diets and inadequate consumption of calcium had a detrimental effect on bone health. Calcium deficiency can decrease bone mineral density, making the bone structures more fragile and susceptible to fractures [1].

The present study also showed vitamin D deficiency. Insufficient consumption of vitamin D by the professional judo athletes may be due to the low content of this vitamin in products usually consumed in Poland. Results of many studies have suggested vitamin D deficiency in athletes,

especially during the autumn and winter periods. As shown in one of our previous studies in judoists during the preparation period, consumption of food supplements containing vitamin D contributed to the realisation of the intake norm for this vitamin [16].

These studies, similarly to the study in adolescent female judo athletes and male elite amateur boxers, deficiencies of vitamins from the B group were shown [12, 13], which seems to be due to the consumption of high quantities of meat products by the study subjects.

CONCLUSION

The energy and macronutrient intakes in the pre-competition period should be monitored closely to avoid excessive imbalances and the consequent reduction in performance and/or development of health problems.

REFERENCES

- Artioli GG, Gualano B, Franchini E et al. Prevalence, magnitude, and methods of rapid weight loss among judo competitors. *Med Sci Sports Exerc* 2010; 42(3): 436-442
- Brito CJ, Roas A FC, Brito I SS et al. Methods of body mass reduction by combat sport athletes. *Int J Sport Nutr Exerc Metab* 2012; 22(2): 89-97
- Petersson S, Berg CM. Dietary intake at competition in elite Olympic combat sports. *Int J Sport Nutr Exerc Metab* 2014; 24(1): 98-109
- Martinez-Rodriguez A, Vicente-Salar N, Montero-Carretero C et al. Nutritional strategies to reach the weight category in judo and karate athletes. *Arch Budo* 2015; 11(1): 381-391
- Da Silva Santos JF, Takito MY, Artioli GG et al. Weight loss practices in Taekwondo athletes of different competitive levels. *J Exerc Rehabil* 2016; 12(3): 202-228
- Benardot D. *Advanced Sports Nutrition*. 2nd ed. Champaign: Human Kinetics; 2012
- Thomas DT, Erdman KA, Burke LM. American College of Sports Medicine Joint Position Statement. Nutrition and Athletic Performance. *Med Sci Sports Exerc* 2016; 48(3): 543-568
- Gibala MJ. Dietary protein, amino acid supplements, and recovery from exercise. *GSSI Sports Science Exchange* 2002; 15(4): 1-4
- Kazemi M, Shearer H, Choung YS. Pre-competition habits and injuries in Taekwondo athletes. *BMC Musculoskelet Disord* 2005; 27(6): 26
- Tsai ML, Chou KM, Chang CK et al. Changes of mucosal immunity and antioxidation activity in elite male Taiwanese taekwondo athletes associated with intensive training and rapid weight loss. *Br J Sports Med* 2011; 45(9): 729-734
- Drummond MDM, Couto BP, Eufrásio RJS. Energy balance in taekwondo athletes during pre-competition. *Arch Budo* 2014; 10: 195-199
- Boisseau N, Vera-Perez S, Poortmans J. Food and Fluid Intake in Adolescent Female Judo Athletes before Competition. *Pediatr Exerc Sci* 2005; 17(1): 62-71
- Reljic D, Jost J, Dickau K et al. Effects of pre-competition rapid weight loss on nutrition, vitamin status and oxidative stress in elite boxers. *J Sports Sci* 2015; 33(5): 437-448
- Mountjoy M, Sundgot-Borgen J, Burke L et al. The IOC consensus statement: beyond the Female Athlete Triad--Relative Energy Deficiency in Sport (RED-S). *Br J Sports Med* 2014; 48(7): 491-497
- Sagayama H, Yoshimura E, Yamada Y et al. Effects of rapid weight loss and regain on body composition and energy expenditure. *Appl Physiol Nutr Metab* 2014; 39(1): 21-27
- Książek A, Kopeć A, Słowińska-Lisowska M. An assessment of diet among high - rank professional judo athletes. *JCSMA* 2014; 5(1): 37-41
- Burke LM, Hawley JA, Wong SH et al. Carbohydrates for training and competition. *J Sports Sci* 2011; 29(Suppl 1): S17-27
- Fleming S, Costarelli V. Nutrient intake and body composition in relation to making weight in young male Taekwondo players. *NFS* 2007; 37(5): 358-366
- Hoffman JR., Maresh CM. Nutrition and Hydration Issues for Combat Sport Athletes. *Strength Condit J* 2011; 33(6): 10-17
- Filaire E, Maso F, Degoutte F et al. Food restriction, performance, psychological state and lipid values in judo athletes. *Int J Sports Med* 2001; 22(6): 454-459
- Degoutte F, Jouanel P, Bègue RJ et al. Food restriction, performance, biochemical, psychological, and endocrine changes in judo athletes. *Int J Sports Med* 2006; 27(1): 9-18
- Dictionary of Sport and Exercise Science. Over 5,000 Terms Clearly Defined. London: A & B Black; 2006
- Biernat E, Boguszewski D. The level of physical activity of the working inhabitants of Warsaw practising martial arts and combat sports. *Arch Budo* 2015; 11: 69-77

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