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Dynamics of strength training of qualified wrestlers during weight loss: case study

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Abstract

Purpose	to investigate the dynamics of strength training of qualified wrestlers under the influence of an experimental strength training program during the period of weight loss.
Material and Methods	A member of the national freestyle wrestling team. took part in the research. The athlete is 20 years old, and has been practicing wrestling for 9 years. The study was conducted during the preparation for the national championship. A training program was developed for qualified wrestlers, which is advisable to use when preparing for competitions in special conditions of weight loss. The experimental program consisted of a strength training program and a body weight loss program with the use of a specially developed diet and drinking regime, and additional use of ergogenic means was also foreseen. In addition, the experimental training program included special training work. Research methods: analysis of scientific and methodological sources; summarizing the practical experience of specialists; pedagogical observations; pedagogical experiment; pedagogical testing; methods of mathematical statistics.
Results	During the study period, the tested athlete, despite a significant decrease in his own weight by 6.5 kg (7.4%), managed to maintain the absolute power index in the bench press (100%), increase the result in the squat with a barbell by 2.8%, by 10% in the deadlift and by 10.5% in the standing long jump. Significant positive changes were observed in the study of relative strength indicators. The subject improved by 8.1% in the bench press, 18.8% in the barbell squat, 11.6% in the deadlift, and 19.3% in the long jump. A significant positive dynamic of the special speed strength indicator is observed when the athlete performs a double leg shot during training bouts ($t = 9.4$; $p < 0.01$). The study of general and special speed-power endurance also revealed significant positive changes in the tested athlete. The time for performing a set of CrossFit exercises decreased by 17.6%. Special Endurance coefficient improved by 10.7%.
Conclusions	The results of the study showed that the use of an experimental program for training qualified wrestlers for competitions, in the conditions of reducing body weight, during eight weeks, contributed to a significant positive dynamic of the strength general and special preparedness of the athletes.
Keywords	wrestling, strength, training program, weight

Анотація

Ірина Собко, Кирило Огар, Геннадій Огар. Динаміка силової підготовленості кваліфікованих борців під час зниження ваги: тематичне дослідження

Мета	дослідити динаміку силової підготовленості кваліфікованих борців під впливом експериментальної програми силового тренування, в період зниження маси тіла.
Матеріал і методи	У дослідженні взяв участь член національної збірної з вільної боротьби. Вік спортсмена 20 років, стаж занять спортивною боротьбою 9 років. Дослідження проводилось під час підготовки до національного чемпіонату України. Розроблена тренувальна програма для кваліфікованих борців, яку доцільно застосовувати при підготовці до змагань в спеціальних умовах зниження маси тіла. Експериментальна програма складалась з програми силового тренування та програми зниження маси тіла з використанням спеціально розробленого режиму харчування і питного режиму. Крім цього, в експериментальній програмі тренування залишалась й спеціальна навчально-тренувальна робота на килимі. Методи дослідження: аналіз науково-методичних джерел; педагогічний експеримент; педагогічне тестування; методи математичної статистики.
Результати	За період дослідження випробуваний спортсмен, не зважаючи на істотне зменшення власної ваги на 6,5 kg (7,4%), спромігся зберегти абсолютний силовий показник у жимі штанги лежачи, збільшити на 10% результат у присіданні зі штангою на плечах, на 2,8% у становій тязі та на 7,9% у стрибку в довжину з місця. Суттєві позитивні зрушення були помічені при дослідженні відносних силових показників. У випробуваного на 8,1% покращився показник у жимі лежачі, на 18,8% у присіданні зі штангою, на 11,6% у становій тязі та на 16,4% в стрибку у довжину. Спостерігається значна позитивна динаміка показника спеціальної швидкісної сили при проведенні спортсменом фронтального проходу в ноги під час тренувальних сутичок ($t = 9,4$; $p < 0,01$). Дослідження загальної та спеціальної швидкісно-силової витривалості також виявило суттєві позитивні зрушення у випробуваного спортсмена. Час виконання комплексу вправ колового тренування зменшився на 17,6%. Коефіцієнт спеціальної витривалості покращився на 10,7%.
Висновки	Використання експериментальної програми підготовки кваліфікованих борців до змагань, в умовах зниження маси тіла протягом восьми тижнів, сприяє суттєвій позитивній динаміці загальної і спеціальної силової підготовленості спортсменів.
Ключові слова	спортивна боротьба, сила, програма тренування, вага

Introduction

In wrestling, athletes are often forced to reduce their body weight to get into the desired weight class, which allows them to increase their relative strength and improve their speed. Weight loss can vary in a wide range, from 1 kg to 8-10 kg, depending on the athlete's own body weight. A loss of up to 10% of the athlete's body weight from the baseline occurs without a significant negative impact on his or her health [1]. Nevertheless, the decrease in weight of

athletes, with a sufficiently significant decrease, in wrestlers partially deteriorates absolute strength and performance indicators [2].

A number of specialists have devoted their works to the study of weight loss of athletes in combat sports and its impact on their fitness indicators. Kravchuk, Ogar, and Novikova [1] studied the effect of weight loss by various methods on the level of performance of qualified sambo wrestlers. They compared interval and forced methods of weight loss. The interval method proved to be more appropriate,

in which the level of performance of female athletes almost did not decrease.

The authors studied the influence of reducing the body weight of athletes, due to the partial removal of water from the body (dehydration) in wrestling on their level of fitness. It was determined that with a weight reduction at the level of 5% of the initial weight, the indicators of absolute strength training and performance partially decreased [3].

Reale et al. [4] summarized the results of previous studies on the issue of manipulating athletes' body weight by various methods and the impact of these methods on the functional fitness of athletes in Olympic single combat sports. Different methods of restoring body weight after its decrease were investigated.

The problem of preservation of absolute power indicators, high-speed power and high-speed power endurance during the reduction of body weight, during preparation for competitions, is actual today in practice of sports wrestling.

It was assumed that at the effective construction of a program of power training, taking into account the choice of an expedient technique of reduction of a body weight, during preparation of skilled wrestlers for competitions, it is possible not only not to lose a level of absolute power indicators and efficiency of sportsmen, but also to improve them.

Purpose: to investigate the dynamics of power fitness of skilled wrestlers under the influence of an experimental program of power training during the period of weight loss of sportsmen.

Relationship to scientific programs, plans and topics. The research was carried out in accordance with the topic of the research plan of the Department of Olympic and Professional Sports, Sports Games and Tourism of H. S. Skovoroda Kharkiv National Pedagogical University for 2021-2026: "Development and substantiation of technologies for improving the health and harmonious development of people of different ages and social groups" (state registration number: 0121U110053).

Materials and methods

Participants

A member of the national freestyle wrestling team (U 23) took part in the study. The age of the athlete is 20 years, the experience of training in wrestling is 9 years. The study was conducted during the preparation for the national championship. The participant provided informed consent to participate in this experiment.

Procedure

Before the beginning of the research the preliminary testing of the sportsman on indicators of power fitness was conducted. Absolute and relative power indicators, indicator of special high-speed power, indicators of general and special high-speed and power endurance were investigated. Current and final testing, on the same indicators, were determined to determine the dynamics of the sportsman's power fitness.

The following tests were used for determination of absolute and relative power indicators: barbell bench press on a horizontal bench, squats with a barbell on shoulders, deadlift, long jump from a place with a push of two legs [5]. For determination of special high-speed and power preparedness the time of performance of a frontal double leg shot during training matches with the same sparring partner was fixed (the moment from pushing off to grabbing two legs by hands was fixed) [6]. The arithmetic mean, standard deviation, Student's t-test were calculated from the five best attempts, and the probable difference between the indicators of the initial and final testing was determined [5]. The general high-speed and power endurance was determined by the time of performance of a complex of exercises of circular training (spreading of hands with dumbbells of 16 kg., climbing on a rope (5 m) with a load of 20 kg, bending and extending the arms in a support on the bars with a weight of 20 kg, lifting a Bulgarian bag weighing 17 kg in front of you in bent arms, climbing a rope (5 m)

without a weight, bending and extending the arms in a support on the bars without a weight). In all exercises except rope climbing, the athlete performed 10 repetitions. Testing of special high-speed and power endurance was determined by means of calculation of the coefficient of special endurance (CSE) [7]. For this purpose the sportsman performed a test task according to the regulations of a competitive match - 2 periods of duration 3 minutes with a break between periods of 30 seconds. Each minute of the test task consisted of 5 background suplex throws, which the sportsman performed on the command of the coach for 40 seconds, then the wrestler made a 20-second sprint, performing suplex throws for speed. The indicator of the coefficient of special endurance was calculated by the formula (1):

$$\text{CSE} = \text{tmin}/\text{tavr} + \text{tst}/\text{tmin} \quad (1),$$

where: tmin – minimal execution time per one sprint;
tavr – average execution time of all (six) sprints;
tst – standart execution time of one sprint (20 s).

The training program consisted of an experimental strength training program and a weight loss program.

The experimental training program was designed for eight weeks in preparation for the national championship. The athlete had to reduce his body weight by 7 kg (from 88 kg to 81 kg), which was almost 8%.

The training program of the tested athlete included three interconnected stages, which had certain tasks and differed from each other by the volume and intensity of training loads, training means and methods, the content of the diet and drinking regimen.

The task of the first stage was to build strength training aimed at developing maximum strength conditions of large muscle groups (legs, back, chest) using the methods of maximum and repetitive efforts and strength endurance of the muscles of the arms and upper shoulder girdle using the static-dynamic method, in accordance with the specifics of wrestling.

The second stage mainly used the interval-circle method, the impact method, and

the static-dynamic method. This stage was aimed at the development of high-speed and explosive power, high-speed and power endurance.

The third stage used the method of maximum effort, interval strength training (mainly to preserve absolute strength indicators and develop endurance and accelerate the recovery of glycolytic muscle fibers).

In addition to the above-mentioned aspects of the experimental training program, i.e. power training, during the whole period of the research the sportsman trained on a wrestling mat, improving technical and tactical preparedness.

At the first two stages of the experimental program the following mesocycles of training were planned: for two weeks the sportsman worked in the developmental mode with the use of shock microcycles, that is, he performed a rather large, in terms of volume and intensity, weekly load. The loads of the third week were of a recovery nature.

The last week before the competition, strength training was of a purely specialized nature, using special and competitive equipment.

The three stages of the strength training program corresponded to three stages of changes in the athlete's diet and drinking regimen. The first stage involved an increase in protein intake: meat (mainly chicken and turkey fillets); fish (tuna, hake, bass); chicken eggs, cottage cheese. We tried to maintain parity between meat and fish consumption (50%/50%). At the same time, the portions of side dishes were reduced by 50% (mainly buckwheat and rice porridge). Vegetable salads were consumed in sufficient quantities. Fruit consumption (apples, pears, persimmons, bananas, tangerines) was also expected to be sufficient in the first part of the day. The following were not consumed at all: sugar and products and dishes containing sugar; bread and flour products, potatoes and dishes containing potatoes. Drinking regimen as usual, without changes - 3-4 liters per day.

At the next stage, dinner was left without a side dish, water consumption was

reduced to 2-2.5 liters, and consumption of sweet fruits was reduced. The rest was the same.

At the last stage, a small portion of a side dish was left only for breakfast, and sweet fruits were excluded from the diet. Animal protein and vegetables remained in full. Water consumption was reduced to 1.5 liters per day.

In addition to the above-mentioned regulated diet and drinking regimen, the subjects took the following ergogenic aids: creatine monohydrate (to maintain skeletal muscle mass, i.e. to prevent muscle tissue catabolism), BCAAs, beta-alanine (for recovery after exercise), vitamins and minerals (for stable functioning of the body and replenishment of its valuable biological substances).

Statistical analysis

Table 1. Dynamics of absolute strength indicators

Tests	Raw Data Weight 88kg		After 2 weeks Weight 85 kg		After 4 weeks Weight 83 kg		After 6 weeks Weight 82,5 kg		After 8 weeks Weight 81,5kg	
	Data	%	Data	%	Data	%	Data	%	Data	%
Bench press, kg	120	100	120	100	120	100	120	100	120	100
Squats, kg	150	100	155	103,3	160	106,6	165	110	165	110
Deadlift, kg	175	100	175	100	175	100	180	102,8	180	102,8
Jump, cm	241	100	243	100,8	248	102,9	253	105,0	260	107,9

Control to check the dynamics of absolute and relative strength indicators took place before the start and every two weeks during the study. At the same time there was a control over the dynamics of the subject's body weight.

Table 1 shows the results of the study of dynamics of absolute power indicators during the research. During the reporting period the

The digital material was processed using traditional methods of mathematical statistics using Microsoft Excel and SPSS programs. The arithmetic mean, standard deviation σ (standard deviation), and the assessment of the reliability of differences between the parameters of the initial and final results were determined by Student's t-test with the corresponding level of significance (p).

Results

For 8 weeks, the athlete performed an experimental training program and a weight loss program using the interval method.

tested sportsman, despite the significant decrease of own weight by 6,5 kg (7,4%), managed to keep the absolute power index in bench press (100%), to increase by 10% the result in squatting with a bar on shoulders, by 2,8% in a deadlift and by 7,9% in a long jump from a place.

Table 2. Dynamics of relative strength indicators

Tests	Raw Data Weight 88 kg		After 2 weeks Weight 85 kg		After 4 weeks Weight 83 kg		After 6 weeks Weight 82,5 kg		After 8 weeks Weight 81,5 kg	
	Data	%	Data	%	Data	%	Data	%	Data	%
Bench press, kg	1,36	100	1,41	103,7	1,44	105,8	1,45	106,6	1,47	108,1
Squats, kg	1,70	100	1,82	107	1,92	112,9	2,00	117,6	2,02	118,8
Deadlift, kg	1,98	100	2,05	103,5	2,10	106	2,18	110,1	2,21	111,6

Jump, cm	2,74	100	2,86	104,4	2,99	109,1	3,1	113,1	3,19	116,4
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Significant positive changes were observed in the study of relative strength indicators (Table 2). The subject improved by 8.1% in bench press, by 18.8% in squatting with

a barbell, by 11.6% in deadlift and by 16.4% in long jump.

Table 3. Dynamics of special speed and power fitness

Test	X1± σ1	X2± σ2	t	p
Double leg shot, sec	0,63±0,039	0,44±0,031	9,40	<0,001

There is a significant positive dynamics of the indicator of special high-speed force (Table 3, 4) when a sportsman conducts a

frontal pass in legs during training bouts ($t = 9,4; p < 0,01$).

Table 4. Dynamics of general and special speed and power endurance

Test	absolute	%	absolute	%	Dynamics%
A set of exercises, sec	187	100	154	82,4	17,6
CSE, c.u	1,95	100	2,16	110,7	10,7

The study of the dynamics of general and special high-speed and power endurance also revealed significant positive changes in the tested athlete. The time of performance of a complex of exercises of a circle training decreased by 17,6% that is a very significant indicator of improvement of functional fitness of a wrestler. There are significant positive changes in the special performance of a sportsman when performing a test with throws of a dummy. The coefficient of special endurance improved by 10.7%.

Discussion

In sports wrestling, the power component of athletes' fitness is one of the most important in achieving high sports results [8, 9]. During the direct preparation for competitions, many wrestlers (to improve relative strength indicators) try to enter a weight category lower than the real weight of the athlete. Such athletes resort to various methods of losing weight, most often the forced method, which involves reducing body weight through partial dehydration. In many cases, this leads to a slight

decrease in absolute strength indicators, and, most dangerously, to a decrease in athletes' performance. In such wrestlers, after losing the "excess" weight, often at the end of the first, beginning of the second period, the intensity and, most importantly, the efficiency of work on the mat significantly decreases [10, 11].

It should be noted that to this day (since the last century) some experts are of the opinion that it is inexpedient to use general means of strength training, and especially exercises with weights in the competitive period of the training macrocycle in the training of qualified wrestlers [11, 12]. Fortunately, recently many coaches have begun to treat strength training differently. Among such specialists is the Italian judo specialist [13], who trained five Olympic medalists in one Olympic cycle, three of whom won gold medals. Author [13] considers strength training to be one of the main components of training qualified athletes. Even in the competitive period, he uses weight-bearing exercises in the training process of qualified athletes [14]. But some experts still hold the opinion that was very popular in the last century. As a result, when losing weight, it turns out that the athlete loses a significant percentage of body weight (due to partial dehydration), while in the training process he uses mainly specific and non-specific means of cardio exercise and adheres to strict dietary and

drinking restrictions, which ultimately leads to catabolism of his muscle tissue and significant losses of strength and performance [4, 15].

This research proves that it is possible not only to preserve, but also to improve absolute and relative power, special speed and power indicators and indicators of work capacity, both general and special. In our opinion, these are the consequences of the application of the experimental power training program in synthesis with the use of the interval method of body weight reduction, with the use of a specially developed diet and the use of ergogenic means. The main thing is that it was possible to prevent the catabolism of muscle tissue, which could lead to a loss of strength conditions and special endurance.

The results of this scientific work complement the previous researches of Iezan [13], Shandrygos [15], on the questions: modern problems of training athletes in sports wrestling [4, 15]; Tropin, Panov, Belobaba [16]; Voronoi [17] physical training in sports wrestling [18, 19]; improvement of power fitness of athletes in sports wrestling [20, 21]; control of physical fitness of athletes [9, 10]; reduction of body weight of athletes in martial arts [21]; planning of training of qualified athletes [10].

Conclusions

1. The analysis of publications of the last years on the researched question showed that today the problem of preservation of power conditions of skilled wrestlers at the reduction of body weight, during preparation for competitions, is actual.

2. A training program for qualified wrestlers was developed, which is advisable to use in preparation for competitions in special conditions of body weight loss. The experimental program consisted of a program of power training and a program of reduction of body weight with the use of a specially developed diet and drinking regime, and also provided for the additional use of ergogenic

means. In addition, the experimental training program included special work on the wrestling mat to improve technical and tactical training.

3. It has been shown that the use of the experimental program for eight weeks in the preparation of qualified wrestlers for competitions has yielded significant positive results. As expected, there was a positive dynamics in almost all the studied indicators. The following is observed: significant positive dynamics of all relative power indicators (from 8,1% to 18,8%); significant positive shifts of special high-speed power ($t=9,4$; $p<0,001$); the result of testing of general (17,6%) and special working capacity (10,7%) improved. The study of the dynamics of the absolute strength of the subject determined positive shifts in three indicators out of four (from 2.8% to 10%), in bench press it was possible to keep the indicator at the initial level.

Prospects for further research

In the future, it is planned to conduct a study comparing the effectiveness of two training programs for qualified wrestlers during weight loss in preparation for competitions (this experimental program and a traditional program with forced weight loss and traditional training methods for these cases).

Conflict of interest

The author declares no conflict of interest.

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