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EFFECTS OF A SPECIFIC MODEL OF TRAINING ON BODY COMPOSITION OF JUDO ATHLETES OF YOUNGER SENIOR AGE

Nenad Rađević[1]

[1]The Government of the Republic of Srpska, Ministry of family, youth and sports, Banja Luka, Bosnia and Herzegovina

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SUMMARY

The goal of a coach is to prepare an appropriate model of training for their athletes and provide adequate and healthy way of regulating their body weight.

On a sample of 32 judo athletes of younger senior age on the territory of the city of BanjaLuka and municipality of Laktaši, a specific model of training was applied for a period of ten weeks and the judo athletes were divided into two groups. One group was the control group, and other was experimental. The experimental group has implemented 60 training sessions, of which 40 judo trainings (25 technical-tactical and 15 situational judo trainings-randoria) and 20 trainings with the load (50-80% of 1 RM).

In this period, the control group worked only judo trainings or 40 training sessions. Statistical analysis of the results is divided into two segments - the descriptive statistics and application of methods of the inferential statistics. The initial and final measurements of body composition of groups were conducted by the bioelectrical impedance(BIA method), and the two-component(2C) model was used for this work - which divides the whole body in total body fat (*fat mass*) and non-fat body mass (*fat-free mass*). From the field of descriptive statistics on the level of the entire sample, the central and dispersion parameters were calculated. The methods of inferential statistics used in this study were *t*-test for dependent and independent samples and analysis of covariance.

The values of percentage of body fat in the experimental group, which was exposed to a specific training process for a period of ten weeks, were notably statistically reduced during this period.Value of body fat from an initial 23.10% after the training protocol, decreased to 20.41%, on the .01 level of significance. Values of the percentage of body fat in the control group were kept on the same, higher level than recommended for judo, even after the training, pointing to the effects of their less successful training protocol.

Key Words: body fat, non-fat body mass, specific training model.

INTRODUCTION

Judo is an Olympic discipline, widespread throughout the world. Some studies have shown that judo athletes possess an exceptional strength, capacity and flexibility, as well as low body fat (Thomas, Cox, LeGal, Verde, & Smith, 1989). With the advent of modern judo, a skill adopted by majority, and given the different somatic types, it became necessary to divide them into some more homogeneous groups by weight. It was necessary to adopt certain rules of fighting and deploy the competitors by their body weight. At official competitions, judo athletes compete with opponents who have similar weight, and the opponents in accordance with weight categories, which were three at first, then five, and for over twenty years, there have been seven categories. The goal of the division in categories is to ensure fair and equal fight in terms of strength, power and agility (Artioli et al., 2010). It is known that some judo athletes use several harmful and unlawful methods and means to regulate their body weight, ie. speed up weight loss, which would give them precedence over lighter and weaker opponent.

The polls showed that 80% of competitors take part in the process of losing weight. According to these researches, what is most commonly applied in such a low sodium diet, which contributes to weight loss, are severe restrictions on taking liquids and food, use of saunas, heated rooms and exercise in rubber suits (Steen & Brownell, 1990; Tipton & Tcheng, 1970).

Use of diuretics, laxatives, diet pills are the extreme methods that are often mentioned in the literature (Steen & Brownell, 1990). It is always important to stress that these are illegal means and methods in sport. Athletes correct weight several times in the season, so their weight ranges from 5% to 10% of total body weight (Ibid).

Recent research has shown that the incorrect way to lose weight or use of illegal means to regulate body weight, result in poor motor skills and are extremely dangerous to the health of athletes, in some cases even fatal. It has been proven that rapid weight loss negatively affects the health parameters.

In short, it can lead to acute cardiovascular dysfunction (Allen, Smith, & Miller, 1977), immunosuppression (Kowatari et al., 2001), low bone density (Prouteau, Pelle, Collomp, Benhamou, & Courteix, 2010), a disorder of thermoregulation (Oppliger, Case, Horswill, Landry, & Shelter, 1996), cognitive disorders (Choma, Sforzo, & Keller, 1998), negative mood (Degoutte et al., 2006), hormonal disorders (Roemmich & Sinning, 1997), temporary growth of defects (Ibid), poor nutritional status (Horswill, Park, & Roemmich, 1990), increased risk of injury (Green, Petrou, Fogarty-Hover, & Rolf, 2007), and the risk of eating disorders (Steen & Brownell, 1990; Oppliger, Landry, Foster, & Lambrecht, 1993).

Increased requirements that characterize modern judo, and the latest training practice and physiological achievements, highlight the necessity of creating new models of training programs,with the aim of achieving better athletic performance as well as body composition in judo as one of its parameters.

The lower physiological limit of fat in the structure of body composition in men is about 5%, and for female athletes, this limit is between 12 and 16%. Muscle mass is also higher in athletes and in males can exceed the value of 55%, even 60% of total body mass (Martin, Spenst, Drinkwater, & Clarys, 1990). In addition, the density of non-fat body mass of individuals is higher than in sedentary people, with a higher mineral content and bone density and muscle mass (Heyward, & Stolarczyk, 1996).Therefore, in analyzing the body composition of athletes, it is necessary to use valid and specific protocols for this population.

The aim of this paper is to show whether a good planning and proper management of the training process, may in time lead athletes to have an optimum weight before getting in »shape«. Or obtaining information about body composition of judo athletes of younger senior age after application of two different training processes. And it is the weight that suits him as a somatotype for the expression of the highest possible operating capacity.

METHODS

The sample of respondents

The sample consisted of 32 judo athletes from the two Judo Clubs: Judo Club »Rade Ličina« from Banja Luka and Judo Club »Laktaši« from Laktaši. Respondents were asked to complete the following requirements: have at least three years of training process, that they have no organic and somatic disorders, that are younger senior age, and male sex.

Variables

Body composition was assessed by bio-impedance-meter - BIA method. As a result of this measurement, we get a percentage of body fat (FFM) and percentage of non-fat body mass (fat-free mass). Measurement was conducted with the apparatus for assessing body composition »Body Composition Analyzer 357 Jawon Gaia« (Jawon Medical, South Korea), and in addition to a percentage of body fat (FFM) and percentage of non-fat body mass (fat-free mass), we determined the following parameters: body weight, body height, standard weight, body fat index.

Description of specific models of training

The specific program is implemented for 10 weeks. It consisted of 25 technical - tactical, 15 situational--specific and 20 trainings with the load, i.e. 12 hours of exercise per week. Additional training with the load was carried out twice a week at the gym, and the method that has dominated in exercising is lifting the submaximal load at maximum speed. The load ranged from 50% to 80% of the maximum, number of sets 4-6, 4-6 repetitions, resting between repetitions per set for 2-3 minutes and 4-5 minutes between exercises.

Statistical analysis

Statistical analysis of the results is divided into two segments - descriptive statistics and the application of methods of inferential statistics. As per the area of descriptive statistics, the central and dispersi-

on parameters have been calculated on the entire sample level: arithmetic mean (*M*), standard deviation (*SD*), variation width (*MAX - MIN*), variance (Var), standard error of mean (*SE*). Normality of distribution was tested using the results of D'Agostino-Pearson test. The methods of inferential statistics in this study used *t* - test for dependent and independent samples and analysis of covariance.

RESULTS

The main parameters that reflect the characteristics of both groups are: age, sports experience, body height, body mass, body fat percentage and non-fat mass.

Tables 1 and 2, show the values of parameters that reflect the basic characteristics of both groups.

TABLE 1
Descriptive statistics of the experimental group.

Parameter	*n*	*M*	*SD*	*MIN*	*MAX*
Age (years)	16	19.87	2.09	18.00	23.00
Sports experience (years)	16	7.62	4.19	4.00	15.00
Body height (cm)	16	179.25	5.75	170.00	192.00
Body weight (kg)	16	70.99	12.55	54.20	104.20
Fat percentage (%)	16	25.00	5.66	9.40	31.10
Percentage of non-fat mass (%)	16	55.50	7.17	45.90	72.50

Legend: ***n*** - Number of respondents; ***M*** - Sample mena; ***SD*** - Standard deviation; ***MIN*** - Minimum value; ***MAX*** - Maximum value.

TABLE 2
Descriptive statistics of the control group.

Parameter	*n*	*M*	*SD*	*MIN*	*MAX*
Age (years)	16	19.81	1.72	18.00	23.00
Sports experience (years)	16	6.18	2.04	4.00	11.00
Body height (cm)	16	179.33	5.25	170.00	189.00
Body weight (kg)	16	68.00	14.19	53.30	118.30
Fat percentage (%)	16	21.50	4.13	7.50	24.60
Percentage of non-fat mass (%)	16	65.00	7.00	46.10	72.90

Legend: ***n*** - Number of respondents; ***M*** - Sample mena; ***SD*** - Standard deviation; ***MIN*** - Minimum value; ***MAX*** - Maximum value.

The percentage of body fat

The following tables (3rd, 4th, 5th, 6th) present the results of changes in body composition under the influence of specific training. It is important to note that at the beginning, in each group of samples, the athletes who had initially lower percentage of body fat (below 15%) were left out of the group. It was unrealistic to expect that their body composition would change with the loss of already low percentage of body fat. For this reason, the number of respondents for this parameter (*n*) was decreased from 16 to 13 in the experimental and to 14 in the control group (Table 3).

The values of body fat percentage in the control group on the initial measurements were less than in the experimental group. Even after the training, they were kept at the same, higher level, than is recommended for the sport, pointing out the effects of their less successful training protocol (Table 5).

Non-fat body mass

Fat-free mass in sport is synonymous with the muscle mass. Its increase with the training protocol indicates what is the most important, an increase of a muscle mass. However, in this study, neither group achieved a statistically significant increase in non-fat mass, i.e. muscle mass. This fact is not surprising since it has been many times proven that the muscle hypertrophy occurs only after 8-10 weeks from the beginning of training with the load. Our protocol,

neither by its loads nor by its duration, was focused on the development of muscle hypertrophy.

DISCUSSION

For each sport, in terms of morphological characteristics (body constitution) of athletes, there is an exact percentage of muscle, fat and bone tissues that are the basis for good functional status of the organism, or for top athletic condition.

Analysis of body composition in this study was performed by using a *bioelectrical impedance* (BIA), which is a new, rapid, noninvasive, accurate and comfortable method for the respondents, which has recently gained the trust of experts around the world (Ponorac, 2008). *A two-component model*, which divides the whole body into total body fat (*fat mass*) and non-fat body mass (fat-free mass) was used for this work.

TABLE 3

Frequencies of the fat percentage per groups.

The experimental group	*n*	The control group	*n*
9.4	1	**7.5**	1
13.9	1	**14.4**	1
14.5	1	15.2	1
17.4	1	15.3	1
18.9	2	15.9	1
19.4	1	16.8	1
20.1	1	16.9	1
22.7	1	17.5	1
22.8	1	17.9	1
24.1	1	19.0	2
25.0	1	19.6	1
26.4	1	20.3	1
26.7	1	20.5	1
26.8	1	24.0	1
31.1	1	24.6	1
In total	16	In total	16

Legend: ***n*** - Number of respondents.

TABLE 4

Values of the percentage of body fat in experimental group (%).

The experimental group	*n*	*M*	*SD*	*SE*
Initial	13	23.10**	4.05	1.12
Final	13	20.41	3.20	.88

$p < .002$

Legend: ***n*** - Number of respondents; ***M*** - Sample mena; ***SD*** - Standard deviation; ***SE*** - Standard error; ***p*** - Probability.

Radovanović, Bratić, Nurkić, and Vukajlović (2005) investigated the impact of targeted training programs prepared on the parameters of anaerobic and aerobic capacity in young judo players with significant experience in training and competition. The results showed statistically important higher levels of anaerobic power (relative value of the average power) and VO_2max, with the decrease in body weight and body fat percentage.

The results of research conducted by Bratić, Radovanović, and Nurkić (2008) with the aim to determine and compare the functional characteristics of

the best young judo cadets (n = 11, age 15.7 years ± .5) and younger senior age (n = 8, age 20 years ± 1.2), showed that judo athletes of younger senior age are characterized by lower percentage of body fat and improved aerobic capacity compared to judo cadets.

TABLE 5

Values of the percentage of body fat in control group (%).

The control group	*n*	*M*	*SD*	*SE*
Initial	14	18.73	3.03	.84
Final	14	19.22	2.90	.80

$p < .170$

Legend: ***n*** - Number of respondents; ***M*** - Sample mena; ***SD*** - Standard deviation; ***SE*** - Standard error; ***p*** - Probability.

TABLE 6

Covariance, the percentage of fat free mass between groups, final measurements.

Group	*n*	*M*	*SD*
Experimental	16	60.05	7.12
Control	16	58.15	6.68

$p < .258$

Legend: ***n*** - Number of respondents; ***M*** - Sample mena; ***SD*** - Standard deviation; ***p*** - Probability.

Looking at the values of the body fat percentage in the experimental group exposed to a specific training process for a period of ten weeks, we see that the average values of body fat significantly decreased during this period. That is, the value of body fat from an initial 23.10% after the training protocol, decreased to 20.41%, on the level of significance of .01. However, despite a reduction in the value of fat percentage, body composition of the experimental group was still in the acceptable upper limits of the sport. Nevertheless, the visibility of the success of specific training is clear with the recommendation to continue to achieve the desired percentage of fat.

Regarding the values of body fat percentage for the control group, after their training protocols, there was no statistically significant change in body fat percentage. Values are from an initial 19.72% slightly reduced to 19.25%. Even after the training, they were kept at the same, higher level, than is recommended for the judo, pointing out the effects of their less successful training protocol.

The study conducted by Silva, Fields, Heymsfield, and Sardinha (2010) on the connection between anaerobic power and body composition of successful judo athletes during the period of three months, which included 10 Korean judo team members, 26 senior members of university teams and 28 junior members of the university team, showed very high correlation of the fat mass and anaerobic power in elite judo athletes, i.e. national team members.

The results show that the judo team members have a higher percentage of muscle and a smaller percentage of fatty component compared to the other two categories of athletes. These results confirm the positive directions of our programmed training model that contributed to the reduction of fatty component.

Also interesting study was conducted by Kim, Cho, Jung, and Yoon (2011) for analyzing the correlation of the body composition and upper body strength in judo athletes. Twenty-seven top judo athletes were measured at the beginning and end of the study, with the time difference of approximately one month. Body composition was estimated by the DXA method, and the range of power load was used to assess the output of the upper body in the bench press position.

The results show that, although not significant, changes were found in body composition and upper body strength. Individual variability was high. Among all the changes in body composition, only total body water and intercellular water were related to variations in the upper body. These results indicate the need for monitoring of total body water, particularly the intercellular water in top judo athletes, in order to

avoid a reduction in upper body strength when it reached the desired body weight prior to competition.

All this supports the fact that athletes must take into account the weight loss before an important competition, especially to respect the instructions of the National Sports Athletics Association (NSAA), and to avoid extreme ways of regulating categories, primarily by reducing fluid intake, which contributes to reducing motor abilities of athletes and the endangerment of the health of athletes (Ibid).

Fat-free mass in sport is synonymous with muscle mass. Its increase by the training protocol indicates what is the most important and that is increasing of a muscle mass. However, in our study neither group achieved a statistically significant increase in non-fat or muscle mass. This is not surprising since it is many times the proven fact that muscle hypertrophy occurs only after 8-10 weeks from training with the load. This certainly leaves the possibility of changes in training modalities to achieve muscle hypertrophy as an adaptive change.

Based on the results of programmed training model, and similar results obtained by Radovanovic et al. (2005), we see that especially planned training program contributes to the improvement of body composition of athletes, or reduction of body weight and body fat percentage. Therefore, we can conclude that changes in the plan and ten-week-training- program right before a competition can result in significant changes, even with competitors who have more years in the training process. This confirms the compliance of our training model with the recommendations of previous researches.

CONCLUSIONS

The method of specific sports training model used in the experimental study group experienced a statistically significant decrease in body fat percentage compared to the initial measurement. However, there was no statistically significant reduction in body fat of the control group at the final measurement. Likewise, neither group achieved a statistically significant increase in non-fat, ie, muscle mass. This would certainly be achieved by extending the training protocol and individual selection of loads to induce hypertrophy.

REFERENCES

Allen, T. E., Smith, D. P., & Miller, D. K. (1977). Hemodynamic response to submaximalexercise after dehydration and rehydration in high school wrestlers. *Med Sci Sports*, 9, 159−163. PMid: 593078

Artioli, G. G., Gualano, B., Franchini, E., Scagliusi, F. B., Takesian, M., Fuchs, M., & Lancha, A. H. Jr. (2010). Prevalence, magnitude, andmethods of rapid weight loss among judo competitors. *Med SciSportsExerc*, 42, 436−442. doi: 10.1249/MSS.0b013e3181ba8055

Bratić, M., Radovanović, D., & Nurkić, M. (2008). Effects of preparatory training period on muscle strength of top judokas. *Akta Medika Median*, 1, 22−26.

Choma, C. W., Sforzo, G. A., & Keller, B. A. (1998). Impact of rapid weight loss oncognitive function in collegiate wrestlers. *Med Sci Sports Exerc*, 30, 746−749. doi: 10.1097/00005768-199805000-00016

Degoutte, F., Jouanel, P., Begue, R. J., Colombier, M., Lac, G., Pequignot, J. M., & Filaire, E. (2006) Food restriction, performance, biochemical, psychological, and endocrine changes in judo athletes. *Int J Sports Med*, 27, 9−18. doi: 0.1055/s-2005-837505; PMid: 16388436

Green, C. M., Petrou, M. J., Fogarty Hover, M. L., & Rolf, C. G. (2007). Injuries among judokas during competition. *Scand J Med Sci Sports*, 17, 205−210. PMid: 17501865

Heyward, V., & Stolarczyk, H. (1996). *Applied Body Composition Assessment.* Champaign, IL: Human Kinetics.

Horswill, C. A., Park, S. H., & Roemmich, J. N. (1990). Changes in the protein nutritionalstatus of adolescent wrestlers. *Med Sci Sports Exerc*, 22, 599−604. doi: 10.1249/00005768-199010000-00010

Kim, J., Cho, H. C., Jung, H. S., & Yoon, J. D. (2011). Influence of performance level on aerobic power and body composition in elite male judoists. *Journal of strenght and conditioning research*, 5, 1346−1354.

Kowatari, K., Umeda, T., Shimoyama, T., Nakaji, S., Yamamoto, Y., & Sugawara K. (2001). Exercise training and energyrestriction decrease neutrophil phagocytic activity in judoists. *Med SciSportsExerc*, 33, 519−524. doi: 10.1097/00005768-200104000-00003; PMid: 11283425

Martin, A. D., Spenst, L. F., Drinkwater, D. T., & Clarys, J. P. (1990). Anthropometric estimates of muscle mass in man. *Medicine and Science in Sports and Exercise*, 22, 729−733. doi: 10.1249/00005768-199010000-00027

Oppliger, R. A., Case, H. S., Horswill, C. A., Landry G. L., & Shelter, A. C. (1996). American College

of SportsMedicine position stand. Weight loss in wrestlers. *Med Sci Sports Exerc*, 28, 9−12. doi: 10.1097/00005768-199610000-00049

Oppliger, R. A., Landry, G. L., Foster, S. W., Lambrecht, A. C. (1993). Bulimic behaviors amonginterscholastic wrestlers: a statewide survey. *Pediatrics*, 91, 826−831. PMid: 8464675

Ponorac, N. (2008). *Sport kao rizik nastanka poremećaja ishrane, menstrualnog ciklusa i metabolizma kosti* [Sport as a risk for eating disorders, menstrual cycle and bone metabolism] (Doctoral disertation). University of Banja Luka, Faculty of Medicine.

Prouteau, S., Pelle, A., Collomp, K., Benhamou, L., & Courteix, D. (2006). Bone density in elite judoistsandeffects of weight cycling on bone metabolic balance. *Med SciSportsExerc*, 38, 694−700. doi: 10.1249/01.mss.0000210207.55941.fb

Radovanović, D., Bratić, M., Nurkić, M., & Vukajlović, V. (2005). Effects of specially designed judo training on anaerobic and aerobic capacity in young judo competitiors. *European Sports Medicine Kongress*, 4, 111−115.

Roemmich, J. N., & Sinning, W. E. (1997). Weight loss and wrestling training: effectson growth-related hormones. *J ApplPhysiol*, 82, 1760−1764. PMid:9173938

Silva, A., Fields, D., Heymsfield, S., & Sardinha, L. (2010). Body composition and power changes in elite judo athletes. I*nternational journal of sports medicine*, 10, 737−741. doi: 10.1055/s-0030-1255115; PMid: 20645233

Steen, S. N., & Brownell, K. D. (1990). Patterns of weight loss and regain in wrestlers:has the tradition changed? *Med Sci Sports Exerc*, 22, 762−768. doi: 10.1249/00005768-199012000-00005

Thomas, S. G., Cox, M. H., LeGal, Y. M., Verde, T. J., & Smith, H. K. (1989). Physiological profiles of the Canadian National Judo Team. *Can J Sport Sci*, 14, 142−147. PMid: 2819609

Tipton, C. M., & Tcheng, T. K. (1970). Iowa wrestling study. Weight loss in high schoolstudents. *JAMA*, 214, 1269−1274. doi: 10.1001/jama.214.7.1269; doi: 10.1001/jama.1970.03180070035006

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Correspodence to:
Nenad Rađević, MSc
Ministarstvo porodice, omladine i sporta
Vlada Republike Srpske
Trg Republike Srpske 1
78 000 Banja Luka
Bosnia i Herzegovina
E-mail: n.radjevic@mpos.vladars.net
Phone: 00387 51 33 83 08
00387 65 69 29 23
Fax: 00387 51 33 88 95