

## Assessment of nutrition in female judokas during the precompetitive body mass reduction period

ANNA KWIATKOWSKA-PAMUŁA<sup>1</sup>, ANNA KURYLAS<sup>2</sup>, ANETA PERENC<sup>3</sup>, EWA ZIÓŁKO<sup>4</sup>,  
RENATA ŻŁOTKOWSKA<sup>5</sup>, MAŁGORZATA MUC-WIERZGON<sup>6</sup>

### Abstract

**Introduction.** Researchers have noticed that the pre-competition nutrition system used by judo contestants in 80% deviates from proper nutrition. The overriding goal, of reaching the so-called “enter weight”, combined with the lack of basic knowledge about proper nutrition, can lead to unintended negative results during competition and in the further perspective, when continuing a sports career. **Aim of Study.** The aim of the study was to assess the energy value and the intake of basic nutrients (carbohydrates, protein and fat) in the pre-competitive period. **Material and Methods.** The objectives were to examine the range of rapid weight loss (RWL) in the tested group of judokas and to specify the relationship between training experience and the RWL. A total of 15 female athletes training judo were assigned to this study. The criteria determining the inclusion in the study were both national judo team membership as well as belonging to one of the three weight categories. The tested athletes’ diets were assessed using the 7-day recall method. The female athletes were asked to report their daily food intake for 7 days before a competition. The diets were assessed using the software of Meal Diary MR BIG v 4.92. The results were compared with the standard of Benardot, 2012. **Results.** In the tested group of female judokas, the energy value and intakes of basic nutrients were significantly different from those specified in the mentioned standard. The problem of RWL in this study appeared common as it affected 93.33% of the participants. The study did not reveal any relationship between training experience and RWL. **Conclusion.** In order to prevent the occurrence of problems related to the low intake of energy and basic nutrients, athletes, coaches and parents ought to be educated in terms of rational nourishment and consequences of RWL.

**KEYWORDS:** judo, nutrition in sport, body mass reduction, health.

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Corresponding author: [aniagwozdz@wp.pl](mailto:aniagwozdz@wp.pl)

<sup>1</sup> Szpital Specjalistyczny Nr 1, Katedra i Oddział Kliniczny Chorób Wewnętrznych, Bytom, Poland

<sup>2</sup> Akademia Wychowania Fizycznego w Katowicach, Katedra Teorii i Praktyki Sportu, Katowice, Poland

<sup>3</sup> Śląski Uniwersytet Medyczny w Katowicach, Wydział Zdrowia Publicznego w Bytomiu, Bytom, Poland

<sup>4</sup> Szpital Specjalistyczny Nr 1, Katedra i Oddział Kliniczny Chorób Wewnętrznych, Bytom, Poland

<sup>5</sup> Śląski Uniwersytet Medyczny w Katowicach, Zakład Medycyny Społecznej i Profilaktyki, Wydział Zdrowia Publicznego w Bytomiu, Bytom, Poland

<sup>6</sup> Szpital Specjalistyczny Nr 1, Katedra i Oddział Kliniczny Chorób Wewnętrznych, Bytom, Poland

### Introduction

In order to equalize chances in combat sports, it was necessary to divide athletes into sex, age and weight categories. As a result, combat sport athletes in particular weight categories are characterized by very similar physical conditions [1]. Since 1996, senior female judokas have been divided into weight categories of up to 48 kg, 52 kg, 57 kg, 63 kg, 70 kg, 78 kg and above 78 kg (the last category does not have any upper limit). The judokas are weighed with an accuracy of 0.1 kg on the day preceding competition. Any contestant exceeding the upper limit of her weight category by a minimum of 0.1 kilogram gets disqualified (Polish Judo Association) [11].

Researchers have noticed that the pre-competition nutrition system used by judo contestants in 80% deviates from proper nutrition [15]. The overriding goal, of reaching the so-called “enter weight”, combined with the lack of basic knowledge about proper nutrition, can lead to unintended negative results during competition at a given tournament, as well as in the further perspective, when continuing a sports career [6]. As the weight limit specified for a given contestant is usually lower than her everyday body mass, it becomes necessary to lower it before a competition. Female athletes training judo often use body mass reduction (BMR) programs in the pre-competition period leading to changes in their nutrition, mainly to a drastic reduction of calories, and a reduction of the volume of consumed liquids, an increased number of training sessions, exercising in thermos-active clothing intensifying perspiration and using other physical means of dehydration [7, 10, 13]. The objective of this study was to assess the nutrition of female judokas in relation to energy demand, contents of nutrients and pre-competition body mass reduction in 3 weight categories.

**Material and Methods**

The study involved 15 contestants of the national senior judo team representing 3 various weight categories. Each weight category was represented by 5 judokas. Detailed group characteristics were based on height and body mass measurements at the study commencement, the determination of the weight category of a given contestant and her training experience in judo training. The average age of tested judokas was  $24 \pm 0.4$ , while the average body height and body mass equaled respectively  $163.5 \pm 5.3$  cm and  $59.2 \pm 4.7$  kg. The average training experience in the tested group amounted to  $12 \pm 0.7$  years. The research tool used in the tests was an anonymous nutrition log (along with respondent’s particulars and fill-in guidance) distributed via the internet.

Respondents filled in the nutrition log on a daily basis for 7 days prior to the main competition, i.e. until official weighing. On each day, a contestant recorded the type of consumed nutrients along with their amount expressed in grams. Respondents were also requested to record dietary supplements taken in the above mentioned period.

The nutrition logs were analyzed using the Dietary Log MR BIG software application v 4.92, calculating the energy value and contents of nutrients (carbohydrates, proteins and fats) in the diets used by the tested female athletes. Afterwards, each variable was averaged and this value was compared with Benardot standards,

2012 (Table 1). Next, the percentage value of standard implementation was calculated for each contestant. In addition, in order to determine whether a given group was affected by the problem of body mass reduction, the number of reduced kilograms was calculated and confronted with initial body mass.

**Table 1.** Dietary standards for judo athletes according to Benardot, 2012

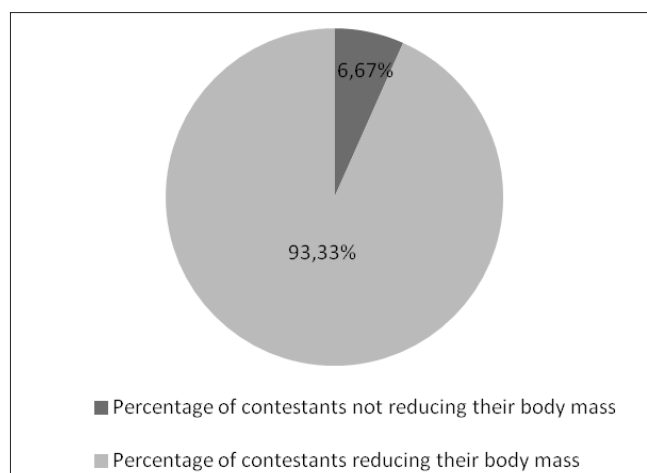
Energy (kcal/kg of BM)	Carbohydrates (g/kg of BM)	Protein (g/kg of BM)	Fat (g/kg of BM)
46	5-7	1,6-1,7	1

The statistical analysis of results was performed using Statistica and Microsoft Excel software. The analysis focused on the relationships of non-measurable characteristics performed by the V-square test for qualitative attributes. If the test result revealed the existence of a relationship between considered variables, the strength of the dependence was calculated using the Cramer’s V correlation coefficient ( $V = 0-1$ ) for the adopted significance level of  $\alpha = 0.05$ .

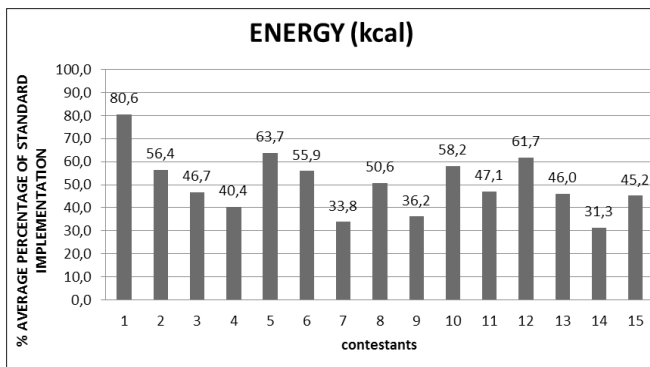
The experiment was performed with written consents of participating judokas. The applied methods were consistent with the ethical principles of the Helsinki Declaration and principles of medical tests involving humans – Decision 5/2015 – Bioethical Commission by Academy of Physical Education in Katowice.

**Results**

The dynamics of body mass reduction was tested on the basis of body mass value at the test commencement and the weight category of a given contestant (Figure 1).



**Figure 1.** Characteristics of tested athletes in relation to the frequency of BMR



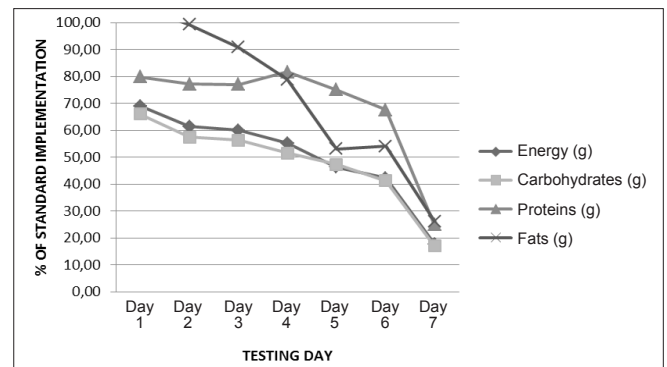
**Figure 2.** Average energy intake of the tested group compared to judo standards

The greatest difference between body mass at the test date and the initial mass amounted to 3.4 kg, which equaled to 6.56% of the initial body mass.

The values of energy intake as well as protein, carbohydrate and fat content reached by the female judokas were compared to recommended according to Benardot's standards (2012). The highest recorded energy value constituted 80.6% of the recommended demand, whereas the lowest amounted to a mere 31.3%. In regards to most of the tested athletes, the dietary energy demand was restricted within the range of 40 to 60% (Figure 2). The lowest average protein intake amounted to 36.9% of the standard value. Only one judoka exceeded the protein intake standard. The remaining contestants failed to reach the required protein intake level. In three cases, the intake of fats exceeded the related standard. The lowest average intake constituted 43.7% of the standard. None of the contestants filled the standard demand for carbohydrates in their diet. In the best case, the average daily intake of carbohydrates amounted to 82.9% of the standard, whereas in the worst case to a low 28.1%.

The analyses performed during the pre-competition period revealed significant deficiencies in energy intake, and a significant decrease in the consumption of basic nutrients in the entire group of female judokas, thus indicating the existence of a BMR-related problem (Figure 3).

Average energy intake of the judo athletes in the first day of the study was 1855.7 kcal per day. It was



**Figure 3.** Average energy and nutrient values in successive days of BMR in relation to dietary standards in judokas athletes

865.2 kcal lower comparing to the standard (2720.9). The lowest consumption of energy took place in 7 day of the study and it was 470.9 kcal/day. Results are shown in Table 2.

**Discussion**

We applied specific nutrition questionnaires to evaluate the knowledge of judo athletes regarding body reduction techniques prior to competition. The results revealed that only some contestants followed the recommended dietary norms on particular days of the pre-competition microcycle. Most of the judo athletes participating in the research project did not meet the recommended energy and macronutrients standards and showed significant deficiencies in their diet prior to competition. Such an approach in BMR can lead to suppressed immunity and decreased performance. It appears that the above-named issue exists in other combat sports and other events which require strict weight categories or have a significant aesthetic component [3].

A significant number of contestants, even with a multi-annual training and competition experience, leave only several days (before the commencement of a competition) for the reduction of body mass. The primary reasons behind such a late timing include the BMR-induced physical and psychological discomfort. Methods aimed at a fast reduction of body mass involve a significantly limited consumption of food and liquids accompanied by increased training intensity, exercising in insulated thermal clothing and the use of sauna. All of

**Table 2.** Average energy values of the tested groups' diet in the following days of the study

	Study period (days)							Standard
	1	2	3	4	5	6	7	
Energy (kcal)	1855.67	1649.93	1614.07	1507.53	1250.87	1141.20	470.87	2720.9

the above-mentioned procedures ultimately lead to the dehydration of the body [1, 5, 6, 13] reducing physical efficiency, decreasing the volume of circulating blood and increasing the body temperature thus overloading the heart, lungs and the whole circulatory system. A body mass loss of 2% adversely affects training efficiency and decreases maximum oxygen uptake by 10-20%. An increase in dehydration is accompanied by various negative symptoms including nausea, dizziness, breathing difficulties, weakness, disorientation, slower metabolism, loss of strength and power as well as lower efficiency leading to less satisfactory sports results [15]. During the BMR period, the contestants complained about various discomforts including low spirit (50%), concentration difficulties (36%), dizziness and headaches (28%), as well as disturbed balance (10%) [16]. Consequences resulting from BMR often adversely affect performance during competition a given athlete has been preparing for. A study performed by Boguszewski et al. (2012) involving judo contestants reducing their body mass revealed that pre-competition assumptions were fulfilled in 46.7%. In turn, judokas not reducing their body mass fulfilled the above named assumptions in 58.3%. The athletes stated that, during BMR, their physical state, muscular strength and stamina were reduced, and were sometimes accompanied by headaches [4].

BMR may also adversely affect numerous health-related variables by leading to circulatory disturbances, immunosuppression, reduced bone density, disturbed thermoregulation, decreased cognitive functions, negative mood, hormonal disorders, temporarily disturbed growth, malnutrition, increased risk of injury, etc. In 1997 there were 3 incidents of hypothermia-induced deaths in wrestlers reducing body mass for competition (ascribed to immense dehydration). The above-named athletes lowered their body mass by approximately 15%. In March 1996, during preparations for the Olympic Games in Atlanta, Korean judoka Chung Se-hoon died of a heart attack, probably caused by BMR [2].

Female athletes frequently performing the BMR (through food intake reduction) during the competitive season can trigger a phenomenon referred to as the "triad" (in sports medicine), involving issues such as disturbed nutrition, disturbed menstruation, osteopenia or osteoporosis. The "triad" may lead to premature termination of sports careers resulting from repeated fractures, conception-related problems or even infertility. However, results concerning this issue are divergent and require further research [9].

The analysis of obtained results revealed that the issue of body mass reduction among Polish female judo contestants was common and affected 93% of the tested group. The contestants reduced their body mass before competition by average of 1.8 kg, i.e. approximately 3%. The highest value of reduced body mass amounted to 3.4 kg (6.6% of BM). The results confirmed that in the pre-competitive period the problem of BMR was significant and, in some cases, could reach alarming proportions. Similar conclusions were reached by Brito et al. who had performed a test involving 580 contestants representing various combat sports. The research-related survey revealed the following percentage values concerning athletes reducing their body mass before competitions: 62.8% of judo, 56.8% of jujitsu, 70.8% of karate and 63.3% of taekwondo contestants (5). Another study, involving 53 Czech representatives of judo, wrestling, kickboxing, karate, boxing, Thai boxing and taekwondo revealed that 77.4% of respondents regularly reduced their body mass before competitions. The average value amounted to 5.4% of body mass, whereas the highest value reached 12%. On average, the contestants reduced their body mass between 6.3 kg and 2.6 kg (maximum 13 kg) [8]. The study performed by Steen et al. (1990) involving wrestlers revealed that 89% of them reduced their body mass one week before competitions [16]. Researchers from Poland [17] examined 40 wrestlers between 14 and 26 years old. Conclusions obtained on the basis of the study-related survey were similar to those formulated on the basis of individual study. The percentage value of athletes reducing their body mass amounted to 97.5%. On average, the contestants reduced 5.5% of their body mass, with values ranging from 2 to 9 kg. A study conducted in Japan involving 29 judokas (7 female and 22 male contestants) revealed that the athletes reduced their body mass by an average of 3.1 kg before competition [18].

The study explicitly reveals the common existence of BMR-related problems in sports requiring low body mass connected with the division into weight categories. In most cases, BMR imposes serious problems to the athletes, being potentially the most important issue affecting their current performance and future sports career. It seems that the negative consequences of BMR on athletes' health and performance require a more thorough analysis and a rational solution. It seems justified to introduce obligatory limitations, guidelines or tests (e.g. anthropometric, biochemical etc.) for athletes in various periods of the season. Among other things, the above named measures would make it possible to determine whether an athlete is properly

nourished, whether the level of fat tissue enables rational mass reduction or whether there are contraindications for excessive body mass reduction. However, the primary aspect should be to educate athletes, coaches and parents about undesirable effects of quick body mass reduction. The implementation of proper nutrition principles, as well as a rational and gradual body mass reduction should be considered priorities.

### Conclusion

It was observed that in the diets of Polish female judokas, the energy value and contents of nutrients in the pre-competition period significantly deviated from adopted standards. According to the standards of nutrition optimum reduction of energy value in the diet is 500-800 kcal per day. Average energy intake at the last day of the study was more than 2300 kcal lower than recommended. Diet of tested athletes was inadequate throughout all study days. The problem of BMR and related consequences seems common among combat sport athletes, affecting 93% of participants. Body mass reduction before competition is a very significant issue for combat sport athletes. On the one hand they must meet the required body mass for particular weight categories, while on the other hand a drastic reduction in body mass may have undesirable health effects, and serious consequences on physical and mental performance, what has been confirmed in numerous research projects [2, 12, 13, 14].

The above-presented results concern a small group of selected female judokas, which precludes the formation of more generally applicable conclusions. However, numerous studies and similar research protocols indicate both the prevalence of this issue as well as its relevance in regards to training efficiency, sports results and, most importantly, athletes health.

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